AUDIT REPORT
VALIDATION OF THE GHG-SEQUESTRATION PROJECT

"FOREST ADAPTATION PROJECT LINDORF"*

according to

ISO 14064-2:2019

Report No: 8003063478- 23/107

Date: 08.11.2023

TÜV NORD CERT GmbH
JI/CDM Certification Program
Am TÜV 1
45307 Essen, Germany
Phone: +49-201-825-3335
Fax: +49-201-825-3290
www.tuev-nord.de
www.global-warming.de

Project Title	FOREST ADAPTATION PROJECT LINDORF – *formerly called as „PROJECT MOUNTAIN FIELD" The project name was changed on request of the project developers after validation.
Version	1.0
Standard	ISO 14064-2:2019(E)
Category	Validation
Scope	Forestry – Improved Forest Management (14)

Report Title	Audit report validation of the GHG- sequestration project "Forest adaptation project Lindorf"
Version	1.1
Project Proponent	Fürst Wallerstein Forstbetriebe
Other Entities involved	Pina Technologies GmbH
Pages	39
Date of issue	08.11.2023
Prepared by	TÜV NORD CERT GmbH Abteilung Nachhaltigkeit
Contact	Am TÜV 1 45307 Essen, Germany Phone: +49-201-825-3335 Fax: +49-201-825-3290 www.tuev-nord.de
Approved by	Alexandra Nuske
Auditor	Martin Opitz (Team Leader, Technical Expert)

Summary:

The project "Forest Adaptation Project Lindorf" was prepared according to the requirements of the ISO standard 14064-2 and is audited according to the same by TÜV NORD CERT GmbH.

Pina Technologies GmbH carried out a project to quantitatively evaluate the greenhouse gas (GHG) reductions and removals of a forest conversion (Improved Forest Management) in the private forests of the Fürst Wallerstein Forstbetriebe. The forest conversion pursues the goal of converting existing single layered pure stands (81% spruce) into bio-diverse and multi-layered mixed stands and achieving an increase in the total standing volume through the long-term establishment of an underlayer.

To calculate the development of wood volume achieved by forest adaptation measures, the software library Tree Growth Open Source Software (TreeGrOSS), developed by the Northwest German Forest Research Institute (NW-FVA), was used.

The quantification of the GHG reductions and removals is based on internationally recognized standards and calculation methods such as the Intergovernmental Panel on Climate Change (IPCC) and the Verified Carbon Standard (VCS).

The forest adaptation is implemented by the owner Fürst Wallerstein Forstbetriebe.

Risks and uncertainties were taken into account in the project as far as possible and appropriate measures were taken.

Three Clarification Requests (CLs) were identified in the course of the validation.

The validation showed that the project meets the requirements of ISO 14064-2.

In a 30 year crediting period a GHG gross sink capacity of 30,263.87 tCO2 e can be achieved

As a result of the validation, TÜV NORD CERT GmbH confirms:

☒ all calculations comply with internationally recognized methods,

☒ there are comprehensible data bases for the conservative determination of the GHG sink performance,

☒ the GHG sink performance was calculated appropriately.

TÜV NORD CERT GmbH confirms that the forest adaption of a spruce dominated even aged forest stand to a biodiverse and multi structured mixed forest stand **on 318.37 ha forested land of the Fürst Wallerstein Forstbetriebe is expected to lead to the following GHG reduction and removal:**

Crediting Period: **01.02.2021 - 31.01.2051**

Gross Emission reductions: **30,263.87 tCO2 e**

*The report confirms the calculated GHG sink performance of the project. It is possible to trade the CO2 certificate with the purpose of a contribution claim and to communicate the financing and the positive GHG sink performance of the project as a buyer.

Table of contents *Page*

1 INTRODUCTION

1.1 Objective

The objective of the validation is to verify the project documentation and implementation on site by an independent third party (TÜV NORD CERT GmbH). In particular, the following are validated:

- The requirements of ISO 14064-2:2019(E);
- Relevant customary laws and regulations

Validation is considered necessary to provide stakeholders with quality assurance on the quantified GHG sink performance.

1.2 Scope and criteria

The validation scope is given as a thorough independent and objective evaluation of the project design and its implementation. Since the project the growth model Tree Growth Open Source Software (TreeGrOSS) which was developed by the NW-FVA and which has not been explicitly tested, the objective assessment includes, in particular, verification of compliance and due diligence with regards to the assumptions made and sources used in the application of the TreeGrOSS model, the justification of additionality, the environmental impact and monitoring plan included in the project report, and other evidence to ensure that the ISO 14064-2 project activity meets all relevant and applicable ISO 14064-2 criteria.

The information included in the project description and supporting documents were assessed and evaluated against the requirements of ISO 14064-2 and the calculation methods used applied.

The validation is based on the information made available to TÜV NORD CERT GmbH and on contract conditions. TÜV NORD CERT GmbH cannot be held liable by any legal entity for issuing a validation opinion based on false or misleading information provided to it during the validation. Validation is not intended to provide advice to project participants. However, indicated requests for clarification and/or corrective action may provide input to improve the project design.

1.3 Level of assurance

Indicate the level of assurance of the validation. The validation has been planned and organized to achieve a

☒ reasonable level of assurance

☐ limited level of assurance

1.4 Project Summary

Pina Technologies GmbH implemented a project in the forest of the Fürst Wallerstein Forstbetriebe in Baden-Wuerttemberg and Bavaria to quantitatively assess the GHG reductions and removals to be achieved in the course of the of a forest conversion project.

Forest conversion pursues the goal of converting the existing single layered pures stands (81% spruce) into bio-diverse and multi-layered mixed stands. The forest conversion is initiated/implemented by three silvicultural relevant activities:

- Thinning and end-use of the overstory in order to develop single-tree stability and allow new growth in lower layers; As the stands at project start are characterized by a high stand stability as a single tree stability, initial interventions/removal amounts are low, but will be increased toward end-use during the project period and after the establishment of an under layer

- Preregeneration based on seeds of silver fir supplemented by douglas fir, lime tree and hornbeam (depending on availability and location); and

- Encouraging and protecting natural rejuvenation (especially oak and hornbeam as well as maple). In addition to the measures outlined above, the goal is to be achieved by intensifying the hunting.

Taking into account project-specific parameters, the project results in a potential additional GHG reduction and removal of 30,263.87 tCO2 e over a project period of 30 years (2021 - 2051) on a forested area of 318.37 ha.

2 VALIDATION PROCESS

2.1 Methods and criteria

Validation is performed in the following steps:

- Contract review
- Appointment of team members and technical reviewers
- Desk review of the project description submitted by the client and additional supporting documents
- Validation planning
- On-site assessment
- Background investigation and follow-up interviews with personnel of the project developer and its contractors
- Preliminary reporting
- Resolution of all non-conformities
- Final reporting
- Technical review
- Release of the VAL

Table 2.1: Validation procedure

Topic	Time
Assignment to VAL	20.09.2023
Remote office / Introduction / Meeting on documentation	10.10.2023
On-site inspection / inspection of the stocks	11.10.2023
Remote office / discussion of the model	19.10.2023
List of deviations	n.a.
Draft report issued	25.10.2023
Final report issued	30.10.2023
Technical review	07.11.2023
Final Approval	08.11.2023

2.2 Appointment of the validation team

Table 2-2: Validation Team

	Name	Company	Function [1]	Qualification Status [2]	Scheme competence [3]	Technical competence [4]	Verification competence [5]	Host country Competence	On-site visit
☒ Mr. ☐ Ms.	Martin Opitz	ETE	TL	LA	☒	14.1	☒	☒	☒
☐ Mr. ☒ Ms.	Alexandra Nuske	TN CERT	OT/FA /TR [B]	SA	☒	14.1	☒	☒	☒

[1] TL: Team Lead; TM: Team Member, TR: Technical review; OT: Observer-Team, OR: Observer-TR; FA: Final approval

[2] GHG Auditor Status: A: Assessor; LA: Lead Assessor; SA: Senior Assessor; T: Trainee; TE: Technical Expert

[3] GHG auditor status (at least Assessor)

[4] As per S01-MU03 or S01-VA070-A2 (suchas 1.1, 1.2, ...)

[5] In case of verification projects

[A] Team Member: GHG auditor (at least Assessor status), Technical Expert (incl. Host Country Expert or Verification Expert), not ETE

[B] No team member

2.3 Document verification

The following documents were reviewed for audit:

The submitted project description: "Forest Adaptation Project Lindorf"

Additional methods and tools used:

- TreeGrOSS (**Tree Gr**owth **O**pen **S**ource **S**oftware)
- IPCC Intergovernmental Panel on Climate Change; Good Practice Guidance for Land Use, Land Use Change and Forestry, 2003.
- VCS AFOLU Non-Permanence Risk Tool, v4.0 19 September 2019
- VCS Methodology 'VM0012 Improved Forest Management in Temperate and Boreal Forests (LtPF), v1.2.
- Climate Action Reserve. (April 09, 2021). Forest Protocol Version 5.0.

All project-specific references used by the GHG project proponent to prepare the project document were also reviewed. A complete list can be found in the Appendix of this report.

2.4 Interviews

Interviews to clarify and verify facts and to hear further views on the project were conducted according to ISO 14064-2 requirements. A topic summary with the interview partners can be found in Table 2-4.

Table 2-4: Interview partners and topics

Interview partners and organizations	Topics
Project Developer: • Florian Fincke (CPO) • Ronja Wolf (PM) • Lukas Antesberger (PM) *Project Owner:* • Dr. Chrisitan Wippermann (Fürst Wallerstein Forstbetriebe)	- Description and implementation of the project - Technical details, feasibility, design, duration - Monitoring system - Financial aspects - Deviations - Duration (crediting period) - Project start - Ownership - Baseline - Additionality - Monitoring/Supervision - Stakeholder consultation (if necessary) - Responsibilities and tasks of the project owner - Double counting - Calculations - Hunting regime - Environmental aspects/social aspects - Editorials in the GHG Report

A list of all interview partners can be found in chapter 5 'References'.

2.5 On-site visit

The on-site inspection on October 11th 2023, consisted of a forest inspection of the project area including an inspection of the already established artificial rejuvenation based on seeds, an expert comparison of forest inventory data[05] as well as an assessment of hunting requirements and browse impact.

2.6 Closure of non-conformities

Significant deviations identified during the validation are either treated as CARs, CLs or FARs.

A **Corrective Action Request (CAR)** is made when:

- Errors were made in assumptions, during application of the methodology, or project documentation, that have a direct impact on project results, or
- Requirements deemed relevant to the validation of the project have not been met.

A **Clarification Request (CL)** is made when information is insufficient, unclear, or not transparent enough to determine whether a requirement has been met.

A **Forward Action Request (FAR)** is made when certain issues related to project implementation should be reviewed during the initial verification.

A detailed list of CARs, CLs, and FARs posed during this validation is provided in the next section 3 of this report.

3 RESULT OF THE VALIDATION

This section summarizes the assessments and findings from the desk review of the GHG Report, the on-site inspection, the interviews, and the evaluation of the supporting documents. Table 3-1 includes a summary of all identified CARs, CLs, and FARs.

Table 3-1: Overview of all CARs, CLs and FARs

No.	Topic / Chapter	CAR	CL	FAR
3.1	Project design	0	2	0
3.2	Application of the methodology	0	1	0
3.3	Environmental impact	0	0	0
3.4	Stakeholder comments	0	0	0
-	**Total**	**0**	**3**	**0**

3.1 Project design

3.1.1 Project type and scope, technologies and measures used, and suitability of the project.

Description

The project area of the Fürst Wallerstein Forstbetriebe is located within the boundaries of the administrative district Ostalbkreis in the state of Baden-Wuerttemberg and in the administrative district Donau-Ries in the state of Bavaria in Germany. The project area is defined by maps, coordinates/01/ or other descriptions. The project area covers 318.37 ha of forested land.

The forest can be classified as even aged (79% is in age-class III) consisting mainly of spruce (81%) with very homogeneous structures on 318,37 ha.

The project aims to convert the existing even aged forest stands into bio- and structurally diverse forest stands. The forest conversion is initiated/implemented by two silvicultural relevant activities/04 IM04/:

- Thinning and end-use of the overstory in order to develop single-tree stability and allow new growth in lower layers; As the stands at project start are characterized by a high stand stability as a single tree stability, initial interventions/removal amounts are low, but will be increased toward end-use during the project period and after the establishment of an under layer
- Pre-regeneration based on seeds of silver fir supplemented by douglas fir, lime tree and hornbeam (depending on availability and location); and
- Encouraging and protecting natural rejuvenation (especially oak and hornbeam as well as maple).

In addition to the measures outlined above, the goal is to be achieved by intensifying hunting.

The forest owner Fürst Wallerstein Forstbetriebe[/200/] contractually commits to implement the defined project activities and to adapt the project activities to new requirements which may result from changes in the project methodology[/04/].

Key data of the project are shown in the table below:

Table 3.1-1a.: Project characteristics

Item	Data			
Project name	Forest adaptation project Lindorf			
Project owner	Fürst Wallerstein Forstbetriebe			
Project implementer	Pina Technologies GmbH			
Specific project categories	☐ Mega project (> 10^6 t CO_{2eq} / a) ☐ Project (≤ 10^6 t CO_{2eq} / a) ☒ AFOLU project ☒ Grouped project ☐ No specific project category			
GHG Report (PD)	☐ Draft:	Ver. 0.1 16.10.2023	Final:	Ver. 0.2 25.10.2023
Methodology	• TreeGrOSS (**Tree Gr**owth **O**pen **S**ource **S**oftware) • IPCC Intergovernmental Panel on Climate Change; Good Practice Guidance for Land Use Change and Forestry, 2003 • VCS AFOLU Non-Permanence Risk Tool, v4.0 19 September 2019			
Project start	01.02.2021			
Crediting period	☒ Project duration (30 y)			
Start of crediting period	01.02.2021 until 31.01.2051			

The key parameters of the project are in Table 1-2:

Table 3.1-1b: Technical data of the project

Parameter	Unit	Value
Project area	ha	318.37
Start stock	Vfm/ha	381,85

Table 3.1-1c: Parameters confirmed in the course of validation

Parameter	Unit	Value
Project area (forested area)	ha	318,37
Start stock	Vfm/ha	381,85

Parameter	Unit	Value
Growth model	n.a.	Reference 202
Growth formulas	n.a.	Reference 07
Root to shoot ratio	n.a.	Reference 51
Biomass to carbon ratio	n.a.	Reference 53
Carbon to CO2 by molar mass ratio	n.a.	Reference 208
Calculation of above-ground biomass of trees	n.a.	Reference 50
Climate-related mortality	n.a.	Reference 204 and 205

Result

☐ No CARs, CLs or FARs have been identified

☒ The following deviations were identified:

Finding: 1	**Anforderung 6.2 e)**		
Classification	☐ CAR	☒ CL	☐ FAR
Description of finding *Describe the finding in unambiguous style; address the context (e.g. section)*	Please provide an elaborated list of activities the project owner is required to implement in order to achieve the estimates carbon sequestration		
Corrective Action #1 *This section shall be filled by the PP. It shall address the corrective action taken in details.*	2 new appendixes added: - 15.2b listing minimum requirements to be fulfilled by the project owner and implementer as stated in project contract - 15.2c: List of project activities as agreed between project owner and Pina Earth and contractually committed (contract appendix)		
DOE Assessment #1 *The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	Two addenda to the contract between the project owner and project implementer have been provided specifying i) the minimum standard as well as ii) detailed project activities in order to achieve the estimated climate performance		
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the first verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed		

Final Assessment

Project type and scope have been assessed during the onsite visit, consisting of an inspection of the forest stand, assessment of the forest management and discussion of the management activities planned.

☒ The project start date information is consistent with the applicable ISO 14064-2 criteria.

3.1.2 Project owner

Description
Fürst Wallerstein Forstbetriebe

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
The GHG sink project "Forest adaptation project Lindorf" covers 318.37 ha of forested land[/01/]. TÜV NORD CERT GmbH was commissioned by Pina Technologies GmbH in agreement with the forest owner to validate the project according to ISO 14064-2[/04/].

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.3 Project start

Description
Project start date is 01.02.2021

Result

☐ No CARs, CLs or FARs have been identified

☒ The following deviations were identified:

Finding: 2	**Anforderung 6.2 k)**		
Classification	☐ CAR	☒ CL	☐ FAR
Description of finding *Describe the finding in unambiguous style; address the context (e.g. section)*	• Please clarify why the project start date as per PDD is differing from the start date as per contract • Please sustain the actual start date with evidence e.g. invoice of sawing or similar.		
Corrective Action #1 *This section shall be filled by the PP. It shall address the corrective action taken in details.*	The project start and end date and was adjusted in the new version of the PDD (v0.2) to reflect the start date and duration as stated in the project contract: 01.02.2021 to 31.01.2051. Evidence was submitted in form of an invoice for the purchase and delivery of seeding material and added as Annex 15.11. Prior to seeding, the soil was prepared by creating holes in the ground.		
DOE Assessment #1 *The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	The start date was adjusted, evidence of the start date (invoice of the contractor conducting the seeding) was provided.		
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the first verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed		

Final Assessment
The start of the project is defined in the project description[/GHG-R/] and in the project contract between the project owner and the forest owner[/04/]. February 2021 or 01.02.2021 is set as the project start date. The

month (February) indicated coincides with the period on which the sowing of silver fir was initiated[/02/].

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.4 Project duration

Description
According to the project description, the project duration is 30 years and ends on 31.01.2051 (2021 - 2051)

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
With the binding project contract the forest owner commits himself to implement the defined project activities[/04/]. At the end of the project period (year 30), the entire project area shall have a maximum share of spruce trees of 40%, a standing volume of rd.85 m³/ha in the upper layer and a second tree layer on the total project area.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.5 Project scope and estimated GHG emission reduction or -GHG removal

Description
For the period of 30 years, a net removal of anthropogenic GHG emissions through the biological sequestration of biologically and structurally diversified, and thus climate-resilient, forests of 24,665.05 t CO2 equivalents is calculated.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
The calculation of the GHG emission reduction is based on the treatment-dependent simulation of growth in the project area. The simulation used is a validated growth model from NW - FVA[/202/]. A Semi-technical documentation[/06/] provided by the project owner and the associated formulas[/07,08/] as well as a demonstration of the growth model were discussed in depth and an expert report[/03/] reviewed. I.e. all calculation steps necessary for the estimation of the sink performance were partly reproduced step by step and discussed. The necessary due care in the selection of scientific sources (see chapter 5) and raw data[/05/] could be confirmed exemplarily.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.6 Project activities

Description
The project activity consists of the targeted conversion of existing even-aged forest stands (81% pine) into bio- and structurally diverse forest stands. The forest conversion will be initiated/implemented by two silvicultural activities:

- Thinning and end-use of the overstory in order to develop single-tree stability and allow new

growth in lower layers; As the stands at project start are characterized by a high stand stability as a single tree stability, initial interventions/removal amounts are low, but will be increased toward end-use during the project period and after the establishment of an under layer.

- Preregeneration based on seeds of silver fir supplemented by douglas fir, lime tree and hornbeam (depending on availability and location); and
- Encouraging and protecting natural rejuvenation (especially oak and hornbeam as well as maple).

In addition to the measures outlined above, the goal is to be achieved by intensifying hunting.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment

The project activity was assessed in the course of an on-site inspection consisting of a forest inspection of the project area including an inspection of the already established artificial rejuvenation based on seeds, an expert comparison of forest inventory data/05/ and the assessment of the hunting conditions and corresponding browsing impact. Subsequently, the planned silvicultural measures were discussed with the project implementer/IM04/ and the tree species mixtures envisaged for the end of the project period were explained. By doing so a comprehensive overview of the initial situation and the project measures of the project could be obtained.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.7 Project location

Description

The project area of the Fürst Wallerstein Forstbetriebe is located within the boundaries of the administrative district Ostalbkreis in the state of Baden-Wuerttemberg and in the administrative district Donau-Ries in the state of Bavaria in Germany. The project area is defined by maps, coordinates/01/ or other descriptions. The project area covers 318.37 ha of forested land.

Project location details are provided in Table 3-1.7:

Table 3-1.7: Project location

No.	Project location
Country:	Baden-Wuerttemberg and Bavaria / Germany
Region:	District of Ostalbkreis (BW) and Donau-Ries (BY)
Contact address:	Fürst Wallerstein Forstbetriebe Bei den Kornschrannen 7 86720 Nördlingen Germany
Latitude:	48°54'59.26"northern latitude (BW) 48°42'22.10" northern latitude (By)
Longitude:	10°17'5.14" eastern longitude (BW) 10°30'38.80" eastern longitude (By)

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
In the course of the site visit, the location of the project was verified using a GPS device/100/, as well as the map material provided/01/. The map material/01/ indicates the distinctive location of the project area.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.8 Conformity with applicable laws, statutes and other regulatory frameworks

Description
The forest is managed in accordance with legal requirements/30.31/.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
The project aims at converting single layer age class forests (81% spruce) into climate resilient mixed stands. The project activities described in 3.1.6 are in line with the recommendations of the German Association of Forest Research Institutes (DVFFA)/101/.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.9 Forest property

3.1.9.1 Proof of ownership

Description
The ownership of the forest areas of the Forstbetrieb Schlegel is adequately documented via the forest management plan and its corresponding maps/01/ and via the forest management by the owner Fürst Wallerstein Forstbetriebe/IM04/.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
The ownership of the forest areas of the Forstbetrieb Schlegel is adequately documented via the forest management plan and its corresponding maps/01/ and via the forest management by the owner Fürst Wallerstein Forstbetriebe/IM04/.

☒ The ownership of the forest land is sufficiently proven.

3.1.9.2 Emissions trading programs and other mandatory limits

Description

The Federal Republic of Germany, as a so-called Annex I country, accounts for the carbon stock changes in the national forests its national carbon footprint, regardless of ownership. Thus, the issuance of certificates from forest climate protection projects for the voluntary market is not possible/DEHSt/.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
Due to the above given decription the estimated tCO2 in this report can only be issued in form of a contribution claim and to communicate the financing and the positive GHG sink performance of the project as a buyer. Therefore double counting is avoided.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.9.3 Participation in other GHG programs

Description
Not applicable for the project activity.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
After reviewing relevant registries (Verra, GS, CDM) for GHG projects, no participation in other GHG programs could be confirmed.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.9.4 Further applied for or received compensation payments for environmental services

Description
Not applicable to the project, the project refers only to the productive forest area.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
None.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.9.5 Rejection by other GHG programs

Description
Not applicable for the project activity.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
The audit team has no indication of rejection by any other GHG program. No corresponding reference can be found on the common project databases.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.10 Additional information relevant to the project

3.1.10.1 Eligibility criteria for group projects

Description
Not applicable for the project activity.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
None.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.10.2 Leakage management for AFOLU projects

Description
Leakage (displacement) can be neglected, since the volume harvested in the baseline scenario does not differ significantly from the volume harvested in the project scenario.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
Due to the project activity leakage can be neglected. The project will not result in intensified thinning activities elsewhere.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.10.3 Sensitive economic data

Description
Not applicable for the project activity.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
None.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.1.10.4 More information

Description
Not applicable for the project activity.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
None.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2 Application of the method

3.2.1 Title and references

Description
The quantification of GHG reduction and removals is based on internationally recognized standards and calculation methods such as the Intergovernmental Panel on Climate Change (IPCC) and the Verified Carbon Standard (VCS) as well as the validated growth simulator of the Northwest German Forest Research Institute (NW -FVA). To be mentioned are:

- TreeGrOSS (**Tree Gr**owth **O**pen **S**ource **S**oftware)
- IPCC Intergovernmental Panel on Climate Change; Good Practice Guidance for Land Use, Land Use Change and Forestry, 2003.
- VCS AFOLU Non-Permanence Risk Tool, v4.0 19 September 2019
- VCS Methodology 'VM0012 Improved Forest Management in Temperate and Boreal For- ests (LtPF), v1.2.

Result

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment
The audit team confirms the clear naming and application of the above listed methods, corresponding "tools" and the TreeGrOSS model. All formulas and models used correspond to good forestry practice in relation to forest climate protection projects.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.2 Applicability

Description

For eligibility, the project owner defines criteria that must be met. A project must fulfil the following criteria:

1. The project takes place exclusively on forested areas in accordance with applicable laws, areas which are assigned to a protection category (NSG, FFH, etc.) are not affected;
2. Ownership is clearly defined as a private or community forest;
3. The project implementation is based on comprehensible forestry expertise;
4. Project activities are not allowed to be 100% publicly funded;
5. No participation in any GHG programs
6. There is a legal contract between the project owner and the forest owner;
7. Tree species and mixture ratios are in accordance with regional scientific recommendations, a minimum number of mixed tree species in fixed proportions is achieved, stand diversity must verifiably be increased, and a regeneration layer/second layer must be present by the end of the project period;
8. Conformity with relevant laws is ensured

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

During the site visit it could be confirmed that the project area is a forest[/100/], that the land does not fall under the above mentioned protection categories and that it is a private forest[/203/].

On basis of the project contract, the forest owner confirms full compliance with the listed requirements in regard to the absence of public funding and non-participation in any GHG program and commits to implement the project activities listed in the project contract[/04/].

The forest management plan and its corresponding attached map material[/01/] serve as evidence of the ownership of the forest areas.

The Fürst Wallerstein Forstbetriebe[/IM04/], which is implementing the project activities, fulfills the required, forestry expertise[/200/].

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.3 Project boundary

Description

The project area is defined by maps, coordinates[/01/] or other unique descriptors. The project area includes 318.37 ha of forested area.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

In the course of the site visit, the location of the project was verified using a GPS device[/100/], as well as the submitted map material[/01,05/]. The available map material from the forest management plan[/01/] indicates the location of the project area.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.4 Baseline scenario

Description

The baseline scenario is the continuation of the current management as a predominantly single stratum age class forest following a consistently economically and commercially oriented forestry.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The results of the Bundeswaldinventur (Federal Forest Inventory)/206/ supports the assumption of the outlined baseline scenario in the states of Baden-Wurttemberg and Bavaria, whose forests are largely managed in age-class forests and whose share of multi-layered forests is with 11.9% and 14.7% counts among the best in the comparison with the other federal states, but is far from being able to be called "common practice".

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.5 Additionality

Description

Three approaches are used to determine additionality for the project:

1. Statutory additionality: Statutory additionality is given if the project measures are voluntary, i.e. not required by law.
2. Performance-based additionality: Performance-based additionality is given if the project contributes to a higher GHG reduction due to its implementation compared to the continuation of the previous management form.
3. Financial Feasibility and Additionality: With the inclusion of the prescribed yield rate/01/, both scenarios are financially feasible. The baseline scenario results in lower costs due to lower complexity of the planned measures for the upcoming equalization period (10 years). Financial feasibility of the baseline scenario and the additionality of the project, are therefore ensured.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The approaches used by the project owner to determine additionality have recently found their way into the determination of additionality/41,42/ and can thus be considered current common practice.

Since the project area has no protection status/203/ and is without exception a commercially used forest, the legislator does not impose any restrictions on the management of the forest beyond those stipulated in the Landeswaldgesetz (State Forest Act)/30/. This means that the implementation of the project and thus the adaptation to a bio-diverse and structurally diverse multi-layered mixed forest stand is not prescribed by law and is therefore voluntary.

When comparing the developments of GHG reductions and removals in the baseline scenario to the project scenario shows that the project scenario is leading in total to a higher GHG sequestratin/06/. I.e. the implementation of the project proposal scores above the performance level in terms of GHG reductions and removals of the baseline scenario.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.6 Quantification of GHG emission reductions and removals

3.2.6.1 Quantification of the sink performance of the baseline scenario

(baseline reductions)

Description

The basis for quantifying the GHG reductions and removals is the raw data of a sample based forest inventory (tree species, top height, diameter).

The simulation of the development of the forest volume over the course of the crediting period is carried out with the help of the TreeGrOSS growth simulator of the NW-FVA. The starting point in year 0 of the project is based on a "digital twin" created from the above mentioned inventory data.

In the growth simulator, the treatment assumptions underlying each scenario (baseline scenario vs. project scenario) are defined in terms of i) tree species composition, ii) thinning [type of tree selection and setting of target density], iii) end-use [target diameter and prescribed yield], and iv) introduction of new trees [seeding, planting, natural rejuvenation].

This is followed by the actual simulation for the entire project duration. The following four processes are simulated:

1. "Density-related mortality" as a function of available/required light conditions.
2. "Climate-induced mortality" as a function of tree species requirements in combination with regional climate models.
3. "Tree growth" based on site-specific growth formulas.
4. Application of the treatment defined in the introduction in form of "end-use, management, natural regeneration".

To compensate for random effects in the growth and mortality algorithms, a Monte Carlo simulation with 10 to 100-fold repetitions is performed.

The subsequent calculation of aboveground biomass is performed using the simulated tree volumes based on functions used in the German GHG reporting which are accepted by the IPCC.

For the calculation of the total living tree biomass, the aboveground biomass is added to the belowground biomass, which is calculated using a root to shoot ratio.

The total amount of GHG reduction and removals is calculated by multiplying the living biomass by the carbon fraction and the specific molecular weight of CO2.

Result:

☐ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Finding: 3	**Anforderung 6.7**		
Classification	☐ CAR	☒ CL	☐ FAR
Description of finding *Describe the finding in unambiguous style; address the context (e.g. section)*	• Please explain differing volume amount in the excel file “Wallerstein_15.5 Forest adaptation project wallerstein v0.1 – charts” • Please provide figures for the modeled growth increment over the project period		

Finding: 3	**Anforderung 6.7**
Corrective Action #1 *This section shall be filled by the PP. It shall address the corrective action taken in details.*	The differing volume was the result of a data miscalculation in the simulation export. The Appendix 15.5 was corrected and submitted in a new version. Another Appendix 15.12 was added, which shows an overview of stock development, usage volumes and climate-induced mortality as well as yearly increment per project phase, differentiated in 3 age groups for the main tree species spruce. Furthermore, 2 supporting documents were added to the Appendix: One which explains the methodology (technical documentation, Appendix 15.9) and an expert assessment report validating the accuracy and usability of the Pina Earth methodology for developing GHG projects (Appendix 15.10).
DOE Assessment #1 *The assessment shall encompass all open issues. In case of non-closure, additional corrective action and DOE assessments (#2, #3, etc.) shall be added.*	Differing volumes have been corrected and an explanation provided. Documentation has been provided estimating the development of the volume standing as well as the volume harvested in 3 different age groups. Documents providing a semi-technical description of the modelling process as well as an Expert report of the applied model.
Conclusion *Tick the appropriate checkbox*	☐ To be checked during the first verification ☐ Additional action should be taken (finding remains open) ☒ The finding is closed

Final Assessment:

Initially, it must be noted that the changes in stand volume are determined in the course of the project using the Tree Growth Open Source Software (TreeGrOSS) of the NW-FVA. The model was not explicitly tested in the course of the audit, nevertheless it can be assumed based on scientific publications that the model originally developed for the Northwest German region provides reliable results also for other areas of Germany without re-parameterization, i.e. within a threshold value of 5%[/43/]. This assumption is additionally supported by the use of a large number of single trees in the simulation (several thousand trees) as well as various repetitions (Monte Carlo simulation), since in this way outliers are leveled and random effects are excluded[/06,07,08/]. Finally, it must be stated, that the model applied by Pina Technologies was assessed externally and found to provide plausible results[/03/].

The treatment assumptions used for each scenario correspond to the expected management activities, as defined in the project contract[/04,IM04/] ,and are in line with the expected positive effect of intensified hunting on natural regeneration[/44/].

The simulation steps listed above are part of the TreeGrOSS software package except for step 3.

The simulation of "climate-induced mortality" is based on scientific findings related to tree species survival models[/45/] and regional climate models[/204/].

The adaptation of the simulated tree volumes into aboveground biomass is done analogously to the German GHG reporting[/50,206/], the calculation of the total biomass and the subsequent quantification of the GHG reduction is done with the help of widely recognized conversion factors[/51/] (root to shoot ratio) or analogously to recognized calculation methods.

In summary:

- The quantification of the GHG reductions and removals is carried out with due diligence.

- The model used and all simulation steps as well as the conversion factors/assumptions used were taken from scientific literature, and the applicability of the model in other areas of Germany was confirmed.
- Random effects are compensated for by applying a Monte-Carlo simulation.
- The simulation step extended by Pina Technologies GmbH is comprehensible and adds expected climate effects to the existing model.
- All sources used are publicly available and comprehensible.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.6.2 Quantification of the sink performance of the project scenario (project reductions)

Description

The quantification of the sink performance of the project scenario is analogue to that described under 3.2.6.1 Quantification of the sink performance of the project scenario, taking into account other treatment assumptions. See above for details.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

For the evaluation see explanations under 3.2.6.1

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.6.3 Leakage quantification

Description

Leakage can be neglected, since the volume harvested in the baseline scenario does not differ significantly from the volume harvested in the project scenario.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

Leakage due to the project activity can be neglected. The project will not lead to intensified thinnings elsewhere.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.6.4 Summary of GHG emission reductions and reductions

Description

The gross climate impact is estimated from the carbon stock changes in the project scenario minus the carbon stock changes of the baseline scenario.

The net climate impact is quantified after subtracting a risk buffer of 18.5%.

For the project period of 30 years, this results in a net CO2 reduction and removal of 24,665 tCO2 e.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

A Semi-technical documentation/08/ provided by the project owner and the associated formulas/06,07/as well as a demonstration of the growth model were discussed in depth and an expert report/03/ reviewed. I.e. all calculation steps necessary for estimating the GHG reductions and removals were followed step by step and checked for plausibility. No discrepancies were found.

Furthermore, the baseline GHG reductions and removals at project start (389.31 tCO2e/ha) calculated by the project developer was compared to a baseline GHG reduction and removals at project start (447.45 tCO2e/ha) calculated using the actual forest stock as provided by the forest inventory and publicly available conversion factors (BEF, root-to-shoot/52/ and wood density[spruce]/209/). There is a difference of -14.93% i.e., it can be assumed that by applying the conversion factors/50/ commonly used in the Federal Republic for the national forest climate assessment, project developers are not overestimating climate performance.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.6.5 Statistical uncertainties in the calculation of emissions

Description

The basis for calculation are the results of the sample based forest inventory. The forest inventory has been carried out in accordance with the standard national procedures. The inventory has a sampling error of 7.56% in relation to the forest stock/01/.

For the simulation of growth in TreeGrOSS, generally accepted growth formulas are applied/07/.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The sampling errors are within the internationally accepted range/53/ of 10%. With regards to forest growth, recognized growth formulas are applied.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.7 Method deviation

Description

The method has been developed specifically for the project, so there are no deviations.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The method has been developed specifically for the project, so there are no deviations. Parameters used correspond to the common practice of internationally recognized standards/IPCC/GS/CDM/.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.8 Monitoring plan

3.2.8.1 Data and parameters available at the time of validation (fixed parameters)

Description

The project uses the following fixed parameters:

- Function for the potential growth in height/202/
- Function for diameter (dbh) increase/202/
- Volume function/202/
- Crown width function/202/
- Crown height function/202/
- Side Index function/202/
- Side Index Height function/202/
- Maximum tree density function/202/
- Climate-related mortality/204,205/.
- Proportion of surviving regeneration plants in the reference scenario/44/
- Proportion of surviving regeneration in the project scenario/44/
- Biomass to carbon ratio/53/
- Carbon to CO2 by molecular mass ratio/208/

- Above-ground biomass from trees/50/
- Below-ground biomass from tree/207/

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The values were assessed for their applicability in the context of the project. They originate from the forestry context and correspond to good professional practice.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.8.2 Data and parameters to be monitored (variable parameters)

Description

The following parameters are monitored:

- Number of trees per stand/01/
- dbh of the trees/01/
- Tree species/01/
- Age of trees/01/
- Tree height/01/
- Crown width[via remote sensing data, at the time of validation still in the "proof of concept"/testing stage, i.e. not yet relevant for quantifying the sink performance of the current project].
- Uniform height curve/01/
- Diameter generation/regression[via remote sensing data, at the time of validation still in the "proof of concept"/testing stage, i.e. not yet relevant for quantifying the sink performance of the current project].

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The parameters and values were assessed for their applicability in the context of the project. The parameter and values correspond to good practice and are recorded during forest inspections, regular renewal of the forest management plan, and the evaluation of remote sensing data by the district forester, forest manager, and project owner. The monitoring measures are sufficient to regularly monitor the status of the project.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.8.3 Applicability and suitability of the monitoring procedure

Description

Commonly applied survey methods will be applied for monitoring purposes.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

Survey methods commonly used in forestry will be applied for monitoring.

The monitoring measures are sufficient to regularly monitor the status of the project.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.2.8.4 Responsibilities for monitoring

Description

Pina Technologies GmbH/IM01,02,03/ is responsible for the data collection of the GHG sink project.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

Pina Technologies is a start-up company consisting of environmental scientists, software developers, and data scientists who are highly qualified to perform the monitoring activities and documentation duties entrusted to them.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.3 Environmental and social criteria

Description

In principle, it can be assumed that the project areas managed by Fürst Wallerstein Forstbetriebe/200,IM04/ meet the legal requirements with regard to environmental issues.

The contractually stipulated forest adaptation to a bio-diverse and structurally diverse mixed stand/04/ corresponds to the generally accepted recommendations for the adaptation of forests to climate change/101/.

Following the VCS AFOLU Non-Permanence Risk Tool, v4.0 19 September 2019, any risks to the project were analyzed and no serious risks were identified. The risk buffer of 18.5% is derived with 15% from the project longevity risk calculation formula prescribed in the aforementioned tool. The remaining 3.5% results from an analysis of the natural risks (storms/fires/insects)/10/.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

The project areas are managed by the Fürst Wallerstein Forstbetriebe. The risk assessment procedure developed by the VCS was carried out correctly and comprehensibly.

☒ The project conforms with the applicable ISO 14064-2 criteria.

3.4 Comments from stakeholders

Description

The project is implemented in a private forest where no external parties are involved. For the reasons mentioned above, no consultations with stakeholders were carried out.

Result:

☒ No CARs, CLs or FARs have been identified

☐ The following deviations were identified:

Final Assessment:

Since the project is implemented in a private forest, its forest areas don't fall under protected areas[/203/], and the project measures correspond to generally accepted recommendations for the adaptation of forests to climate change[/101/], the argumentation of the project owner can be followed

☒ The project conforms with the applicable ISO 14064-2 criteria.

4 VALIDATION CONCLUSION

Pina Technologies GmbH has commissioned TÜV NORD CERT GmbH to carry out the validation of the "Forest adaptation project Lindorf" on the forest areas of the Fürst Wallerstein Forstbetriebe in the federal state of Baden-Wurttemberg and Bavaria in Germany with regard to the requirements of ISO 14064-2.

The project activity includes active forest conversion from pure stands (81% spruce) to bio-diverse and structurally diverse mixed stands and to achieve an increase in total standing volume through the long-term establishment of a dense under and mid-layer.

The review of the project design documentation and additional documents related to the baseline scenario and the monitoring methodology, as well as the subsequent background investigation, have provided TÜV NORD CERT GmbH with sufficient evidence to verify that the specified criteria have been met.

In detail, the conclusions can be summarized as follows:

- An appropriate level of assurance was applied.
- All data and information used for ex-ante calculation of emission reductions are projected and / or hypothetical in nature.
- The project is in compliance with all relevant host country legislation. If applicable, its GHG claims.
- The additionality of the project is justified in the GHG report/GHG-R/.
- The monitoring plan is transparent and appropriate.
- The calculation of the projects emission reductions is done in a transparent manner so that the calculated emission reductions of 30,263.87 tCO2 e can be achieved.

The conclusions of this report indicate that the project, as described in the GHG report/GHG- R/, meets all criteria applicable to validation under ISO 14064-2 without qualifications or limitations.

As a result of the validation, the auditor confirms that the GHG emission reductions are appropriately calculated without material misrepresentations. TÜV NORD CERT GmbH hereby confirms that the project can achieve the following emission reductions in the above-mentioned reporting period:

Period	**Project-related sink performance**	**Project-related emissions**	**Leakage**	**Buffer 18,5%**	**Net CO2e sink capacities**
01.02.2021-31.03.2051	30,263;86 tCO2 e	0	0	-5,598.81 tCO2 e	24,665.05 tCO2 e
Net CO2e sink services for the period: 01.02.2022-31.03.2051					24,665.05 tCO2 e*

*The report confirms the calculated GHG sink performance of the project. It is possible to trade the CO2 certificate with the purpose of a contribution claim and to communicate the financing and the positive GHG sink performance of the project as a buyer.

Munich, 07.11.2023

TÜV NORD JI/CDM Certification Program
Val/Ver Team Leader
Martin Opitz

Hanover, 08.11.2023

TÜV NORD JI/CDM Certification Program
Final Approval
Alexandra Nuske

5 REFERENCES

Table 5-1: Documents provided by the project participant

Reference	Document
/GHG-R/	PDD_Forest adaptiation project _Wallerstein_V0.1 PDD_Forest adaptiation project_Wallerstein_V0.2
/01/	Project area maps
/02/	Invoice sowing of douglas fir / project start
/03/	Fachgutachten Methode ´02 Waldumbau - Pina Earth´; Fachgutachten im Rahmen der Akkreditierung unter dem Wald-Klimastandard; Prof. Dr. Jürgen Nagel; 23-08-17
/04/	Project contract between Pina Technologies GmbH and forest owner Fürst Wallerstein Forstbetriebe • Contract document • Minimum Standard of the project activity • Detailed description of the project activity
/05/	Wallerstein_15.1 - Forest Inventory Data
/06/	Results GHG sink • Wallerstein_15.5 Forest adaptation project wallerstein v0.2 – charts • Wallerstein_15.12 Vorrat und Nutzungs Verlauf_Wallerstein
/07/	Formulas TreeGrOSS
/08/	Wallerstein_15.9 Methodology Documentation Pina Earth (DE)
/09/	App monitoring concept
/10/	Natural risks; risk assessment analogue to VCS AFOLU Non-Permanence Risk Tool, v4.0 19 September 2019
/30/	Federal Forest Act (BWaldG)
/31/	Forest Act of the State of Baden-Wurttemberg (LWaldG) Forest Act of the State of Bavaria (BayWaldG)
/40/	Duda. (October 27, 2006). Vergleich forstlicher Managementstrategien. Georg-August-Universität Göttingen.

/41/	VCS Methodology for Afforestation, Reforestation and Revegetation Projects, Version 0.1, 17 December 2021

Reference	Document
/42/	Climate Action Reserve. (April 09, 2021). Forest Protocol Version 5.0.
/43/	Albrecht, A., Kohnle, U., & Nagel, J. (2011). Übertragbarkeit empirischer statistischer Waldwachstumsmodelle: Prüf- und Anpassungsverfahren an-hand des Beispiels BWinProfür Baden-Württemberg. Allgemeine Forstund Jagdzeitung
/44/	Fuchs, Z., Vacek, Z., Vacek, S., & Gallo, J. (2021). Effect of game browsing on natural rejuvenation of European beech (Fagus sylvatica L.) forests in the Krušné hory Mts. (Czech Republic and Germany). Central European Forestry Journal, 166-180.
/45/	Brandl, Paul, Knoke, & Falk. (2020). The influence of climate and manage-ment on survival probability for. Forest Ecology and Management 458.
/50/	Riedel, & Gerald. (23. November 2016). Nationale Treibhausgasberichter-stattung: Neue Funktionen zur Schätzung der oberirdischen Biomasse am Einzelbaum.
/51/	Wördehoff, Spellmann, Evers, Aydin, & Nagel. (2012). Kohlenstoffstudie Forst und Holz. Nordwestdeutsche Forstliche Versuchsanstalt.
/52/	IPCC Good Practice Guidance for LULUCF; TABLE 3A.1.10 DEFAULT VALUES OF BIOMASS EXPANSION FACTORS (BEFS/Root-to-Shoot).
/53/	Diestel, & Weimar. (December 2014). Der Kohlenstoffgehalt in Holz- und Papierprodukten - Herleitung und Umrechnungsfaktoren. Thünen Institut.

Table 5-2: Background investigation and evaluation documents

Reference	Document
/100/	GPS records / 2023-10-11_11.10.2023_14_02_04
/101/	Anpassung der Wälder an den Klimawandel Positionspapier des Deutschen Verbandes Forstlicher Forschungsanstalten (DVFFA)

Table 5-3: Websites used

Reference	Link	Organization
/200/	https://fuerstwallerstein.de/unternehmensgruppe/forstbetriebe/	*Fürst Wallerstein Forstbetriebe*
/202/	https://www.nw-fva.com/publish/software/treegross	*TreeGrOSS (Tree Growth Open Source Software)*
/203/	https://fisnatur.bayern.de/webgis https://udo.lubw.baden-wuerttemberg.de/public/index.xhtml	*Bayerisches Fachinformationssystem Naturschutz Online (FIN-Web)* *Landesanstalt für Umwelt Baden-Württemberg; Daten- und Kartendienst der LUBW*
/204/	https://www.klimafolgenonline.com/	*Potsdam Institute for Climate Impact Research (PIK) e. V.*
/205/	https://geoportal.bgr.de/mapapps/resources/apps/geoportal/index.html?lang=en#/geoviewer?metadataId=09ca3d99-e2ab-467c-8815-19b7e1c6eb09	Survival models developed by Brandl et al. (Brandl, Paul, Knoke, & Falk, 2020),
/206/	https://bwi.info/start.aspx	*Third Federal Forest Inventory (2012); Johann Hein- rich von Thünen-Institut, Federal Research Institute for Rural Areas, Forest and Fish- rei*
/206/	https://www-genesis.destatis.com/genesis//online?oper- ation=table&code=41261-0012&bypass=true&levelindex=0&levelid=1675871025536#abreadcrumb	*41261-0012: Damaged wood felling: federal countries, years, cause of felling, wood species groups, forest ownership types.*
/207/	https://gitlab.com/vochr/rbdat	*Vonderach. (2023). rBDAT.*
/208/	https://www.ipcc.ch/publication/good-practice-guidance-	*IPCC, Good Practice Guidance for Land Use, Land-Use Change and Forestry*

Reference	Link	Organization
	for-land-use-change-and-forestry/	
/209/	http://db.worldagrofor-estry.org/wd	*IGRA Database - Wood Density*
/210/	https://pina.earth/	*Pina Technologies Ltd.*
/DEHSt/	https://www.dehst.de/DE/startpage/startpage-node.html	*German Emissions Trading Authority*

Table 5-4: List of interviewees

Reference	MoI[1]		Name	Organization / Function
/IM01/	V	☒ Mr. ☐ Ms	Florian Fincke	Pina Technologies GmbH, CPO / Project Developer
/IM02/	V	☒ Mr. ☐ Ms	Ronja Wolf	Pina Technologies GmbH, PM / Project Developer
/IM03/	T	☒ Mr. ☐ Ms	Lukas Antesberger	Pina Technologies GmbH, PM / Project Developer
/IM04/	V	☒ Mr. ☐ Ms	Dr. Christian Wippermann	Fürst Wallerstein Forstbetriebe, project owner and implementer

[1] Interview means: (telephone, e-mail, visit)