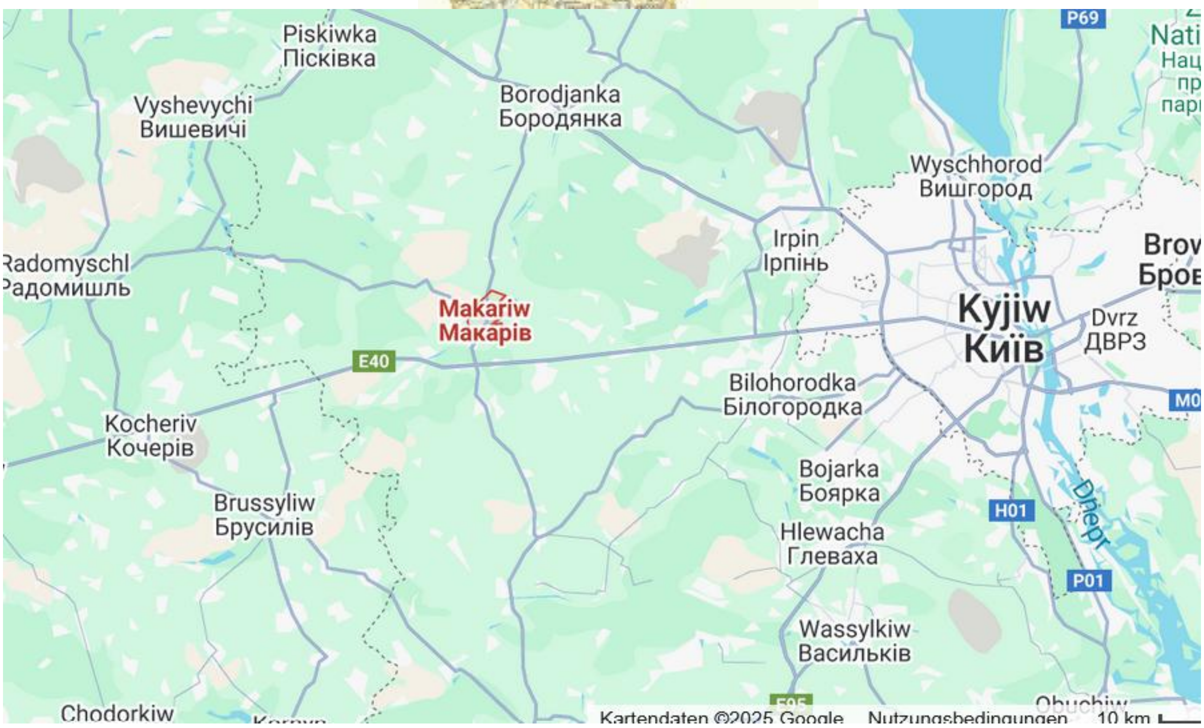
Methodology for climate protection projects in forests for Ukraine

Climate protection forest Makariv

(Version 1.1)



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Introduction

The forest is a large carbon store. 50% of the organic dry mass is pure carbon (C) (Ref. 06). Tree growth removes carbon dioxide (CO2) from the atmosphere and stores the C in the trunk and all other parts of the tree. The formation of biomass is referred to as a CO2 sink. When a tree dies, it decomposes, and the C is released as CO2 (a CO2 source). In natural forests in temperate zones, growth and decay are balanced, with a constant average wood biomass stock (Ref. 14). Recent research even assumes that in temperate zones, the sink effect extends beyond this balance in the wood stock, especially in the soil (Ref. 28).

If a forest is sustainably managed, the cycles of forest regeneration are significantly shortened compared to a natural forest. The forest is deprived of its stock-rich age and decay phases. This happens because with the aging of the trees comes a loss of quality. For example, a 100-year-old spruce is harvested even though it would remain standing for another 100 to 200 years. In a sustainably managed forest, growth and use are balanced. However, the average wood stock is half that in a natural forest at equilibrium (Ref. 14).

There is considerable silvicultural scope for stockpiling in managed forests. For example, parts of the forest are no longer managed for ecological reasons and established as reserves, or old-growth forest islands are preserved, leading to higher average stocks (Ref. 13, 15, 18, 20). For spruce, there is a trend toward reducing the rotation period to meet the timber industry's demand for weaker timber assortments and to reduce the risk of storm damage (Ref. 41). This tends to lead to lower average stocks. In mountainous areas, timber harvesting is unprofitable in many locations, and harvesting occurs below the growth rate, resulting in increasing stocks. In the Central Plateau, however, stocks are being partially depleted, partly as a result of the boom in wood energy (Ref. 18, 30, 31). All of these sometimes-contradictory developments are reversible and sensitive to the timber market. If forest timber prices rise, use intensifies.

If we consider the forest as a carbon reservoir, then forest use and mortality are carbon sources, while growth acts as a carbon sink. Forest owners can control the biomass stocks of their forests through the intensity of timber use. Forest owners can commit to maintaining a certain stock. And this is precisely what is happening in the current project for the public forest in the Makariv region.

Certification

The “Climate protection forest Makariv” was developed according to the “Methodology for climate protection projects in forests” according to ISO 14064:2 with external certification.

Climate protection forest Makariv

Methodology for carbon (C) sequestration through adapted forest management (Improved Forest Management IFM), validation by TMS LLS

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Inhalt

Preliminary remark

As early as 2022, the non-profit association STW e.V. addressed the topic of climate protection in Makariv, Kyiv region. It gathered comprehensive information about the mining of the forest and made the fundamental decision to evaluate a climate protection project for mine clearance and the disposal of explosive ordnance. A feasibility study was prepared in 2022. The war in Ukraine then delayed the final decision-making process because various meetings could not be held or could only be held to a limited extent. Through intensive internal communication, forest owners were won over, resulting in a project area of over 33,667.80 (23,678.3) hectares. These, too, required a decision-making process in the respective committees. With the project launch on October 14, 2022, the project can now be validated and verified for the first time in one go. The application of a methodology according to the international standard ISO 14064-2 with external certification makes the project highly credible for the voluntary market for climate protection measures.

Makariv Forest enables project participants to contribute to climate protection and thus value the ecosystem service of climate protection in the voluntary market for climate protection measures. The proceeds will, in turn, be used in the forest, which is undergoing major changes as a result of the war in Ukraine and global warming. This will partially finance the adaptation of the forest to the warmer climate and the associated costs.

The good cooperation with the DP “Lisa Ukraine” was of great value. The DP was fundamentally open to the project, prepared the inventory data and also participated in the substantive discussion on stockpiling.

Climate protection forest Makariv

The "Methodology for Climate Protection Projects in Forests" according to ISO 14064:2 is being applied to the "Makariv Forest Climate Protection" project. The project is being validated and verified using the method. Content in green refers to the "Makariv Forest Climate Protection" project.

1 Information about the project organization

Organization Contact Person Project Developer/Author of the Project/Program Description	T3C Ltd VD - First Floor Incubator Building Masdar City, Abu Dhabi, UAE Telefon: +971 50 6466599 info@t3c.ae Publisher: STW e.V. Aachener Str. 23 70376 Stuttgart Telefon: +49 711 96 88 24 30 www.stwev.com stw@stwev.com

Terminology: The terminology of the ISO 14064:2 standard is used.

The basic prerequisite for applying this method is that the applicant has a contract with the owner of the forest in question, or has been granted the authority to mitigate climate change. This can include: land registry entries (list of parcels), operational plans, and other area records. As a rule, the entire forest of an owner must be considered.

Climate protection forest Makariv

The project covers predominantly publicly owned forests in the Kyiv region in Makariv.

The area data comes from the DP “Lisa Ukraine” branch “Makariv Forestry”.

The project comprises the areas of accessible forest excluding scrubland according to the inventory of the DP "Lisa Ukraine" branch "Makariv Forestry." The project area in Makariv is 33,667.80 (23,678.3) hectares (Ref. 101).

2 Description of the project

2.1 Project summary

Scientific basis of the methodology
In the sustainably managed forest model, an equilibrium stock of standing timber is established over larger areas. Growth and utilization are balanced. Mortality is negligible in the normal forest model[1] (Ref. 07, 08, 09). The amount of growth depends on the natural location. In Ukraine, forest locations are defined by the potentially natural forest communities (Ref. 19). In natural forests, there is no utilization. There, the trees grow significantly older and eventually die. In natural forests, an equilibrium stock of standing timber is also established. This, too, is dynamic; growth and decay are balanced. According to Ref. 14 (Korpel 1995), the average standing timber stock in natural forests in temperate zones is about twice as high as in sustainably managed forests. It refers to the montane beech-fir-spruce forest of the temperate zone, one of the most common forest communities in Ukraine. Prusa (Ref. 25) shows that this also applies to other forest communities.

Use determines the dynamics of the storage. If more is used than grows, the average stock decreases; if less is used, the average stock increases. From a certain stock level, natural mortality increases, and the stock approaches equilibrium in the natural forest.

Forest owners control the development of biomass stocks in the forest by varying the intensity of timber use relative to growth. By partially refraining from use in managed forests, the stock and thus the carbon storage are increased or secured. In the special case of forest reserves (and old-growth forest islands), forest owners completely forgo timber use.

Forest owners undertake to maintain a stockpile that exceeds the “normal” timber stock for the duration of the project by accumulating stocks and/or guaranteeing that the stock will not fall below a certain level.

The start of the project must be documented by the forest owners’ expressions of intent to commit and to take concrete account of the project in management.

This method can be applied to individual stand-alone projects as well as to projects within a program.

[1] The "normal forest model" is an idealized model of forest structure in which all ages are represented with equal areas. Scientific yield tables are based on this model (Ref. 07, 08).

Project details

a) Title, purpose(s) and objective(s) of the project;

Method for climate protection projects in the forest
The method aims to facilitate climate protection projects in forests using recognized methods with the aim of generating tradable emission reduction certificates (ER) for the voluntary market for climate protection measures.

Climate protection forest Makariv
Title: Climate protection forest Makariv
Purpose and objective: Implementation of a climate protection project to generate emission reduction certificates (Verified Emission Reductions VER) for the voluntary market for climate protection measures.

b) Type of climate protection project;

The project type is the biological sequestration of carbon in the forest through improved forest management (IFM). The special case is the establishment of a forest as a natural forest reserve without further use. The starting point and reference scenario is a "normally" managed forest without any obligations. Several forest owners can join together to form a project. Each project defines its own reference scenario and has its own monitoring system. Projects can be combined into a program. The program primarily serves organizational purposes for project development, monitoring, marketing, and sales.

Climate protection forest Makariv
DP "Lisa Ukraine" branch "Makariv Forestry" implements a project on biological carbon sequestration in forests (adapted management, improved forest management IFM, stock management in managed forests).

c) Location of the project

The location of the project must be described, including geographical and physical information (e.g., GPS coordinates) that allows for clear identification and description of the specific scope of the project. A project typically encompasses the entire forest area owned by a forest owner. New forest reserves can also be implemented as independent projects on geographically defined sub-areas of an owner.

Forest reserves already formally established are not excluded from the project. Forest reserves whose commitment period ends during the project term may be considered. Areas may be excluded from the project for specific reasons, such as areas in marginal yield situations for which inventories may not be available, or areas pending sale. Leakage must be excluded when excluding areas.[2].

The project area (forest property, reserve) must be clearly defined in terms of location and size, down to 0.1 hectares. It must be a geographically defined forest area according to the legal definition of forest (Ref. 04).

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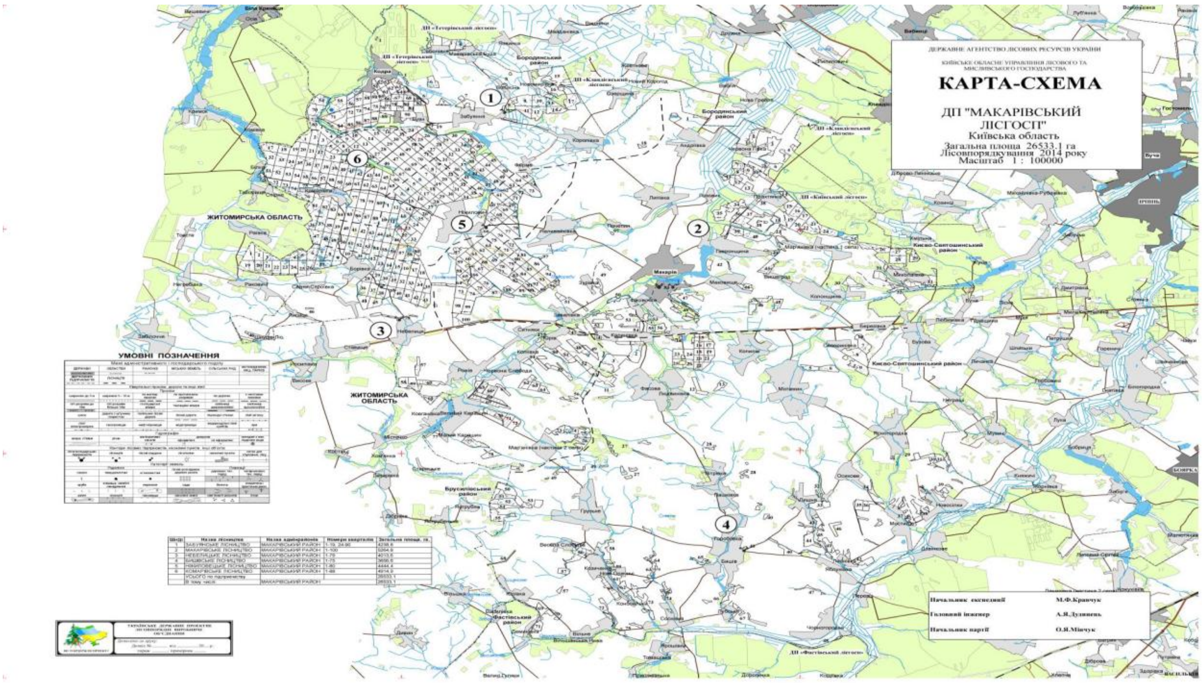
[2] Leakage are negative externalities. This means that underutilization of the forest in one location cannot be offset by increased utilization in another location. Internal leakage affects the forest owner himself. External leakage, usually in the form of market leakage, can also occur geographically farther away.

The basis for this may be: land registry entries (list of parcels), operational plans, and other area records. As a rule, the entire forest owned by an owner must be taken into account.



Climate protection forest Makariv
The project area is located in Central Ukraine and includes mainly public forest in the Kyiv Mountains

d) Conditions before project start

The conditions must be described before the project begins. The forest will be managed within the framework of legal requirements (Ref. 04). Forest owners are free to manage the forest within this legal framework. In principle, there is no obligation to manage it. Small private forests are often underutilized. Larger areas are generally managed according to a plan. Ideally, as much should be used as regrowth. Depending on the distribution of stocks by age, this can involve a build-up, a reduction, or a balanced operation. A sustainable natural utilization rate is determined in the business plan. However, this does not represent an obligation. Depending on economic conditions or disasters, the harvest may temporarily be above or below the cutting rate. The strategy can change if general conditions such as timber prices or timber harvesting costs change.

For a project area, the historical and current situation is described regarding stock, growth, felling rate, and other forest functions such as protection from natural hazards, recreation, and biodiversity. The information from the operational plan is generally used.

Climate protection forest Makariv
At the start of the project, the forest in the project area had a stock of 280 m³/ha, which is legally required. The model stock level is 280 m³/ha. Reducing the stock is not a viable option from a silvicultural or legal perspective, although implementation would also be operationally feasible given the appropriate timber market situation.

upper model value	280	m3/ha
lower model value	280	m3/ha
Commitment reserve	280	m3/ha
Obligation Difference	0	m3/ha

e) Carbon storage through control of wood use

The method of carbon sequestration through the project must be described. Within the framework of this methodology, this involves managing the standing timber stock through appropriate planning and implementation of timber use.

It is necessary to determine how exactly the biomass stock development in the forest is controlled, in particular by the intensity of wood use in relation to the growth:

- By which (partial) renunciation of use in the managed forest is the stock and thus the carbon storage increased or secured.
- By establishing forest reserves (or old-growth forest islands) in which forest owners completely or largely refrain from using timber

Climate protection forest Makariv
The IMP and FSC ensure the stock and thus the carbon storage. The forest owner is obligated not to fall below the stock of 280 m3/ha. The difference to the potential stock of the lower model value of 280 m3/ha is creditable and amounts to 0 m3/ha.

f) Biological sequestration of CO_2 with forest

The technology is the biological sequestration of CO_2 in forests. The products will be tradable verified emission reductions (VER). This involves increasing and/or securing carbon stocks in existing forests, as well as plantations and encroachments. This is achieved by appropriately considering these measures in the planning and implementation of timber harvesting measures. The expected extent of VER will be specified.

Makariv Project

Project area	23'678,3	ha
upper model value	280	m3/ha
lower model value	280	m3/ha
Commitment reserve	280	m3/ha
30 years m3/ha/year	4,91	m3/ha
Conversion of softwood	1,11	tCO2/m3
Conversion of hardwood	1,5	tCO2/m3
Sequestration	5,94	tCO2/ha/Year
Sequestration	140.296,517	tCO2/Jahr
Project durationt	30	Years
Total sequestration	4.318.329,238	tCO2

Climate protection forest Makariv
The technology is the biological sequestration of CO_2 in forests. The aim is to increase and/or secure the carbon stock in existing forests. The products will be tradable verified emission reductions (VER). The expected amount of VER is 140,296 tCO2e per year, or a total of 4,318,329 tCO2e over 30 years.

g) Estimation of storage performance

For the project area, the expected additional sink capacity in tonnes of carbon dioxide equivalents (tCO2e) resulting from the forest owner's commitment is estimated.

Climate protection forest Makariv
The project forest owner is legally obligated to maintain a minimum stock of 280 m³/ha. The additional climate protection performance of the model value of 280 m³/ha, taking into account the tree species distribution, is expected to be 140,296 tCO2e per year, or a total of 4,318,329 tCO2e over 30 years.

h) Risks

The risks of the project that may significantly affect carbon storage must be described.

For Ukraine, this methodology stipulates that there is no risk deduction in the sink calculation. Risk management is described in Chapter 7.5.

Climate protection forest Makariv
The current standing timber stock, at 280 m3/ha, is equal to the commitment stock of 280 m3/ha. The risks of biomass loss, which would reduce the stock below the commitment level, are assessed as low. Furthermore, by not considering soil carbon in the project, a carbon buffer at least as large as that contained in the living tree biomass is available.

i) Tasks and responsibilities

Tasks and responsibilities are presented, including contact information for the project owner, other project participants, relevant monitoring authorities, and/or leaders of climate protection programs to which the climate protection project is committed.

Climate protection forest Makariv
Responsible for implementation:

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www.stwev.com
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The project is affiliated with the climate program of the STW e.V. association. STW e.V. maintains the project register, and T3C Ltd is responsible for marketing and sales.

Control body for validation and initial verification:

TMS LLC

j) Accessibility of information

The review body must be granted access to the following information: all information relating to the eligibility of a climate protection project to participate in a climate protection program and the quantitative determination of the sink performance, including legal, technical, economic, sector-specific, social, environmental, geographical, site-specific, and temporal information.

Climate protection forest Makariv All references related to the project are available in digital form.

k) Environmental impact assessment

Companies with an officially approved operating plan do not need an environmental impact assessment (EIA) for the CO_2 sink project. An officially approved operating plan covers spatial planning requirements. Certifications according to a recognized procedure such as FSC or an equivalent procedure can also be used as evidence of environmental and social compatibility. If none of these documents are available, compliance with spatial planning requirements (e.g., forest development plan) must be demonstrated.

Climate protection forest Makariv
All uses are subject to approval by the Lisa Ukraine Development Partnership (DP). This ensures that all legal requirements are met. The forest is also FSC-certified, FC-FM/COC-804927.

l) relevant results from consultations with interested parties and mechanisms for ongoing communication;

If forest development plans or similar inter-company plans subject to public participation and approved business plans exist within the framework of which the project is being implemented, no special consultation and communication is required. The same applies to FSC or equivalent certifications. If no such basis exists, public consultations on the project must be conducted (consultation of affected parties from the environmental, economic, and social sectors).

Climate protection forest Makariv
Officially approved operational plans are in place, fulfilling spatial planning requirements regarding public consultations. Timber marking is controlled by DP Lisa Ukraine. In addition, the company is FSC certified.

m) chronological plan

A chronological plan is created containing the following information:

- Date of commencement of project activities
- Date of project completion
  The project duration is at least 30 years. The project duration is extended in the event of deficits in the project register until these deficits are offset. Compensation is achieved through continued sink effects on the area, through compensation within the framework of the program, or through other measures while maintaining climate integrity. See also Chapter 7.5
- Monitoring period

The monitoring period for projects in managed forests is 1 to 5 years. Für Special

regulations apply to forest reserves and old-growth forest islands.

- Official forest reserves and old-growth forest islands each have a contractual term agreed with the DP Lisa Ukraine. Due to the Forest Service's monitoring of the reserves and old-growth forest islands, project-specific monitoring is not required.

- Non-official reserves and old-growth forest islands must be established in accordance with the criteria of the official ones. The program organization is responsible for appropriate monitoring.

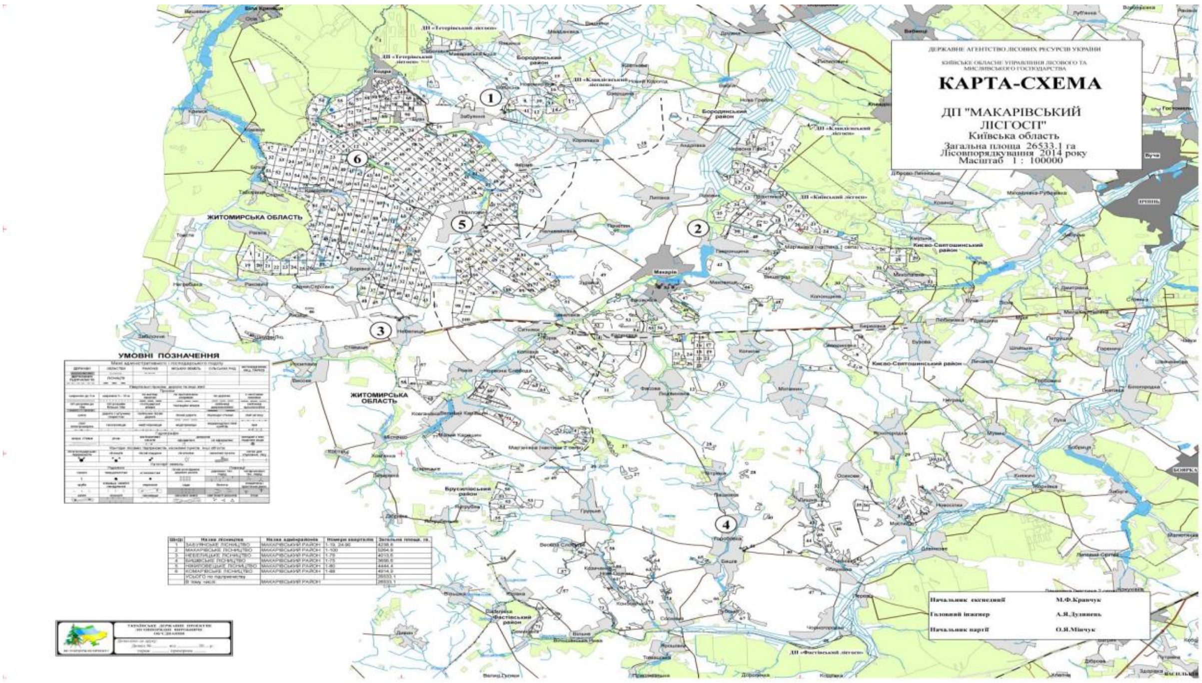
Climate protection forest Makariv
- Project start is October 14, 2022
- The project duration is 30 years (project end date is December 31, 2051)
- Officially approved operating plans are in place, which means that spatial planning requirements are met. Some of the operations are also FSC-certified.
- Monitoring is carried out every 5 years based on the usage records (from the usage statistics of the DP Lisa Ukraine). Usage is measured while standing.

3 Identification of greenhouse gas sources, sinks, and reservoirs relevant to the project

3.1 Spatial definition

The precisely designated forest area is the geographical definition of the project (location and size). Forests are greenhouse gas reservoirs (carbon sinks). They can be both greenhouse gas sources and sinks. The project area must be defined by maps, coordinates, or other clear descriptions..

Climate protection forest Makariv
Owners' forest area -> project area
The project area is 33,667.80 (23,678.3) ha (Ref. 101)
The inventories cover 33,667.80 (23,678.3) ha (Ref. 105).



Overview CO2 Project

	Forest area total, ha	Minus NWF, ha	Creditable Project area, ha	participation secured
„Lisa Ukraine" Branch "Makariv Forestry"	33.667,8	9.989,5	23.678,3	23.678,3

3.2 Carbon storage in the forest

The following carbon stores, which can also be sources and sinks, have been identified:

- Above-ground living biomass (trees, shrubs, ground vegetation)
- Underground living biomass (roots of trees, shrubs, ground vegetation)
- Deadwood (from trees and shrubs, standing and lying) 10-30% of the total biomass
- Litter layer (partially decomposed biomass lying on the ground)
- Soil carbon (mineralized C content in the soil) 50% to 66% of total biomass

In principle, all CO2 stores can be considered by measuring them or estimating them using reliable models. For practical reasons, non-tree biomass, deadwood, litter cover, and soil carbon can be omitted. This is conservative, as these stores are equal to the wood stock or negligible in quantity (aboveground non-tree biomass, ground vegetation).

For practical reasons, only living tree biomass is generally considered (above-ground trees plus roots, in the list above only the first two storage units mentioned above). Yield and stock models always refer to the living wood stock (above-ground). Conversion factors (root-to-shoot ratio, biomass expansion factors BEF, Ref. 06) are used to convert the living standing wood stock to the biomass of the entire tree. The wood stock is recorded using conventional inventories, and wood utilization is also recorded using conventional measurement methods. Both data sources are converted to living tree biomass.

It should be noted that the soil of normal sites contains approximately the same amount of carbon as the living biomass (Ref. 10, 40). The carbon storage is aligned with the living biomass. However, soil carbon can only be measured in the laboratory and reacts slowly to management measures (Ref. 35). Therefore, omitting soil carbon represents a significant contribution to conservation. For every ton of CO2 stored in trees, another ton is expected in the soil. If additional carbon stores are considered, their calculations must be revalidated.

Dead wood can be taken into account, it can also be conservatively omitted.

Climate protection forest Makariv
The total living tree biomass is counted (trunk deadwood, branches, brushwood, roots). Living non-tree biomass, deadwood, and soil carbon are not counted.

a) controlled by the project owner of the project

The relevant carbon store is the living tree biomass, which is directly influenced by the project owner through timber harvesting. The wood stock is determined using standard, recognized methods of forest inventory or stock estimation. The biomass of the entire tree is then calculated using the relevant conversion factors.

Climate protection forest Makariv
The tree biomass is controlled by the use of.

b) belonging to the climate protection project

The living biomass of shrubs and ground vegetation, as well as the litter layer, are negligible in quantity and do not need to be recorded.

Deadwood can account for a significant proportion of biomass in near-natural forest stands. The proportion of deadwood increases with age and the wood stock of the forest stand, often as a result of years of disuse. The deadwood stock is in line with the standing live wood stock. If recognized methods for measuring or estimating deadwood volume are used, this carbon storage can be accounted for in the project. It is conservative not to include deadwood in the project.

Soil carbon accounts for half to two-thirds of the carbon stock in temperate forests (Ref. 27, 40). Soil carbon generally fluctuates in line with the standing wood stock. However, it reacts with a delay to changes in wood stock and is difficult to measure at the farm level with reasonable effort. It is conservative not to consider soil carbon. Soil carbon is not considered in the method.

Climate protection forest Makariv
The living biomass of shrubs and ground vegetation, litter cover, deadwood, and soil carbon are part of the project but not taken into account in the calculation of CO2 sink capacity.

c) influenced by the climate protection projectt (Leakage)

Leakage is a negative externality. This means that underutilization of forest land in one location cannot be offset by increased utilization in another. Internal leakage affects the forest owner himself. External leakage, usually referred to as market leakage, can also occur geographically farther away.

Internal leakage: Leakage in the narrower sense is avoided by requiring a forest owner to include his entire forest in the project. Excluding areas must be justified, and it must be conservative in terms of the carbon footprint. For example, areas of marginal production not included in the timber inventory, areas pending sale.

Climate protection forest Makariv
The entire forest area was declared.

External leakage [3]: In principle, it cannot be ruled out that more timber will be logged elsewhere due to the sink project. However, the timber market is highly interconnected, both globally and nationally. Current utilization in Ukraine is approximately 4.1 m3/ha/year. The sustainable utilization ranges from 7.1 to 8.6, with an average of 7.9 m3/ha/year (Ref. 30). The project results in the underutilization of the sustainable utilization potential at the project level. As long as the overall Ukrainian utilization remains below the sustainable potential, no leakage can be attributed to the individual project. Only when this utilization rate is exceeded does a possible causal relationship arise.

[3] External leakage: The sustainably available utilization potential in Ukraine is estimated at 7.1 to 8.6 m3/ha/year from 2017 to 2056, with an average of 7.9 m3/ha/year. (Hofer P. et al. 2011: Wood utilization potential in Ukrainian forests. Evaluation of utilization scenarios and forest growth trends. Federal Office for the Environment, Bern. Environmental Knowledge No. 1116: 80 pp.) Ref. 30.

As long as total Ukrainian use remains below the sustainable potential of 7.1 m3/ha/year, external leakage is assumed to be zero in this methodology. If the national use rate of conservatively 7.1 m3/ha/year is exceeded, less the sink capacity of all Ukrainian forest sink projects, a leakage of 10% of the sink capacity is taken into account.[4]

Climate protection forest Makariv
The parameter of the entire usage is documented.

Project emissions: Project emissions are greenhouse gas emissions generated by the project, such as forest ranger inspection trips and biodiversity conservation measures. These types of emissions are lower or at most equal to those of normal management (road construction, harvesting and skidding machines, forest ranger trips for planning and monitoring, and truck transport).

Potential reductions in management emissions are not included in the project's emission reductions. Project emissions, which are generally smaller, are assumed to be zero in this methodology.

Climate protection forest Makariv
Projektemissionen werden mit Null berechnet.

3.3 Temporal definition

Project start and duration

The project start date within the framework of the method is determined by concrete activities to promote sink performance and by the documented intention to commit. For the pilot project, a project start date of January 1, 2022, can be assumed. All other projects can only credit sink performance from January 1, 2022, at the earliest.

Under this method, the duration of projects in managed forests is at least 30 years, with extensions possible. In the case of reserves or old-growth forest islands, the duration is at least 49 years.

Climate protection forest Makariv
Project start is October 14, 2022

2021	Resolution on the evaluation of a climate protection project (General Assembly 19.01.2021)
2022	Resolution to launch the project at the General Assembly on June 24, 2022
2022	Start of the project

[4] (FOEN (ed.) 2017: Forest and Wood Yearbook 2017. Federal Office for the Environment, Bern. Environmental Status No. 1718: 110 pp.), Ref. 18.

4 Determination of the reference scenario (Baseline)

4.1 Greenhouse gas sources, sinks and reservoirs of the baseline scenario

The storage shown in 3.2 applies.

Climate protection forest Makariv
For the reference scenario, the living tree biomass is taken into account.

4.2 Reference scenario normal management

The reference scenario determines how the forest would be managed without a climate protection project and how this would affect forest stockpiling. Historical observations show that the intensity of use and thus stockpiling can change significantly over decades and centuries. Economic considerations also do not allow for a reliable forecast of future timber use and stockpiling.[5]

The reference scenario is assumed to be a moderate use scenario, which is conservatively within the silvicultural and legal scope. It is defined either by an average stock level at the end of the project period, as defined in scientific yield table models[6]

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[5] Historically, there have been two major periods of deforestation and devastation: the medieval period of deforestation to create agricultural land, and the early industrial devastation of forests until the second half of the 19th century.

With the first Federal Forestry Police Act of 1876, sustainable forest management was introduced by law. Since then, the timber price and timber harvesting costs have been key indicators for the intensity of timber use. Especially in the mountains, timber use is often not profitable at present; the forest is being used below its potential, and stocks are increasing. However, the development in several decades remains uncertain.

Considering global demographics, demand for all raw materials will increase, including wood. The price of wood could rise. Wood utilization technology is increasingly moving toward engineered wood products that no longer require thick trunks as raw material. Reducing the rotation period for spruce is being discussed and implemented (Ref. 41). Timber harvesting technology is also progressing. One scenario is that large-scale timber utilization will once again become profitable. At that point, the currently built-up stocks will be quickly depleted.

[6] The yield tables represent idealized sustainable use concepts for various tree species and growth conditions (credit ratings), which ideally indicate increment as a benchmark for use, as well as a corresponding equilibrium stock. Yield tables are suitable for determining the reference scenario in that they are increment-based and not value-based. They reflect management focused on optimal mass yield. The use of yield tables is conservative. Firstly, the current yield level is higher than they depict. Secondly, use concepts are being promoted today, especially for spruce, that assume significantly shorter rotation periods and thus lower average stocks (Ref. 41). In other words, legal and silvicultural flexibility would allow for even significantly lower average stocks than those indicated in the yield tables.

by tree species and quality, or it is defined by other recognized target stock sizes (e.g. in permanent forest).

The reference scenario is represented as the linear balance line from the initial stock at the beginning of the project period to the normal stock (target stock) at the end of the project period.

If the project assumptions are based on an inventory, a new inventory must be conducted no later than 15 years after the inventory date. This deadline can be extended if a new inventory is conducted within five years of the project's validation using this method. If the increase in storage has changed based on the inventory compared to the project assumptions, the baseline must be redefined (even retroactively). If the new inventory reveals lower storage values than previously reported, the relevant quantities must be entered as negative in the project register and offset during the project term.

If compensation is no longer possible, the term can be extended or the loss can be covered by third-party certificates from within or outside the program. This will be done at the latest during the verification process at the end of the project term.

4.3 Ex ante Project scenario

The project's credited storage effect must be at least 10% higher than that of the reference scenario at the end of the project term.7 If this is not the case, the certificates generated up to that point will be cancelled and must be offset by third-party certificates from within or outside the program.

Climate protection forest Makariv

The evaluation of the inventories by the "Lisa Ukraine" branch "Makariv Forestry" showed a stock of 280 m3/ha at the end of 2020. The offsetting with the use made in 2022 and the increase results in the starting stock on 1 January 2022 of 280 m3/ha (Ref. 110).

The model assumptions used are those from the Kyiv region table in Makariv. According to the information from the DP Lisa Ukraine, the framework values for the stockpiling of altitude levels from Graubünden can be adopted (Ref. 111).

The reference scenario (baseline) and project scenario Makariv are presented in detail in Ref. 110.

The use of yield tables is conservative. They were developed in the 1960s and 1970s. Afterward, especially in the 1990s, yield levels rose significantly, meaning the yield tables underestimated actual growth. This underestimation has since slowed due to global warming, but is still clearly present. Ideal average stock levels (target stocks) are specified in the literature for specific forest types in permanent forests.

[7] The requirements for inventories are 5% standard deviation with a 95% confidence interval. If the inventory difference is at least 10%, the error ranges of subsequent inventories do not overlap.

Vegetation	Model stock
	m3/ha
Pine	310
Oak	249
Ash	173
Acacia	137
Birch	172
Aspen	170
Alder	226
Other	256
Average	280

Distribution of vegetation

A blend of the digital boundaries with the digital distribution of the vegetation height levels 2020 resulted in the following distribution:

				Modell	
Forest characteristics			SZ	lower limit	upper limit
		ha	%	m3/ha	m3/ha
Pine		16.219,6	68,50%		310
Oak		2.699,3	11,40%		249
Ash		118,4	0,50%		173
Acacia		94,7	0,40%		137
Birch		2.107,4	8,90%		172
Aspen		355,2	1,50%		170
Alder		1.846,9	7,80%		226
Other		236,8	1,00%		256
Average		23.678,3	100,00%		
					Ende 2020
		mean model value, area-weighted			280,227

Makariv Project

Project area	23.678,3	Ha
upper model value	280	m3/ha
lower model value	280	m3/ha
Commitment reservet	280	m3/ha
30 years m3/ha/year	4,91	m3/ha
Conversion of softwood	1,11	tCO2/m3
Conversion of hardwood	1,5	tCO2/m3
Sequestration	5,94	tCO2/ha/year
Sequestration	140.296,517	tCO2/year
Project duration	30	Jahre
Total sequestration	4.318.329,238	tCO2

The table shows the stockpile over the project period. This results in 4.91 m3/year/ha or 5.94 tCO2/year/ha, or 140,296 tCO2e per year, as long as the stockpile remains above the commitment level of 280 m3/ha.

The statements made in Section 3.2 regarding the eligibility of the various forest carbon stores apply. The following discussion focuses on the carbon store of living tree biomass.

The key data concern forest area, stocks and use

Climate protection forest Makariv **Forest area: The forest area (project area) is 23,678.3 ha. accessible forest less the existing forest reserves of the participating forest owner (Ref. 101).** **Stock and increment data are derived from sample-based inventories conducted by the DP Lisa Ukraine (Ref. 105). Stock at the start of the project on January 1, 2022, was 280 m3/ha.** **The use is recorded in full during the marking process. The data is expressed in standard meterage (standing solid timber).** Usage data accepted by DP Lisa Ukraine for sustainability control are used.

4.4 Analysis of additionality (corresponds to Add. Tool CDM)

Additionality is assessed based on the CLEAN DEVELOPMENT MECHANISM TOOL01 Tool for the demonstration and assessment of additionality Version 07.0.0. (Ref. 21).

The additionality of the project is based on the voluntary commitment that a forest owner makes by reducing forest use and thus increasing timber stocks.

The alternative to the project is not to make any commitment.

1. **Determination of alternatives**
   Alternative one is the reference scenario. In accordance with the scientific and legal framework, a stockpile is assumed, based on the stockpile at the start of the project, which, including a conservative buffer, aims for a realistic value at the end of the project period.
   Alternative two is to secure or accumulate stocks above the baseline.

In this commitment, the project owner fundamentally differs from forest owners who do not enter into this commitment and use the forest "normally" (as in the reference scenario). For the duration of the commitment and to the extent agreed upon, the project owner refrains from using timber, even if the price of timber were to rise and timber use would yield more than the sink performance. The forest owner can freely choose the extent of the timber stockpiling commitment.

The commitment applies to the stock for which emission reductions (ERs) have been generated and sold. This means that a forest owner can stop storing additional carbon during the project term and instead use the entire further increase. However, they may not reduce the stock in question, and monitoring must be carried out until the end of the term. If the commitment is weakened during the project term or the stock is reduced below the committed value, climate integrity must be maintained. The loss of emission reductions must be offset internally within the project or through the purchase of recognized certificates. If a deficit exists at the end of the regular term, this must be offset through external ERs, or the term is extended until the deficit is offset. In the case of a program, the program ensures the offset.

Für den bewirtschafteten Wald gibt es bisher keine Projekte.

Climate protection forest Makariv

Forest climate protection projects are organized under the program of the association Forest Climate Protection Ukraine:

2. **Economic analysis**
   The medium to long-term developments in timber prices and harvesting costs and thus in the intensity of use cannot be reliably predicted (Ref. 36).[8] The uncertainties are very high, and a medium- to long-term forecast of the timber market is hardly possible. The net present value method is generally applied to plantations and for periods of 5-21 years.[9] This makes no sense for longer periods (years). Economic considerations are not suitable for proving additionality given the long-term nature of forest sink projects.

A cost-benefit analysis is not required within the methodology.

Differentiation from other climate or biodiversity policy instruments (financial aid/double counting), impact allocation: Funding for forest reserves is exclusively for biodiversity, not for CO2 reduction. Thus, 100% of the CO2 sink performance can be attributed to forest owners.[10]

Eine Wirkungsaufteilung ist im Rahmen der Methodik nicht darzustellen.

Avoiding double counting: It is possible that the emission reductions achieved are also quantitatively recorded and/or reported in other ways (= double counting).

According to Zimmermann's legal assessment (Ref. 11), the sink capacity of a forest belongs a priori to the forest owner and not to the state.

The methods for avoiding double counting within the framework of the method are as follows. At least one of these must be applied:

• Effective tracking systems and CO2 registries such as STW e.V. ensure that each credit is counted only once. This registry assigns unique serial numbers to the credits and carefully tracks their issuance, transfer, and retirement.
• Transparency in reporting and verification processes is essential. This includes clear documentation of the ownership and retirement of emission allowances, which is publicly accessible in the registry in which the project is registered. This ensures that all stakeholders can view the status and history of each allowance.
• Compliance with international standards and agreements is crucial to avoid double counting. Article 6 of the Paris Agreement describes cooperative approaches, including a mechanism to reduce greenhouse gas emissions and promote sustainable development, with rigorous accounting to avoid double counting.
• The involvement of external auditing providers, such as TÜV, increases the credibility of project claims and ensures that they are not duplicated. These auditors assess compliance with certain criteria and standards and thus confirm the authenticity of the emission certificates.

Climate Protection Makariv Forest
The project owners reserve the right to use all three methods to avoid double counting.

- Effective tracking systems and CO2 registers
- Transparency in reporting and verification processes
- Compliance with international standards and agreements
- Involvement of external auditing service providers, such as TÜV.

All greenhouse gas information is stored within the Makariv Forest's operational data security system. The STW e.V. association maintains the project register, in which confirmed VERs are recorded. Sales, decommissioning, or transfers to a program are recorded.

3. Explanations of other obstacles to the project (barriers)

A project with a commitment means a restriction on the freedom of management, especially the use of wood over a very long period of time. Rising energy wood prices are making the use of otherwise poor-quality wood species attractive again. While wood use has declined overall in Ukraine in recent years, it varies considerably depending on the region and type of ownership. Stockpiles are also being depleted regionally.

Forest owners are therefore not readily willing to enter into a long-term commitment regarding forest stockpiling (References 30, 31, 32, 33, 34). It can also be assumed that in this environment, forest owners will, if at all, implement moderate forest CO2 sink projects in order to minimize the restriction on management freedom caused by the commitment. The reluctance of forest owners is reflected in the fact that the only major CO2 sink project in Ukraine has so far not been replicated, despite its success for years. The establishment of reserves also falls far short of political goals, despite subsidies. Only half of the politically targeted 10% reserve area of the total forest has been achieved (References 44, 45). The mentality of forest owners is rather against a long-term commitment.

The obstacles identified for the project are generally applicable to Ukraine and therefore valid for the method. They do not need to be presented at the project level.

4. Common practice

Current stockpiling practices in Ukraine are diverse. In publicly owned forests, stocks often remain constant. In some central and Jura regions, stocks are declining due to intensive use of wood for energy. Overall, stockpiling increases predominate in Ukraine. However, all of this is reversible if the non-harvesting revenues from timber sales increase again, either because prices themselves are rising or because harvesting technology becomes more efficient, or both. Current practices are therefore diverse, but all forest owners have in common that they can respond to market changes and can and would intensify timber use accordingly if demand increases. Revenues from timber sales continue to represent the main source of income from forest management. (Ref. 31).

The common practice described is generally applicable to Ukraine and therefore fundamentally valid for the methodology. Common practice does not need to be presented at the project level.

5 Greenhouse gas sources, sinks and reservoirs relevant for the baseline scenario

The greenhouse gas sources, sinks and reservoirs listed in Chapter 3.2 apply.

6 Greenhouse gas sources, sinks and storage relevant to the project

The greenhouse gas sources, sinks and reservoirs listed in Chapter 3.2 apply.

7 Quantitative determination of emissions and quantities removed

7.1 Relevant greenhouse gases, greenhouse gas sources, sinks and/or reservoirs

According to Chapter 3.2, the relevant storages, sources and sinks are:
- Living tree biomass derived from wood stock (storage)

The wood stock is influenced by the following dynamic parameters:
- Usage (Source)
- growth (sink)
- Mortality (source).

Climate protection forest Makariv

The relevant greenhouse gas reservoir is the living tree biomass derived from wood stock.

Greenhouse gas sources and sinks are the increment, mortality and use.

7.2 Determination of living tree biomass from the wood stock

Recognized methods for timber inventory are applied, usually on a sample basis with defined precision for tree species and/or tree species groups. For sample inventories, a maximum standard error of 5% with a confidence interval of 95% is permitted. If the error is higher, the difference of 5% must be deducted from the estimated stock. If no inventory data are available and estimation methods are used, the assumptions must be made conservatively to prevent overestimation of the stock. The standing timber stock is measured in cubic meters of stem deadwood, separated by tree species or tree species groups. The standing timber stock in m3 is converted into tCO2e of living tree biomass using recognized conversion methods.

Deadwood can be counted if it is recorded using recognized methods and conservatively converted into tCO2e.

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Wood stock

The timber stock was derived from inventories of the individual farms. These originate from different years for the project area. For the climate protection project, the DP Lisa Ukraine processed the relevant inventories and updated them to the end of 2022. The resulting stock for December 31, 2022, was 280,277 m3/ha (Ref. 12), with 69% coniferous and 31% deciduous wood.

The calculation back to the beginning of 2022 using the official usage data (Ref. 113) results in a starting stock as of 01.01.2022 of 280 m3/ha.

		growth
	%	m3/ha
Pine	68,50%	5,3
Oak	11,40%	3,2
Ash	0,50%	4,9
Acacia	0,40%	3,9
Birch	8,90%	3,7
Aspen	1,50%	5,9
Alder	7,80%	5,1
Other	1,00%	5,5
Growth		4,91

Starting stock	01.01.2022
Stock	m3/ha
2021	280
2022	280,227

Ref. 108, Tabelle Höhenstufen

Conversion factors m3 stem wood to tCO2 tree biomass Ref. 16a

Brändli, U.-B.; Abegg, M.; Allgaier Leuch, B. (eds.) 2020: Ukrainian National Forest Inventory. Results of the fourth survey 2009–2017. Birmensdorf, Swiss Federal Institute for Forest, Snow and Landscape Research WSL. Bern, Federal Office for the Environment. 341 p. NFI4 Table 101

LFI4 Tabelle 101	Jura	Midland	foothills			Ukraine
Biomass living trees/stem wood volume	**kg/m3**	**kg/m3**	**kg/m3**			**kg/m3**
Softwood	605	592	604			621
Hardwood	804	865	804			832
Total	697	718	653			689

= X*0.5*44/12/1000

Conversion factors	Jura	Midland	foothills			Ukraine
Tree biomass tCO2/stem wood m3	**tCO2/m3**	**tCO2/m3**	**tCO2/m3**			**tCO2/m3**
Softwood	1.11	1.09	1.11			1.14
Hardwood	1.47	1.59	1.47			1.53
Total	1.28	1.32	1.20			1.26

Direct conversion, wood density and expansion factors are not needed separately, they are already taken into account in the first table.

	Softwood	1.11	tCO2/m3
	Hardwood	1.47	tCO2/m3

Conversion of standing timber stock into tonnes of CO2 living tree biomass.

As part of the evaluation of the National Forest Inventory for the production regions of Ukraine, the DP Lisa Ukraine has published biomass contents of living trees per m³ of standing stemwood for deciduous and coniferous trees. This already includes the root-to-shoot ratio and biomass expansion factors.

7.3 Determination of use

Usage can be determined in one of the following two ways

a) Timber utilization is measured in standing m3. The same conversion methods from m3 to tCO2e can be used as for the stock. As a rule, all trees to be used are measured. Recognized methods are used (clipping at a height of 1.3 meters, use of a recognized volume tariff). Additional estimates should be treated conservatively (no underestimation of utilization). Field control identifies any deviations between the marking and the actual harvest and corrects the utilization values.

b) Timber utilization is measured after harvest (harvest volume, horizontal measurement, harvester measurement, factory measurement, estimates). The volume is recorded in full. Estimates should be conservative (utilization should not be underestimated). The utilization measured while standing is checked for plausibility against the actual utilization and, if deviations (overutilization) of more than 10% occur, corrected if necessary.

Recognized estimation and calculation methods are used to convert harvested volumes in m3 to standing harvest volumes in m3 and, from there, to tCO2e. Conversions should be conservative. Harvested wood is included in the calculation as a CO2 source..

The belowground portion of harvested trees remains in the forest and decomposes slowly. It accounts for 19 to 40% of the living tree biomass (range of biomass expansion factors). Stems of harvested trees can persist for decades. The remaining belowground portion of harvested trees can be included in the project storage using an intermediate decomposition rate, provided recognized methods are available. Otherwise, this portion of the storage is calculated using the harvested trees as the source, which is conservative.

Added to this is harvest loss, which is the portion of the harvested crop that remains in the forest. Complete decomposition can take years or even decades. Using recognized methods, this portion of biomass remaining on the area can be subtracted from the source of use. It is conservative to include harvest loss in its entirety as a source at the time of use..

The following conversion factors are used (Ref. 42)

Nutzung Vorratsfestmeter					
Umrechnung Ernte- in Vorratsfestmeter					
Ernteverlust	Ernteverlust	Ernteverlust	Ernteverlust	Ernteverlust	Ernteverlust
Rindenzuschl.	Rindenzuschl.				
NH-Stammh.	LB-Stammh.	NH-Ind.h.	LH-Ind.h.	NH Energieh.	LH-Energieh.
NH o.R.	LH o.R.	NH m.R.	LH m.R.	NH m.R.	LH m.R.
m3					
1.235	1.277	1.087	1.149	1.087	1.149

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The usage data in Makariv are measured while standing during the marking process. This eliminates the need for a back calculation from the lying measurement according to the table above.

7.4 Determination of growth

The increase can be determined in two ways

a) The increase is derived from subsequent inventories.
b) The increase is estimated

For a) the increase is derived from subsequent inventories, using the stock change method. Two inventories are compared in summary. Utilization and mortality are taken into account. The difference directly results in the sink capacity. Net increase = Stock 2 – Stock 1

Regarding b) the increment is derived from models Yield table models or other growth models indicate the quality of tree species based on the natural location and assuming certain management concepts. Yield table models indicate the increment in storage cubic meters or harvest cubic meters. The back-calculation to tCO2e is conservatively calculated using recognized factors..

The increase was derived from the information in the inventory report concerning the entire forest of the Makariv for the project area.

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The increment was determined based on follow-up inventories (Ref. 105) conducted by the DP Lisa Ukraine branch Makariv forest. The average increment is 4.91 m3/ha/year (Ref. 105).).

		Growth
	%	m3/ha
pine	68,50%	5,3
oak	11,40%	3,2
Ash	0,50%	4,9
acacia	0,40%	3,9
birch	8,90%	3,7
aspen	1,50%	5,9
alder	7,80%	5,1
Other	1,00%	5,5
Growth		4,91

7.5 Risk

The legal framework for forest management in Ukraine stipulates that forests must be managed in such a way that they can continuously and fully fulfill their functions. The goal is to achieve a near-natural forest structure, and in principle, a permit from the Forest Service is required to fell trees in the forest. Clear-cutting is prohibited (Forest Law). This framework prevents forest owners from carrying out drastic interventions in the forest. Risks for the loss of stored carbon are classified into the following groups based on the Verified Carbon Standard (VCS) (Ref. 29):

1) Internal risks
2) External risks
3) Natural risks

The risk assessment according to VCS (Ref. 29) results in a total of 15 points for projects in Ukraine, and a minimum of 10 points for official reserves. These are very low values.11 Under the method presented here, the following applies:

Loss risk measures

If biomass loss falls below the value for which certificates were sold, the generation of further certificates must be halted until the stock has returned to the level it existed before the damaging event. Project owners and program organizations can bridge such interruptions by creating an unsold buffer of certificates. Monitoring must be maintained throughout the entire project duration. If a deficit in the project register exists at the end of the regular project duration, the project duration is extended by the period during which the deficit is offset by continued sink effects. Monitoring is extended accordingly. Project deficits can also be offset by the program or by other measures while maintaining climate integrity. Both measures must be confirmed by monitoring.

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Since the project began in 2022, there have been no biomass losses.

[11] Regarding risk assessment under VCS: Internal risks for Ukraine projects are assessed with 14.0 points, while external risks are assessed with 0 points, in compliance with VCS rules.

Risk minimization in forest reserves

Official forest reserves: Subsidies for the establishment of forest reserves are intended to promote biodiversity. Contracts with the DP Lisa Ukraine are usually concluded for 50 or 99 years. The forest service is obligated to safeguard the reserve status. Because of this institutional safeguarding of reserve status, no further monitoring is required. Forest reserves with institutional status can be implemented as individual projects by the owners or as part of an IFM project and within a program. In the event of a reserve's closure, climate integrity must be maintained through compensation within the program or through other appropriate measures.

Forest reserves with ex-ante determination of sink performance are accepted under the method if they have an official status and are supported with subsidies.

Forest reserves with ex-ante determination of sink performance without official status must establish a monitoring system that confirms the reserve status for each monitoring period. This status must be secured by an entry in the land register. The unofficial reserve project must join a program. The land register entry is an easement in favor of the program. The program guarantees the reserve status and the certificates generated thereby. The program defines the forest owner's security measures, e.g., by retaining a risk buffer. An external verifier checks whether any uses have been made in the reserve. See Chapter 10 Monitoring.

Old-growth forest islands should be treated in the same way as reserves.

Climate protection forest Makariv

Not applicable. The Climate Protection Forest Makariv project concerns the productive area of the managed forest.

Risks result in 1.0 points according to Ref. 29 Table 10. For forest reserves with institutional status, the minimum value is 10. These are very low values. The internal risk assessment considers the longevity of the project. 30 years is the minimum. An external risk of loss is a forest fire, in which carbon from trees is directly emitted. However, the risk is very low to negligible. Storm events can affect large quantities. If the wood is left lying, the biomass loss is not significant; however, if it is cleared, the loss can be significant. Under the VCS regime, the points are converted into a percentage. This is the percentage of generated certificates that must be transferred to a risk pool. Risk mitigation in this methodology is described above. The establishment of a buffer is voluntary.

8 Quantitative determination of sink performance

8.1 Determination of the sink capacity in managed forests ex-post

The method is based on the formulas of the AR CDM method AR-AMS0001. IPCC 2006, GL for AFOLU (Ref. 12)

The formulas of the CDM methodology are used as follows:

- Reference scenario (baseline): equation 1
- Baseline Sink: Equation 10
- Conversion factors (BEF) are used to convert wood stock to living tree biomass. Equations 2-9, 15, and 16 are therefore not applied. The national biomass expansion factors (BEF) take into account total tree biomass, not just the aboveground biomass. The root-to-shoot ratio variable is therefore not applied.
- For the ex-ante calculation of the sink power, equations 11-14, 17 and 18 are used.
- Leakage is assumed to be zero, therefore equation 19 is applied. The conditions for this in chapter 3.4 c) must be observed.
- The total net sink power is calculated according to equation 21.
- The certificates will not be time-limited, equations 22 and 23 will not be applied.
- For ex-post calculations, equations 24, 29, 35, and 36 are applied. The remaining equations are not relevant due to the use of conversion factors.

8.2 Determination of the reference scenario (Baseline)

Carbon stocks in the baseline scenario

In Equation 1, aboveground and belowground biomass are added together. Using the BEF eliminates this.

Equation 10: $\Delta C_{BSL,t} = (B_{(t)} – B_{(t-1)}) * (44/12)$

in which

$\Delta C_{BSL,t}$	=	C-Inventory change without project scenario in the year t (tCO_2 e)
$B_{(t)}$	=	C stock without project scenario in the year t (tCO2 e)
$B_{(t-1)}$	=	C stock without project scenario in the year t-1 (tC)
44/12	=	CO_2/C

Note:

Example: Term 30 years,
Stock of the reference scenario at project start (baseline): B(t0) = current stock. Target stock of the reference scenario (baseline): B(t30) = normal stock from ET or other literature. Normal stock: Derived in detail or summarily from the tree species, tree species group, and credit rating, or conservatively estimated.

Assumed baseline sink performance

The target stock, and thus the intended sink capacity, can be selected within the scope of silvicultural and legal flexibility. This is an owner decision that must be coordinated with the other operational objectives. Starting from the stock at the beginning of the project, a linear adjustment will be made over the project term until the target stock at the end of the project.

The difference between the reference scenario and the project scenario results in the assumed sink performance

Estimated net sink:

The ex-ante net sink in the year t (ΔCACTUAL,t is calculated using the following Equation 18 of the methodology.

Equation 18: $\Delta C_{ACTUAL,t} = \Delta C_{PROJ,t} - GHG_{PROJ,t}$

Wobei

$\Delta C_{ACTUAL,t}$ =	Ex-ante net greenhouse gas sink in the year t
$\Delta C_{PROJ,t}$ =	Project carbon sink per year t (tCO_2/a)
$GHG_{PROJ,t}$ =	Project emissions per year t ($t\ CO_2/a$)

Climate protection forest Makariv

Die ex-ante Netto Senke pro Jahr beträgt 140.296 **tCO2.**

Ref. 108, Worksheet "Scenario in tCO2." Reference and baseline scenarios in tCO2e/ha Implementation of the methodology formulas

										Nrt removal	5 years
2021	Jahr	Kiefer	Eiche	Esche	Akazie	Birke	Espe	Erle	Andere		
2022	1	95.419,907	12.956,640	870,240	553,995	11.696,070	2.717,280	14.128,785	1.953,600		
2023	2	95.431,068	12.965,904	901,441	578,925	11.714,012	2.775,742	14.154,630	1.980,152		
2024	3	95.442,231	12.975,175	933,761	604,976	11.731,981	2.835,463	14.180,523	2.007,065		
2025	4	95.453,395	12.984,453	967,240	632,200	11.749,978	2.896,468	14.206,463	2.034,344		
2026	5	95.464,561	12.993,737	1.001,919	660,649	11.768,002	2.958,786	14.232,450	2.061,994		143.173,098
2027	6	95.475,727	13.003,028	1.037,842	690,379	11.786,054	3.022,444	14.258,485	2.090,019		
2028	7	95.486,895	13.012,326	1.075,052	721,446	11.804,134	3.087,472	14.284,568	2.118,426		
2029	8	95.498,065	13.021,630	1.113,597	753,911	11.822,242	3.153,899	14.310,698	2.147,218		
2030	9	95.509,235	13.030,941	1.153,523	787,837	11.840,377	3.221,756	14.336,876	2.176,402		
2031	10	95.520,407	13.040,258	1.194,881	823,289	11.858,540	3.291,072	14.363,102	2.205,982		144.338,532
2032	11	95.531,580	13.049,583	1.237,722	860,337	11.876,731	3.361,879	14.389,376	2.235,965		
2033	12	95.542,755	13.058,913	1.282,099	899,052	11.894,950	3.434,211	14.415,698	2.266,355		
2034	13	95.553,931	13.068,251	1.328,067	939,510	11.913,197	3.508,098	14.442,069	2.297,158		
2035	14	95.565,108	13.077,595	1.375,683	981,788	11.931,471	3.583,575	14.468,487	2.328,379		
2036	15	95.576,286	13.086,946	1.425,006	1.025,968	11.949,774	3.660,676	14.494,954	2.360,025		145.630,636
2037	16	95.587,466	13.096,304	1.476,098	1.072,137	11.968,105	3.739,435	14.521,469	2.392,102		
2038	17	95.598,647	13.105,668	1.529,021	1.120,383	11.986,464	3.819,889	14.548,033	2.424,614		
2039	18	95.609,830	13.115,039	1.583,842	1.170,800	12.004,851	3.902,075	14.574,645	2.457,568		
2040	19	95.621,013	13.124,416	1.640,629	1.223,486	12.023,267	3.986,028	14.601,306	2.490,970		
2041	20	95.632,198	13.133,801	1.699,451	1.278,543	12.041,710	4.071,788	14.628,015	2.524,825		
2042	21	95.643,385	13.143,192	1.760,383	1.336,078	12.060,182	4.159,392	14.654,774	2.559,141		147.379,527
2043	22	95.654,572	13.152,590	1.823,499	1.396,201	12.078,683	4.248,882	14.681,581	2.593,924		
2044	23	95.665,761	13.161,994	1.888,878	1.459,030	12.097,211	4.340,297	14.708,438	2.629,179		
2045	24	95.676,951	13.171,405	1.956,601	1.524,686	12.115,768	4.433,679	14.735,344	2.664,913		
2046	25	95.688,143	13.180,823	2.026,753	1.593,297	12.134,354	4.529,070	14.762,299	2.701,133		
2047	26	95.699,336	13.190,248	2.099,419	1.664,996	12.152,968	4.626,513	14.789,303	2.737,845		149.033,628
2048	27	95.710,530	13.199,679	2.174,691	1.739,920	12.171,611	4.726,053	14.816,356	2.775,057		
2049	28	95.721,725	13.209,118	2.252,662	1.818,217	12.190,282	4.827,734	14.843,460	2.812,774		
2050	29	95.732,922	13.218,563	2.333,428	1.900,037	12.208,982	4.931,603	14.870,612	2.851,003		
2051	30	95.744,120	13.228,014	2.417,090	1.985,538	12.227,710	5.037,707	14.897,815	2.889,753	Total:	
		2.867.457,751	392.756,236	45.560,516	33.797,612	358.799,662	112.888,963	435.300,614	71.767,885	4.318.329,238	

Estimated external effects (Leakage)

Climate protection forest Makariv

Leakage is assumed to be zero. The conditions for this are listed in Chapter 3.2.c), and they must be observed. Equation 19 applies.

Equation 19: Lt = 0

Equation 20 for determining leakage does not apply

Emissionsreduktionen im Projektszenario (ex-ante)

Equation 11 states that the C-storage of the project scenario at the beginning of the project (t=0) must be equal to the C-storage of the baseline scenario (t=0).

Equation 11: $N_{(t=0)} = B_{(t=0)} = x$ tC

where

$N_{(t=0)}$ C stock at time t in the project scenario (tC/ha)
$B_{(t=0)}$ C stock at time t in the reference scenario (tC/ha)

Equation 12:

$$N_{(t)} = \sum_{i=1}^{I} (N_{A(t)i} + N_{B(t)i}) * A_i$$

where

$N_{(t)}$ = C stock at time t project scenario (tC)

A_i = rea of stratum i (Area of stratum $_{I(}$ (ha)
$N_{(A)}$ = Above-ground C reserves (Aboveground carbon stock)
(tC) $N_{(B)}$ = Underground C stock (Belowground carbon stock) (tC)

Instead of N(A) and N(B) aboveground and belowground carbon stocks, the Ukrainian conversion factors are used (Ref. 136, Table 101). Ref. 132 Worksheet "Converting m3 to tCO2"

Climate protection forest Makariv
Die Gleichungen 13 – 16 werden nicht verwendet wegen der Anwendung der Umrechnungsfaktoren.

Gross sink capacity of the project ΔCPROJ,t

Equation 17: $\Delta C_{PROJ,t} = (N_t - N_{t-1}) * (44/12) / \Delta t$

where
$C_{PROJ,t}$ = Project net greenhouse gas sinks (tCO_2/a)
N(t) = C stock at time t in the project scenario (tC)

Table with the values using the equations:

Year	Emission reductions in the baseline scenario in tons of CO_2e	Emission reductions in the project scenario in	Net attributable emission reductions in CO_2e
Year 1			
Year 2			
Year 3			
Year 4			
Year n **Total** (tCO_2 e)			

Climate protection forest Makariv

Ref. 108, Worksheet «Scenario in tCO2»

	Jahr	Net attributable emission reductions, tCO2e
2021	0	
2022	1	140.296,517
2023	2	140.501,875
2024	3	140.711,176
2025	4	140.924,541
2026	5	141.142,098
2027	6	141.363,979
2028	7	141.590,318
2029	8	141.821,259
2030	9	142.056,946
2031	10	142.297,532
2032	11	142.543,174
2033	12	142.794,033
2034	13	143.050,279
2035	14	143.312,086
2036	15	143.579,636
2037	16	143.853,115
2038	17	144.132,719
2039	18	144.418,649
2040	19	144.711,115
2041	20	145.010,332
2042	21	145.316,527
2043	22	145.629,932
2044	23	145.950,789
2045	24	146.279,348
2046	25	146.615,871
2047	26	146.960,628
2048	27	147.313,897
2049	28	147.675,970
2050	29	148.047,149
2051	30	148.427,746
		4.318.329,238

Estimate the net change in emissions of non-CO2 gases such as CH4 and N2O for calculating the net change

No non-CO2 gases such as CH4 and N2O can be identified as project emissions.

The method does not consider non-CO2 gases such as CH4 and N2O as project emissions.

Other greenhouse gas emissions from project activities

Other emissions from biomass burning, tillage, fossil fuel emissions, artificial fertilizers and emissions from the decomposition of N-fixing species cannot be identified as being caused by the project.

Therefore, no other project-related emissions are taken into account for the method.

Net climate impact of the project Calculation in chapter. 5.8

The table above shows the project's expected positive net climate impact over its lifetime. Leakage is assumed to be zero.

The following formulas and variables are used for the ex-post calculations of the net climate effect:

Net creditable sink capacity:

The net attributable greenhouse gas sink for each year was calculated as follows:

Equation 21: $ER_t = \Delta C_{PROJ,t} - \Delta C_{BSL,t} - GHG_{PROJ,t} - L_t$

in which

ER_t	Net creditable sink capacity in tCO_2/a	Net sink
$\Delta C_{PROJ,t}$	Net creditable project sink performance in tCO_2/a)	Gross sink
$\Delta C_{BSL,t}$	Net sink capacity in the reference scenario in tCO_2/a)	Baseline sink/source)
$GHG_{PROJ,t}$	Project emissions tCO_2/a)	Ukraine: hier = 0
	Leakage (t CO_2/a)	Ukraine: hier = 0

Climate protection forest Makariv
Ref. 108, Arbeitsblatt «Szenario in tOO2»
Makariv: ERt = 140'296 tCO2/a

For specifications to avoid double counting, see chapter. 4.2

External climate effects (Leakage)

Failure to account for soil carbon results in an underestimation of the sink capacity by approximately 50%. This underestimation provides a multiple buffer for potential external leakage effects. Due to the very conservative project assumptions that exclude soil, leakage is valued at zero in the method (see Chapter 3.2 c).

No non-CO2 greenhouse gases related to the project can be identified. The method does not consider non-CO2 greenhouse gases.

8.3 Determination of the sink capacity in the forest reserve ex-ante

The following assumptions are made for calculating the reference development (managed forest) and the project development (unmanaged forest = natural or virgin forest):

Annahme 1: The stock doubles from the “normally” managed forest to the natural forest.

If appropriate data are available, the calculations are applied as in the IFM project type. Model assumptions can also be used to determine the carbon sink effect in forest reserves. Natural forests contain approximately twice as much carbon as managed forests. 12 This one-time increase in the average biomass stock is defined as a carbon sink project. This is conservative, since in Eastern Europe, even natural forests in wood-stock equilibrium continue to store additional carbon, primarily in the soil (Ref. 27). Recent research also shows that primeval forests in temperate zones always remain carbon sinks, even beyond the supposed equilibrium state (Ref. 28). The further accumulation of carbon occurs primarily in the soil.

Annahme 2: The forest type (natural forest community) determines the creditworthiness and the average normal stock.

The average timber stock of the normal operating class, weighted by location, is assumed as the reference scenario from the yield tables. The project generates the average stock of the natural forest, which is twice as high. The difference is the sink effect of the project. The application of the yield tables is conservative, as the yield level of the yield table growth models dating from the 1960s and 1970s has increased significantly (up to 40% for spruce, up to 20% for beech (Ref. 9).

The conversions from standing stocks to tCO2e are carried out according to Ref. 6: Thürig Esther, Schmid Stéphanie 2008: Annual CO2 flows in forests: Calculation method for the greenhouse gas inventory. Z. Forstwes. 159 (2008) 2: 31–38.

Climate protection forest Makariv
Not applicable.
The Climate Protection Forest Makariv project covers the accessible area of the managed forest, excluding scrub forest. Forest reserves are excluded from the project perimeter.

[12] Management deprives the forest of its rich and long-lasting optimal and decay phases. The decay phase, in particular, is characterized by high biodiversity. A forest reserve always also acts as a carbon sink for a time. The doubling of biomass stocks is demonstrated by Korpel Ref. 14 and Prusa Ref. 25. While in sustainably managed forests, growth and use are balanced, in natural forests, growth and decay are balanced. Both represent dynamic equilibria in biomass stocks over larger areas, but at very different levels.

9 Data quality management

A quality management process for managing data and information shall be established and implemented, including the assessment of uncertainty related to the project and the baseline scenario. Where practical, uncertainties associated with the quantification of greenhouse gas emission reductions or increases in removals shall be reduced.

Climate protection forest Makariv
The inventory data (stock, growth, mortality) are based on sample inventories carried out by the DP Lisa Ukraine branch Makariv forest in the holdings (sample inventory with concentric sample circles).

The standard error of the stock cannot be determined precisely. For a representative area, a sample of 2 hectares results in over 3,500 samples. Therefore, the total error (standard error) is likely to be less than 2%.

The usage data originate from the usage control of the DP Lisa Ukraine, branch Makariv forest, and are recorded while standing. Therefore, a back calculation from the harvest measurement (lying measurement, factory measurement) is not necessary.

All data used come from DP Lisa Ukraine branch Makariv forest. They therefore comply with regulatory requirements.

10 Monitoring of the climate protection project

a) Purpose of monitoring

Managed forest
Monitoring ensures that the project's creditable carbon sink performance in the managed forest is determined ex post using recognized methods and conservatively determined.

Reservation
For forest reserves with a lifespan of at least 50 years, the emission reductions (sink capacity) are determined ex ante based on model assumptions. The monitoring method consists of monitoring the cessation of timber use on the reserve area. This means checking that no timber is actually being used.

For **official reservation** with a term of 50 years or more, the following applies: Due to the contractual arrangements between the forest owners and the DP Lisa Ukraine, the Forest Service is obligated to monitor compliance. Furthermore, the Forest Service has sovereign oversight of the forest and ensures compliance with the forest and nature conservation laws under which the reserve was established. Due to this institutional safeguard, further monitoring is unnecessary.

The following applies to **unofficial reservation**: Forest reserves with ex-ante determination of sink performance without official status must establish a monitoring system that confirms the reserve status for each monitoring period. This status must be secured by an entry in the land register. The unofficial reserve project must join a program. The land register entry is an easement in favor of the program. The program guarantees the reserve status and the certificates generated thereby. The program defines the forest owner's security measures, e.g., by retaining a risk buffer. An external verifier checks whether any uses have been made in the reserve.

Old-growth forest islands should be treated analogously to reservation (both official and unofficial). When establishing and counting old-growth forest islands, the "Selection Criteria for Old-Growth Forest Islands, Recommendations for the Elimination and Assessment of Old-Growth Forest Islands" 13 must be taken into account. The area of reserves and old-growth forest islands is calculated separately from the other project area (ex-ante calculation of the sink capacity for reserves and old-growth forest islands, ex-post calculations in managed forests).

Climate protection forest Makariv
The project Climate protection forest Makariv concerns the accessible area of the managed forest.

b) Types of data and information to be included in the report, including units of measurement

Project area in hectares to the nearest 0.1 ha.

Carbon storage as in 3.2.

The standing living wood stock in m3/ha is accounted for by tree species or tree species group. In principle, all carbon stores can be accounted for using recognized methods. They are all aligned with the stock of living trees (living tree biomass). Living tree biomass must be recorded. Other stores can be conservatively excluded from the calculation.

Wood stock: The wood stock in m3 of hardwood is converted into tCO2 of living tree biomass.

Growth: The increase in m3 of hardwood is converted into tCO2 of living tree biomass.

Usage: The usage is calculated like the stock when **measuring standing**.

If the use is recorded by **measurement after harvest** (lying measurement, factory measurement), a recalculation is made to the standing measurement in m3 (Ref. 42) and tCO2 (Ref. 6).

c) Origin of the data
Stock and growth data are derived from measured inventories or model assumptions. Use of marking records and operational records.

Climate protection forest Makariv
Project area: 33,667.80 (23,678.3) ha, table from Makariv Forest based on data from DP Lisa Ukraine, Ref. 101. Carbon storage: see Chapter 3.2, the eligible storage is the living tree biomass. Wood stock at the beginning of the project: The data compiled from various inventories result in a stock at the end of 2022 of 280.227 m3/ha (Ref. 105). Back calculation, taking into account increment, mortality, and use, to the beginning of 2022 results in 280 m3/ha (Ref. 113). Increment: Calculated from follow-up inventories: 4.91 m3/ha/year
Usage: From the DP Lisa Ukrainian usage control branch Makariv forest (Ref 113)

c) Monitoring methods, including approaches for estimation, modeling, measurement, or calculation

Managed forest (ex-post)

In managed forests, storage capacity is determined ex post. This method focuses on the wood stock, which is converted into living tree biomass. Omitting other carbon stores (soil, etc.) is conservative. Storage capacity can be determined in two ways;
Calculation of sink performance ex-post

a) Inventory difference method (Stock Change) SL = Vti – Vt1

b) Zuwachs/Verlust-Methode (Gain – Loss)

$$SL = Vt1 + \sum_{t=1}^{n} \binom{n}{t} Z - \sum_{t=1}^{n} \binom{n}{t} N - \sum_{t=1}^{n} \binom{n}{t} M - L$$

[13] Thibault L. et al. 2010: Selection criteria for old-growth forest islands. Recommendations for the selection and assessment of old-growth forest islands. Federal Research Institute WSL 77 P., (Ref. 15)

Here are:

SL = Sink capacity
Vt1 = Stock at time 1
Vti = Stock at time i
Z = Increase
N = Utilization
M = Mortality = 0
t1 = Time 1
ti = Time i
L = Leakage = 0

Sink performance
The sink capacity is determined separately for each tree species or tree species group. Values recognized in the literature for the parameters wood density, carbon content, and biomass expansion are to be used (Ref. 6).

Wood stock
The timber stock is determined in m³ of standing stem wood using recognized forest inventory methods. The results must be documented with an indication of the accuracy (standard error). If the stock is estimated, the estimation parameters must be recognized and applied conservatively.

The timber stock is recorded by tree species or tree species groups and converted to living tree biomass using recognized factors.

Climate protection forest Makariv
The gain/loss method is used. Sink capacity is determined based on coniferous and deciduous wood. Timber stock at the start of the project: The timber stock is based on sample inventories. This was extrapolated to the end of 2022, taking into account increment, mortality, and use. Ref. 105. The calculation back to the start of the project on January 1, 2022, resulted in 280.227 m3/ha.

Usage
The use can be recorded standing before or lying down after harvesting (in the forest or factory survey)

a) **N as standing measurement**
b) **N in harvest measure**

To a) Standing measurement

The standing measurement of utilization allows the same conversion factors to be applied to biomass as for the standing timber stock. Plausibility must be verified using the actual quantities of timber sold.

To b) Harvest measure

The harvested volume is recalculated to the standing volume using recognized conversion factors. (e.g.: N=1/0.8 = stored solid cubic meter plus harvest loss**)**

Climate protection forest Makariv
The usage of DP Lisa Ukraine sustainability control is used. These are already specified in the tariff-based fixed meter of standing timber.

Growth
The increase shall be determined or estimated based on sample inventories. Recognized methods shall be used. In the case of estimates, a conservative approach shall be taken into account

Climate protection forest Makariv
Growth: From follow-up inventories Ref. 105

Mortality
Mortality does not equate to the immediate release of stored carbon. Deadwood can be measured and conservatively converted into tCO2e. Decomposition is very slow. Over a 30-year project duration, thick trunks do not decompose completely, and the amount of shelter is negligible. According to this methodology, deadwood can also be conservatively omitted.

Leakage

NCH_i = Usage volume of Ukraine in the year in the calculation,

NP = sustainable use potential in Ukraine = **66‘456‘000** m3/Year[14]

Climate protection forest Makariv: NCH2021 = 14'000’300 m3 in 2021

The 2022 figure is not yet available. The 2021 figure is used as a proxy for 2022. In 2021, 14,000 million m³ of wood were harvested, which is in line with previous years. This is far from the utilization potential of 66.456 million m³. For capacity reasons alone, it is not expected that the utilization potential will be reached.

$SLCH_i$ = Credited forest sink performance in Ukraine, total of all projects, in monitoring year 1 for leakage control,

Climate Protection Forest Makariv
Projects: none
SLCH2022 = 0 m3

Leakage-Kontrollparameter
Total use in Ukraine must not exceed 14 million m3/year (less project sinks) to assume zero leakage (see Chapter 3.2 c).

If (NPi – SLCHi) > NCHi then Leakage = 0 otherwise Leakage = 10%

Climate protection forest Makariv

2022: NP2022 – SLCH2022 = 66‘456‘000 – 0 = 66‘456‘000
(NP2022 – SLCH2022) > NCH2022: 66‘456‘000 > 14'000’000 Condition applies

Leakage is rated as zero (see Chapter 3.2 c).

Climate protection forest Makariv
Creditable sink capacity (greenhouse gas report) Monitoring

The verification covers the 2022 monitoring period (January 1, 2022 – December 31, 2022). The monitoring results in a final stock in 2022 of 280 m³/ha. The farm thus fulfills its obligation not to fall below 280 m³/ha and can offset 140,296 tCO2 according to the committed project scenario. Ref. 108, Table "Monitoring."

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[14] According to Ref. 44, the productive forest area in Ukraine amounts to 10.4 million hectares. Of this, 10% are protected from commercial use in the medium to long term as reserves. 10.4 million hectares * 0.9 * 7.1 m3/ha/year = 66.456 million m3/year Ref. 44
https://www.land.nrw/pressemitteilung/zusammenarbeit-mit-der-ukraine-auf-dem-gebiet-der-forst-und-holzwirtschaft-soll
https://pro-consulting.ua/issledovanie-rynka/analiz-rynka-lesozagotovki-v-ukraine-2023-god
https://epravda.com.ua/rus/experts/kak-ukraina-budet-uvelichivat-lesozagotovku-801619/

Calculation of the sink capacity in the forest reservation ex-ante

Stock change approach for ex-ante calculation of sink performance

The methodology is fundamentally a stock-change approach. It compares an average C stock without a project with an average C stock with a project (only living tree biomass).

The sink performance is calculated according to:

$$SL = \sum_{i=1}^{n} \binom{n}{i} Vni - Vbi$$

These include:

SL = Sink capacity in tCO_2
Vn = average stock of a natural forest in equilibrium in tCO_2, project case

It applies: Vn tCO_2= Vn m^3 * BEF*A ha

Vb = average stock of a sustainably managed forest (normal stock) in tCO_2, baseline

It applies: Vb tCO_2= Vb m^3 * BEF*A ha

A ha = Project area

i = Location type defined by creditworthiness and tree species/tree species group

According to Korpel Vn = 2* Vb (Assumption 3 in Chapter 4.4)

$$SL = \sum_{i=1}^{n} \binom{n}{i} Vbi$$

For all i = average upper limit creditworthiness:

$$SL=Vb$$

Vb tCO_2 = average stock of a sustainably managed forest (normal stock) in tCO_2,

It applies: Vb tCO_2= Vb m^3/ha * BEF tCO_2/m^3 * A ha

BEF = Biomass expansion factor

A ha = Project area

SL tCO_2 = Vb m^3/ha * BEF tCO_2/m^3 * A ha

This sink capacity only applies to living tree biomass. This is conservative, as other similarly oriented carbon pools such as soil carbon, litter cover, and deadwood are not taken into account. The assessment of creditworthiness and the use of yield tables are also conservative.

Climate protection forest Makariv

Not applicable in Makariv. The project does not affect forest reservations.

e) Monitoring time and periods taking into account the needs of the intended users;

The monitoring period covers the entire project duration of at least 30 years. The individual monitoring periods (ex-post) can last between 1 and 5 years. Monitoring must be maintained throughout the entire project duration. If a deficit in the project register exists at the end of the regular project duration, the project duration will be extended by the period during which the deficit is offset by continued sink effects. The monitoring period will be extended accordingly. Project deficits can also be offset by the program or by other measures while maintaining climate integrity. Both measures must be confirmed by monitoring.

Climate protection forest Makariv
The monitoring period is 5 years. The annual usage data from the operating statement is used.

f) monitoring-related tasks and responsibilities;

Forest owners ensure that monitoring is carried out professionally (in-house, program provider, external body)

Climate protection forest Makariv
The basic data for monitoring (use) is collected by the management in coordination with the DP Lisa Ukraine branch Makariv Forest during the marking process. The monitoring report is prepared by the management. An external body can also be commissioned to do this (program, external body).

g) Greenhouse gas information management systems, including the location and retention of stored data.

Climate protection forest Makariv
All greenhouse gas information is stored within the operational data security system of Wald Makariv. The STW e.V. association maintains the project register, in which confirmed VERs are recorded. Sales, decommissioning, or transfers to a program are recorded.

11 Documentation of the climate protection project

Documentation must be available to demonstrate the climate protection project's compliance with the requirements of this part of ISO 14064. This documentation must meet the validation and verification requirements (see 5.12). Information applicable to multiple projects within a program can be retained by the program organization and does not need to be recorded anew for each project.

Climate protection forest Makariv
The project is described in this document. Information specific to the Climate Protection Forest Makariv project is enclosed in gray boxes and green text. References from 01 to 99 are method-specific. References from 101 and above refer to the Climate Protection Forest Makariv project.

12 Validation and/or verification of the climate protection project

The project owner should have the climate protection project validated and/or verified. If the project applicant requests validation and/or verification of the climate protection project, the project applicant must submit a greenhouse gas declaration (monitoring report) to the validator or verifier.

Information that applies to several projects within a program can be retained by the program organization and does not need to be recorded again for each project.

The project applicant should ensure that the validation or verification complies with the principles and requirements of ISO 14064-3.

Climate protection forest Makariv The project Climate protection forest Makariv was validated on 08.07.2025 by TMS LLC and the project was verified for 2022.

13 Reporting on the climate protection project (Monitoring report)

The project applicant must prepare a greenhouse gas report (monitoring report) and make it available to the intended users. The greenhouse gas report must:

- identify the intended application and user of the greenhouse gas report, and

- have a structure and content that meet the needs of the intended user

Information that applies to several projects within a program can be retained by the program organization and does not need to be recorded again for each project.

Climate protection forest Makariv The monitoring report is included in Chapter 10 of this document.

13.1 Formal requirements

If the project proponent issues a public statement on greenhouse gases claiming compliance with this part of ISO 14064, it shall publish the following:

a) an independent third-party validation or verification statement prepared in accordance with ISO 14064-2;

Climate protection forest Makariv There is an independent validation or verification declaration from TMS LLC dated 08.07.2025

or

b) a greenhouse gas report containing at least the following:
   1) the name of the project applicant;
   2) the climate protection program(s) to which the climate protection project is committedt;
   3) a list of greenhouse gas declarations, including an indication of greenhouse gas emission reductions and removal increases, expressed in tonnes of CO_2e;
   4) a statement describing whether the greenhouse gas declaration has been validated or

verified, including the type of validation or verification and the level of assurance achieved;

5) a brief description of the climate protection project, including size, location, duration and types of activities;
6) a statement on aggregated greenhouse gas emissions and/or removals from greenhouse gas sources, sinks and reservoirs related to the climate protection project and controlled by the project applicant, stated for the relevant period (e.g. annual value, total up to the given point in time, overall value) in tonnes of CO_2e;
7) a statement on aggregate greenhouse gas emissions and/or removals from greenhouse gas sources, sinks and reservoirs relative to the baseline scenario, expressed in tonnes for the relevant period CO_2e;
8) a description of the baseline scenario and evidence that the reductions in greenhouse gas emissions or increases in removals are additional to those that would occur in the absence of the project;
9) where applicable, an assessment of durability;
10) a general description of the criteria, procedures or good practice guidance used as a basis for calculating greenhouse gas emission reductions and removal increases;
11) the date of the report and the period covered.

13.2 Parameters to be monitored

Marked in green: project-specific Makariv

Parameter	Project area, ~~forest area reservation~~
Description of the parameter	23'678.3 (in 2022)
Unit	hectares
Data source	ocuments DP Lisa Ukraine branch Makariv forest

Parameter	Usage quantity in the project in the year of crediting
Description of the parameter	

	Use of reserve cubic meters						
	Conversion of harvest to storage cubic meters						
	NH-Stemh.	LB-Stemh.	NH-Ind.h.	LH-Ind.h.	NH Energyh.	LH-Energyh.	
	NH o.R.	LH o.R.	NH m.R.	LH m.R.	NH m.R.	LH m.R.	total
	m3	m3	m3	m3	m3	m3	m3

Unit	m3/year
Data source	Operating accounting

Conversion in the project is not necessary because the usage is measured standing.

Parameter	Officially approved operating plan
Description of the parameter	Document Operating plans are available. Uses are subject to approval
Unit	n/a
Data source	Owner/Factory

Parameter	Optional: Certification of forest management according to a voluntary standard
Description of the parameter	The project area is FSC-certified. Certification group: FC-FM/COC-804927, License code: FSC-A00510
Unit	n/a
Data source	Owner/Factory

Parameter	Required if no operational plan or certification is available: Public consultation on the project
Description of the parameter	Document
Unit	n/a
Data source	Owner/Factory

Parameter	New inventories In the case of newer inventories, the calculation bases must be adjusted (stock, increase).
Description of the parameter	Document The DP Lisa Ukraine conducts successive inventories across the entire region. The inventories of the establishments were conducted in different years, and this practice will continue. No more recent inventory data is available.
Unit	n/a
Data source	Owner/Factory /DP Lisa Ukraine

Parameter	Usage volume of Ukraine in the year of allocation, N-CH
Description of the parameter	14'000'000 m3 in 2021 als Proxy für 2022
Unit	m3
Data source	Wood use statistics

Parameter	Credited forest sink performance in Ukraine, total of all projects, in the monitoring year for leakage control, SL-CH
Description of the parameter	Project
Unit	m3
Data source	Central office

Parameter	Leakage control parameters Must not exceed 7.1 million m3/year (less project sink performance) to assume zero leakage
Description of the parameter	2022: NP2022 – SLCH2022 = 66‘456‘000 – 0 = 66‘456‘000 (NP2022 – SLCH2022) > NCH2022: 66‘456‘000 > 14'000'000 Condition applies
Unit	m3
Data source	Calculation: total wood use in Ukraine minus total sink capacity of all projects.

13.3 Fixe Parameter

Marked in green: project-specific

Parameter	Standing timber stock reference value and project – starting value
Description of the parameter	280
Unit	m^3/ha
Data source	Calculated in Ref. 105, Table Update Stock

Parameter	Wood density softwood, dry matter TS
Description of the parameter	0.384
Unit	t TS/m^3
Data source	Ref. 24: Volz, Richard; Nauser, Markus; Hofer, Peter (2001): Climate policy needs forests and wood. Forest and Wood 3/01, pp. 39-41

Not applied due to use of WSL conversion, Ref. 16, Tabelle 101

Parameter	Wood density hardwood, dry matter TS
Description of the parameter	0.566
Unit	t TS/m^3
Data source	Ref. 24: Volz, Richard; Nauser, Markus; Hofer, Peter (2001): Climate policy needs forests and wood. Forest and Wood 3/01, pp..39-41

Not applied due to use of WSL conversion, Ref. 16, Table 101

Parameter	Biomasse Expansionsfaktor BEF Laubholz
Description of the parameter	1.47
Unit	tCO_2/ m^3
Data source	Ref. 136: Brändli, U.-B.; Abegg, M.; Allgaier Leuch, B. (eds.) 2020: Ukrainian National Forest Inventory. Results of the fourth survey 2009–2017. Birmensdorf, Swiss Federal Institute for Forest, Snow and Landscape Research WSL. Bern, Federal Office for the Environment. 341 pp. LFI4 Tabelle 101 Not applied due to use of the WSL conversion, Ref. 16a, Table 101

Parameter	Biomass expansion factor BEF softwood
Description of the parameter	1.11
Unit	tCO2/ m3
Data source	Ref. 136: Brändli, U.-B.; Abegg, M.; Allgaier Leuch, B. (eds.) 2020: Ukrainian National Forest Inventory. Results of the fourth survey 2009–2017. Birmensdorf, Swiss Federal Institute for Forest, Snow and Landscape Research WSL. Bern, Federal Office for the Environment. 341 pp. LFI4 Tabelle 101 Not applied due to use of the WSL conversion, Ref. 16a, Table 101

Parameter	C- Share in biomass dry matter
Description of the parameter	0.5
Unit	Dimensionless
Data source	Ref. 06: Thürig Esther, Schmid Stéphanie 2008: Annual CO2 fluxes in forests: Calculation method for the greenhouse gas inventory. Z. Forstwes. 159 (2008) 2: 31–38 Not applied due to use of the WSL conversion, Ref. 16a, Table 101

Parameter	CO_2/C Molecular weight ratio
Description of the parameter	44/12 = 3.67
Unit	Dimensionsless
Data source	Ref. 06: Thürig Esther, Schmid Stéphanie 2008: Annual CO2 fluxes in forests: Calculation method for the greenhouse gas inventory. Z. Forstwes. 159 (2008) 2: 31–38

Parameter	Conversion of harvest into storage cubic meters
Description of the parameter	

Usage of reserve m3						
conversion	Harvest in storage m3					
Harvest loss	Harvest loss	Harvest loss	Harvest loss	Harvest loss	Harvest loss	
Rindenzuschl.	Rindenzuschl.					
NH-Stammh.	LB-Stammh.	NH-Ind.h.	LH-Ind.h.	NH Energieh.	LH-Energieh.	
NH o.R.	LH o.R.	NH m.R.	LH m.R.	NH m.R.	LH m.R.	total
dimensionsl.	dimensionsl.	dimensionsl.	dimensionsl.	dimensionsl.	dimensionsl.	dimensionsl.
1.235	1.277	1.087	1.149	1.087	1.149	1.19

Unit	Dimensionless
Data source	Ref. 42: Conversion of horizontal dimensions without bark to stock cubic meters in bark, Renato Lemm, WSL

Not used in the Makariv project, as the DP Lisa Ukraine records the uses in standing stock.

Parameter	Nachhaltiges Nutzungspotenzial des Projekts, NP
Description of the parameter	7.1 to 8.6, average 7.9, conservative 7.1
Unit	million m3/year
Data source	Ref. 30: Hofer P. et al. 2011: Wood utilization potential in the forest. Evaluation of utilization scenarios and forest growth development. Federal Office for the Environment, Bern. Environmental Knowledge No. 1116: 80 pages.

14 Environmental and social criteria

In principle, it can be assumed that forest sink projects within the framework of officially approved operational plans meet the legal requirements for environmental concerns. Certification according to a voluntary forest management standard can be cited as additional evidence of the environmental and social compatibility of the sink project.

If no such basis exists, public consultations on the project must be conducted (consultation of affected parties from the environmental, economic, and social sectors).

Climate protection forest Makariv
The participating forestry companies have officially approved operational plans, and their uses are officially approved. The company is FSC-certified (Group Artus Certificate FC-FM/COC-804927, License Code: FSC-A00510)

References

References 1-100 are method-specific.

References >100 are project-specific.

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