LIFE Project Number

LIFE20 PRE/BE/000011

Technical Report

Covering the project activities from 01/01/2021[1] to 30/06/2025

Reporting Date[2]

30/09/2025

LIFE PROGNOSES

LIFE PRotection of Old Growth Forests in Europe: Natural heritage, Outline, Synthesis and Ecosystem Services

Data Project

Project location:	Austria, Belgium, Bulgaria, Czech Republic, Germany, Italy Slovenia, Ukraine
Project start date:	01/01/2021
Project end date:	31/12/2024 **Extension date:** 30/06/2025
Total budget:	€ 1.382.855
EU contribution:	€ 794.471
(%) of eligible costs:	57,95%

Data Beneficiary

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[1] Project start date

[2] Include the reporting date as foreseen in part C2 of Annexe II of the Grant Agreement

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2. List of key-words and abbreviations

Old-growth forests (OGFs)

Old-growthness

Remote Sensing

Ecosystem services (ESSs)

Identification

Awareness raising

Mapping

ALS	Airborne Laser Scanning
APCs	Article-processing Charges
AT	Austria
BE	Belgium
BG	Bulgaria
CANG	Angermünde City Administration
CBR	Carpathian Biosphere Reserve
CULS	Czech University of Life Sciences Prague; same as abbreviation CULS
DE	Germany
DG	Directorate-General
DMP	Data Management Plan
EC	European Commission
ECO	E.C.O. Institute for Ecology
EPFD	European Primary Forest Database
EFI	European Forest Institute
ESS	Eco system services
EU	European Union
EU-WGFN	EU Working Group on Forest and Nature
GA	Grant Agreement
IBP	Index of Biodiversity Potential
IT	Italy
JORE	Johanneum Research Forschungsgesellschaft mbH
JRC	Joint Research Committee
MC	Management Committee
MESP	Ministry of Environment and Spatial Planning
NMS	Non-metric multidimensional scaling
NP	National Park
NPAB	National Park of Abruzzo
NPCB	Central Balkan National Park Directorate

NPKA	National Park o.Ö Kalkalpen Ges.m.b.H
NW-FVA	Northwest German Forest Research Institute
OA	overall accuracy
OGF	Old-growth Forest
OGI	Old Growth indicator
OGI ad	Adjusted Old-Growth indicator
RMSE	root mean square error
RO	Romania
RS	Remote Sensing
SC	Steering Committee
SI	Slovenia
SK	Slovakia
SOFO	Sonian Forest Foundation
TIC	Total Inorganic Carbon
TOC	Total Organic Carbon
TM	Technical Meeting
TREM	Tree-Microhabitats
UA	Ukraine
UNIE	Eberswalde University
UNIL	University of Ljubljana
UNIT	University of Tuscia
VR	Virtual Reality
WHS	World Heritage Site
WP	Work Package

3. Index of deliverables and milestone products

WP1		
A.0.00: Life Prognoses Data Management Plan	Milestone product	Annexed to the Final Report
A.0.00: Method and site description	Milestone product	Annexed to the Final Report
A.1.11: Final version of set of old-growth criteria and indicators.	Milestone product	Annexed to Midterm Report
A.1.11: Additional manuscript scientific paper OGI	Additional deliverable	Annexed to the Final Report
A.1.12: Evaluation of the JRC compiled database against detailed site maps	Deliverable	Annexed to the Final Report
A.1.13: Manuscript remote sensing methodologies update February 2022	Deliverable	Annexed to Midterm Report Update Annexed to the Final Report
A.1.21: Mapping guideline	Milestone product	Annexe d to Midterm Report Update Annexed to the Final Report
A.1.21: Compiled polygon maps	Deliverable	Download from Zenodo via the Life Prognoses Data Management Plan
A.1.21: Digital result maps for 9 test sites	Deliverable	Download from Zenodo via the Life Prognoses Data Management Plan
A.1.22: Compilation of the polygon maps	Deliverable	Download from Zenodo via the Life Prognoses Data Management Plan
A.1.22: Report evaluation of existing datasets	Deliverable	Annexed to the Final Report
A.1.23 & A.1.24: Manuscript article about evaluation RS approach	Deliverable	Annexed to the Final Report
A.1.25: Final report summarising the results of WP A.1	Deliverable	Annexed to the Final Report
WP2		
A.2.01: Literature review & methodology report microclimate	Deliverable	Annexed to Midterm Report
A.2.01: Temperature data and maps	Deliverable	Download from Zenodo via the Life Prognoses Data Management Plan

A.2.02: Literature review & methodology report Carbon	Deliverable	Annexed to Midterm Report
A.2.03: Literature review & methodology report biodiversity	Deliverable	Annexed to Midterm Report
A.2.04: Methodology report recreation and tourism	Deliverable	Annexed to Midterm Report
A.2.04: Questionnaire recreation and tourism	Milestone product	Annexed to Midterm Report
A.2.05: Database ecosystem services	Deliverable	Download from Zenodo via the Life Prognoses Data Management Plan
A.2.06 Published Scientific paper 1 microclimate	Deliverable	Annexed to the Final Report
A.2.06 Published Scientific paper 2 microclimate	Deliverable	Annexed to the Final Report
A.2.06 Manuscript Scientific paper carbon	Deliverable	Annexed to the Final Report
A.2.06 Manuscript Scientific paper biodiversity	Deliverable	Annexed to the Final Report
A.2.06 Submitted Scientific paper recreation and tourism	Deliverable	Annexed to the Final Report
A.2.06: Report on calculated ecosystem services	Deliverable	Annexed to the Final Report
WP3		
B.3.00: Communication plan	Deliverable	Annexed to Midterm Report
B.3.01: Communication guideline: Inspiration book for awareness-raising	Deliverable	Annexed to the Final Report
B.3.03: Awareness-raising video clip	Deliverable	Annexed to Midterm Report
B.3.03: Policy brief 1: summary European Conference	Deliverable	Annexed to the Final Report
B.3.03: Policy brief 2	Deliverable	Annexed to the Final Report
Coordination		
C.0.0.2: Minutes management committee 2021-2022	Deliverable	Annexed to Midterm Report
C.0.0.2: Minutes management committee 2023-2025	Deliverable	Annexed to the Final Report

C.0.0.3: Minutes steering committee 2021-2022	Deliverable	Annexed to Midterm Report
C.0.0.3: Minutes steering committee 2023-2025	Deliverable	Annexed to the Final Report
Monitoring plan update June 2025	Milestone product	Annexed to Midterm Report
C.0.0.1: Management plan After Life	Deliverable	Annexed to the Final Report
C.0.0.4: Midterm report with payment request	Deliverable	/
C.0.0.4: Final report with payment request	Deliverable	/
C.0.0.3: Layman's report	Deliverable	Annexed to the Final Report
C.0.0.4: Report on Impact monitoring	Deliverable	Annexed to the Final Report
Annexe to the Financial Report	Deliverable	Annexed to the Final Report

4. Executive Summary

The Life Prognoses project has been finalized on June 30th, 2025, after four and a half years. In 2021, mainly preparatory actions have been conducted, such as the **development of a definition of old-growth forest (OGF) and indicators,** literature reviews for ecosystem services (ESSs) and remote sensing (RS) mapping methods. In 2022, the preparatory part led to the **development of a comprehensive field assessment and methods for assessing several ESS**. These methods were tested on the field and finetuned. During the summer of 2022, the field experts started conducting field mapping and sampling for ESS on locations in Austria, Belgium, Bulgaria, Germany, Italy and Slovenia. The fieldwork continued in 2023 and the first part of 2024. During the second half of 2024, the focus lay on the compilation of the collected data in several comprehensive datasets. These datasets were all published on Zenodo. The Data Management Plan (DMP) describes the data outputs and how and where they have been stored. In 2024 and 2025, the datasets have been analysed, and several scientific papers and reports have been in the making. Some of these papers have been published already during the project implementation time, others are still in the process of reviewal or to be submitted to a peer reviewed Journal. Moreover, a **RS approach was developed for the identification and delineation of old-growth.** This method is suitable for the identification of patches with high old-growth potential but should be complemented with a field assessment for a conclusive identification.

To support the Europewide mapping of old-growth forests, the partners developed a **method to calculate the degree of old-growthness** from data for the selected old-growth indicators (European Commission 2023). This method, called the Adjusted Old-Growth Indicator (OGI_{ad}) builds on the calculation of the Old-Growth Indicator (OGI) (Meyer 2021). To ensure the data collection for the calculation of this index is feasible for all member states, a 'rapid assessment' is proposed that allows to calculate the OGI_{ad} from the data of only three indicators. Together with the developed RS approach, the OGI_{ad} allows for a timely mapping of old-growth forests in Europe.

Life Prognoses also focused on **awareness raising** about the importance of old-growth forests and their protection for a multitude of target groups. The awareness raising activities for the broad public were conducted from the very beginning of the project and are continued beyond the implementation time. Awareness raising focusing on European policy makers took place during the second half of the project implementation time, through field trips, a conference, a webinar, and a policy brief. The scientific partners participated in plenty of scientific conferences to disseminate the results of their research in the European scientific community.

The scientific, as well as the awareness-raising activities had their impact on a wide variety of domains:

- At least at 17 occasions the insights and results of the project were shared with policy-makers at regional, national and European level.
- 8 scientific articles were drafted, of which 2 have been published in peer-reviewed journals within the project implementation period.
- 5 scientific reports have been published.
- At least 10 collaborations with partners outside of the project were established for scientific purposes.
- 19 new datasets were created about the features of old-growth forests .
- On at least 18 occasions the scientific insights of the project were communicated to fellow scientists.
- At least 1.711.255 people were reached through awareness-raising activities.
- The project offered unique opportunities to enhance the quality and creativity of awareness-raising activities.
- The project inspired the development of at least 9 new projects of which some have started already.
- 751 partners outside of the project got involved for the development of the awareness raising activities.

5. Introduction

The EU Green Deal and New Forestry Strategy state that by 2030, all primary and OGFs located on EU territory should be strictly protected. When this resolution was made, no EU-wide definition of OGF was available, and neither were there any EU-wide applicable indicators to support the demarcation of OGFs.

The Life Prognoses Project was developed to address this deficit. Now the project is finalised, a definition, a set of indicators and methods to identify and delineate OGFs have been developed. Furthermore, the Life Prognoses Project effectively supported capacity building for the implementation of strict protection for remaining OGFs. This capacity building was done firstly, by scientific assessment of the added value of ESS in unmanaged forests compared to managed forests, and, secondly, by awareness raising on the local level as well as on the EU level. On a local level, different activities for a broad public were organised. A guideline for the organisation of these activities was collected in the 'Inspiration Book for Awareness Raising about Old-Growth Forests' which can be found in Annexe **Error! Reference source not found.**. On the EU level, stakeholders such as the national institutions responsible for the implementation of protection, private owners, the forestry industry, and local communities were assembled to discuss the implementation of strict protection in OGFs. The conclusions of these discussions together with the results from the assessment of ESSs and identification methods were formulated in a policy brief, which can be found in Annexe **Error! Reference source not found.**. The results of the project regarding the identification of OGFs, ESS and awareness raising were shared and discussed through a European webinar jointly organised with the EUROPARC Federation.

The achievements and outcomes of the Life Prognoses Project provide the EU with important knowledge and tools to support national governments in protecting their forests and ultimately achieving the target of protecting all OGFs on EU territory. The results of the project will therefore have a lasting impact on European biodiversity and forest conservation.

6. Technical Report

6.1.Technical progress, per Action

A.1.11 Definition of OGF

Status	Completed		
Responsible	INBO		
Partners	ECO, CULS, UNIE, NW-FVA, UNITUS, MESP, UNIL		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/12/2021	**Actual end date/anticipated end date**	06/03/2022

Conducted Activities

Activity	Description	Partners
Report on definition and criteria for OGFs	INBO with feedback from UNITUS, NW-FVA, ECO, MESP, UNIL, UNIE	The report gives an extensive overview of existing definitions of Primary and OGF and suggests a set of criteria and indicators for the assessment of Old-growth status, including proposed threshold values and methods to combine and conclude different scoring outcomes

Description of the action and progress

Definition, criteria and indicators

The project foresees the development of a document with definitions, criteria, indicators and thresholds for old-growth beech forests. A preliminary definition and set of criteria were finalized in June 2021 and sent for feedback to the partners. The revised version was sent around for final feedback at the end of 2021, and published on the Prognoses website in March 2022 (see: https://lifeprognoses.eu/outputs-of-the-project/)

The document gives an extensive overview of existing definitions of Primary and OGF and the first proposal of a set of criteria and indicators for the assessment of OG status in beech forests. Proposed threshold values and methods to combine and conclude different scoring outcomes are included.

Upon request by DG Environment, the concept was presented to an expert group from the EU Working Group on Nature and Forests on the 19th of July 2021. With a focus on the definition, indicators and thresholds for primary and OGFs, feedback was given during the next meeting of this expert group on the 5th of October 2021. The comments of several project partners and members of the EU-WGFN expert group (UNITUS, NW-FVA, Dr. Laurent Larrieu…) were incorporated in the revisions of the report. The draft of the document was presented and elaborately discussed at the second working session of the SC meeting of PROGNOSES (November 16th, 2021). The extensive report version of the document has been concluded at the beginning of March 2022 and published on the website.

It has proven to be very relevant in the framework of the discussions within the EU WGNF and the drawing of a guidance document on Primary and OGFs by DG Environment: 'Commission Guidelines for Defining, Mapping, Monitoring and Strictly Protecting EU Primary and Old-Growth Forest'. It has proven to be very relevant in the framework of the discussions within the EU WGNF and the drawing of a guidance document on Primary and OGFs by DG Environment: 'Commission Guidelines for Defining, Mapping, Monitoring and Strictly Protecting EU Primary and Old-Growth Forest'.

Extra: development of the adjusted Old-Growth Indicator (OGI_{ad})

Additionally, we developed a method to calculate the level of old-growthness from data for the EU indicators for beech-dominated forests. This method, named the 'adjusted Old-Growth Indicator' or 'OGI_{ad}', builds on the old-growth indicator (OGI) proposed by Meyer et al (2021). For its development, we used a large dataset collected according to the field mapping approach in ten forests across Europe included in the world heritage site 'Ancient and Primeval Beech Forests of the Carpathians and Other Regions in Europe'. With this dataset the coverage of the natural range of variability of beech old-growth forests could be improved significantly. Also, the OGI_{ad} requires less data to assess old-growthness and thus is more broadly applicable. The full-fledged field mapping approach, however, is rather labour-intensive. This is a serious drawback to realise a timely mapping of all old-growth forests Europe-wide. To accommodate the time limitation, we proposed key points for a 'rapid' field assessment to collect just as much data as to estimate the OGI_{ad} with sufficient accuracy. The development of a plotless field survey is in progress. A draft of the manuscript of the paper describing these scientific developments can be found in the Annexe **Error! Reference source not found.**.

Extra: threshold values for old-growth ranges of the old-growth indicators

From the data for the nine primeval LIFE Prognoses test sites and data for three additional German sites (total 12 primeval sites) we calculated robust threshold values for the old-growth indicators. These threshold values are important to score the indicators and calculate the OGI for a patch of potentially old-growth forest.

Modifications and difficulties

This output is considered of great importance and relevance, not only to the project but also to the process of definition of primary and OGFs by the EU DG Environment. There has been intensive interaction also with the Working Group on Nature and Forests and DG Environment. The release of the first draft had been preponed to June/July to provide the necessary input to the expert meeting of WGNF.

Furthermore, there was a strong interaction with other processes on the definition of OGF: the JRC (Barredo et al. 2021 Mapping and assessment of primary and OGFs in Europe. JRC-report) and the European Forest Institute (O'Brien et al. 2021. Protecting OGFs in Europe A review of scientific evidence to inform policy implementation. EFI Report). This has strongly improved the

content of the document and delivered highly relevant input to the ongoing policy process. At the same time, this resulted in more time spent on this WP than originally attributed, and some delay in the final reporting.

The document is much more elaborate than originally envisaged and was therefore finalized slightly behind schedule, in March 2022. This slight delay does not pose any difficulties to subsequent tasks depending on its input. Action 2.05, the data collection on the field started only in May 2022.

Output

Milestone	Responsible partner	Deadline	Actual completion
Preliminary definition and set of criteria ready	INBO	31/08/2021	31/07/2021
The final version of the set of criteria is ready	INBO	31/12/2021	6/03/2022

Deliverable	Responsible partner	Deadline	Actual completion
Report Vandekerkhove et al. 2022	INBO	31/12/2021	06/03/2022

Complementary actions outside LIFE

See above: interaction with the EU DG Environment, the JRC and the EU WGNF.

After LIFE Project Perspectives

The document was also published on the INBO website and has been, and continues to be, downloaded since by both scientists and policy makers. The results of the report have been presented at several scientific and policy conferences.

A.1.12 Compilation of existing mapping products

Status	Completed		
Responsible	INBO		
Partners	ECO, CULS, UNIE, UL		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2023
Foreseen end date	31/12/2022	**Actual end date/anticipated end date**	31/12/2023

Modifications and difficulties

The original aim of the of the action was to compile a GIS database of existing maps of old growth forests in Europe with a specific focus on Beech Forests. Sabatini et al (2018) have done already a comprehensive work on the collection of different data sources and spatial datasets. Together with the DG Environment and Joint Research Centre initiative (JRC) the first database was updated and published in 2020 (Sabatini et al., 2020). A very similar compilation of existing mapping exercises was performed by the JRC and incorporated in the publication 'Mapping and assessment of primary and OGFs in Europe' (Barredo et al., 2021). In concertation with DG Environment, this subtask was postponed to a later phase of the project, to avoid redundant work. The time gained in 2021 was invested in the further elaboration of WP A1.11. The original description of the task was altered and re-oriented towards the comparison of the database with the field situation in a set of test sites.

Description of the action and progress

Evaluation of the JRC compiled database against detailed site maps.

The altered version of this action comprises the evaluation of the European Primary Forest Database EPFD v2.0, which is the most comprehensive dataset on primary forests in Europe, even if it still has knowledge gaps. We conducted a study to assess three aspects: first, the extent of beech forests inclusion in the EPFD, second, the way in which the datasets were recorded (remote sensing, field work, combination of both), and third, the precision of the delimitation of the beech-forest polygons. The evaluation was made against the detailed site maps of old-growth for the sites where the field sampling took place. The assessment indicates that the polygons from the EPFD v2.0 dataset can only be used to a limited extent as remote sensing reference data for old growth forests. The outcome of this action is a report on the accuracy of the delineation of old-growth forests in the JRC mapping exercise. The report describing the assessment and results can be found in Annexe **Error! Reference source not found.** and is published on the INBO-publication portal:

https://purews.inbo.be/ws/portalfiles/portal/125132694/LifePrognoses-1_1_2_Compilation_of_existing_datasets_def.pdf

Output

Milestone	Responsible partner	Deadline	Actual completion
Compilation of existing mapping exercises: description and GIS-layers	INBO	31/12/2021	Skipped and replaced by mapping of test sites
Evaluation of the existing mapping exercises: description and GIS-layers	INBO	31/12/2022	24/04/2025 Replaced by a confrontation of the test-site mappings with existing mapping exercises

Deliverable	Responsible partner	Deadline	Actual completion
Compilation of existing mapping exercises:	INBO	31/12/2021	See above

description and GIS-layers				
Evaluation of existing maps, delivery of the report	ECO	31/12/2022	01/04/2025	

A.1.13 Screening of Remote-Sensing-based mapping methods for OGF

Status	Completed		
Responsible	JORE		
Partners	ECO, UNITUS, INBO		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/12/2021	**Actual end date/anticipated end date**	26/01/2022

Conducted Activities

Activity	Description	Partners
Literature review	JORE	Literature review on the application of RS techniques for the mapping of OGFs
Submission manuscript	JORE	A manuscript of the analysis of RS techniques was submitted to a journal.

Description of the action and progress

In 2021, a thorough literature review is made on the application of RS for the identification and mapping of primary and OGFs. Scientific search engines (Scopus, Web of Science) were screened, and papers were selected to be analysed. The results of the analysis are compiled in a scientific review paper that has been submitted to a peer-reviewed journal in January 2022.

Modifications and difficulties

The literature that specifically deals with the identification of OGFs through RS is scarce and often still under development. However, many papers exist that cover the use of RS to quantify specific features that are important indicators for sites with a high level of old-growthness. These can be related to features at stand level (such as irregular canopy height and cover; tree species composition, ...).

The authors (JORE) incorporated the feedback given during the SC in November 2021 in the paper, as well as the remarks of the co-authors delivered by the end of December 2021. Therefore, the submission of the manuscript to a peer-reviewed journal was delayed slightly. Instead of submitting by the end of 2021, the manuscript was submitted on the 26th of January 2022 to ***European Journal of Forest Research.*** Another reason for this delay is the fresh publishing agreement between JORE and Springer Nature, which allows publication free of charge, but only from the 1st of January 2022. This way JORE could save an amount of ca. 3.000 euros for APCs.

In February the manuscript was rejected by the journal due to changes in the journal's policy. They suggested redirecting the manuscript to ***Environmental Modelling & Assessment*** (also Springer). The paper was submitted there in April 2022. Reviews were received by the end of July (major revision required). The revised version was submitted by the end of September, and by the end of November a second review was received: one of the reviewers requested some additional revisions.

The third and final revision has been submitted at the beginning of January 2023. The paper was accepted and published in the journal on 19 May 2023. This final version of the paper can be found in Annexe **Error! Reference source not found.**.

Output

Milestone	Responsible partner	Deadline	Actual completion
RS review paper manuscript submitted	JORE	31/12/2021	26/01/2022

Deliverable	Responsible partner	Deadline	Actual completion
Published review paper	JORE	31/12/2021	19/05/2023

A.1.21 Field mapping and testing of indicators

Status	Completed		
Responsible	ECO & INBO		
Partners	NPKA, INBO, NPCB, NW-FVA, UNITUS/NPAB, UL, CBRE		
Foreseen start date	The first trimester of 2022	**Actual start date**	Last trimester of 2021
Foreseen end date	31/12/2022	**Actual end date**	31/10/2023

Conducted Activities

Activity	Description	Partners
Field trip for field protocol, Abruzzo, Italy	SOFO, INBO, UNITUS, NPAB, ECO	In November 2021 the National Park Abruzzo was visited to discuss the old-growth indicators and field protocol for collecting data in the component parts located in the park.
Field workshop for mapping protocol 1 in Ljubljana, Slovenia, March 2022	SOFO, INBO, ECO, UNIL	Testing parts of the field protocol and adjustment
Field workshop for mapping protocol 2 in Kalkalpen, Austria, June 2022	INBO, UNITUS, ECO, NW-FVA, UNIL	Testing parts of the field protocol and adjustment
Field workshop for mapping protocol 3 in Kellerwald, Germany, October 2022	SOFO, INBO, UNITUS, NPAB, ECO, NW-FVA, UNIL	Testing parts of the field protocol and adjustment

Description of the action and progress

Following the first field workshop, the list of old-growth indicators (Action A.1.11) was finalized and aligned with the methodology for inventory at the sampling-plot level. A form for the plot inventory was drafted in December 2021. By April 2022, this information was consolidated into a draft protocol, including a detailed description of a common minimum program for:

- delineation of the test site and sampling units,
- sample plot selection, and
- descriptive parameters and measurement protocols for sampling at the plot level.

This sampling design was tested in the field in Slovenia (University Forest of Ljubljana) by teams. from Austria, Slovenia, and Italy in March 2022. In June 2022, a final field discussion and test took place in Kalkalpen National Park (partners from Austria, Germany, and Belgium). The final draft version (v6.1) was distributed on 6 July 2022 among the partners for field use. After incorporating minor adjustments, based on experiences in the field—particularly the field test in Kellerwald, Germany (October 2022)—the protocol was finalized and published as an official project output in June 2023. It is available through the INBO publication portal (DOI: 10.21436/inbor.97064651).

Preparation for Field mapping: selection and delineation of sampling plots

For each sampling site, plots were selected and delineated based on existing maps and management plans. The sites in which the sampling took place are presented in Table 1.

Table 1: Study sites: name (NP = National Park), country (ISO 3166-1 alpha-2 two-letter country codes), latitude and longitude (decimal WGS84), region.

site	country	lat	lon	beech forest region	biogeographic region
Abruzzo NP	IT	41.78	13.75	Central Mediterranean	mediterranean
Central Balkan NP	BG	42.74	24.77	Moesian-Balcanic	alpine
Hainich NP	DE	51.08	10.44	Subatlantic-Hercynic	continental
Kalkalpen NP	AT	48.22	13.79	Alpine	alpine
Kellerwald NP	DE	51.15	8.98	Subatlantic-Hercynic	continental
Klenovský Vepor	SK	48.55	19.60	Carpathian	continental
Krokar	SI	45.54	14.77	Illyrian	alpine
Sinca forest	RO	45.66	25.17	Carpathian	continental
Snežnik	SI	45.57	14.47	Illyrian	alpine
Sonian forest	BE	50.75	4.42	Atlantic	atlantic
Stara Planina	BG	42.76	24.55	Moesian-Balcanic	alpine
Uholka forest	UA	23.70	48.31	Carpathian	continental

Delineation of the field sampling plots

In most sites, the delineation of test areas (approx. 1,000 ha each) was finalized by the end of 2022. These were further subdivided into sampling units according to the protocol criteria (species composition, stand age, management history, set-aside history, soil conditions).

For Slovenia, smaller sampling areas (100–200 ha) were selected within the SFR of Snežnik and Krokar, and in the surrounding managed forest. Within these units, plots were selected following the protocol or using existing systematic/random designs.

In Figure 1 to Figure 6, the delineated areas and field designs are shown for Sonian Forest, Kalkalpen, Abruzzo, Central Balkan and Kellerwald.

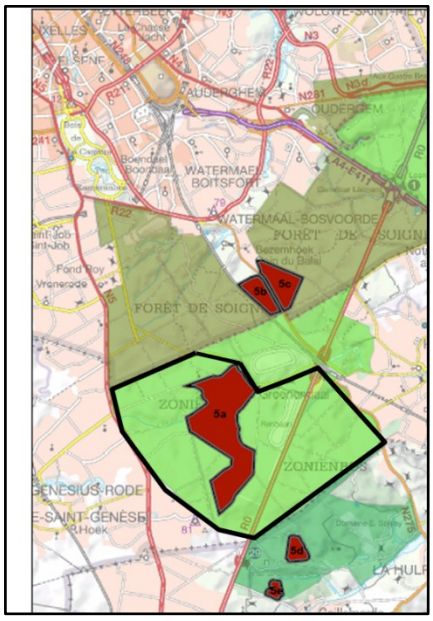


Figure 1: Delineation of the study area for Sonian Forest (Belgium)

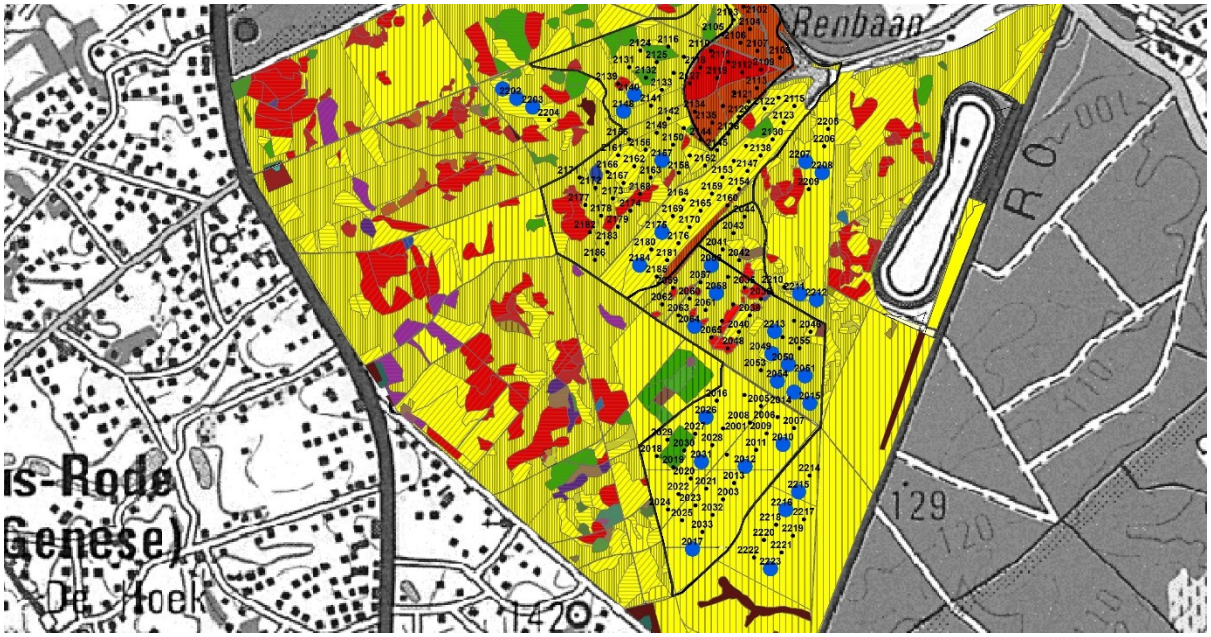


Figure 2: Field sampling design Sonian Forest (Belgium): numbered plots = dendrometric sampling; blue dots = additional soil sampling. Black thick line = delineation of the World Heritage component part. Yellow = beech dominated; dense vertical dashing = old stands (>150y).

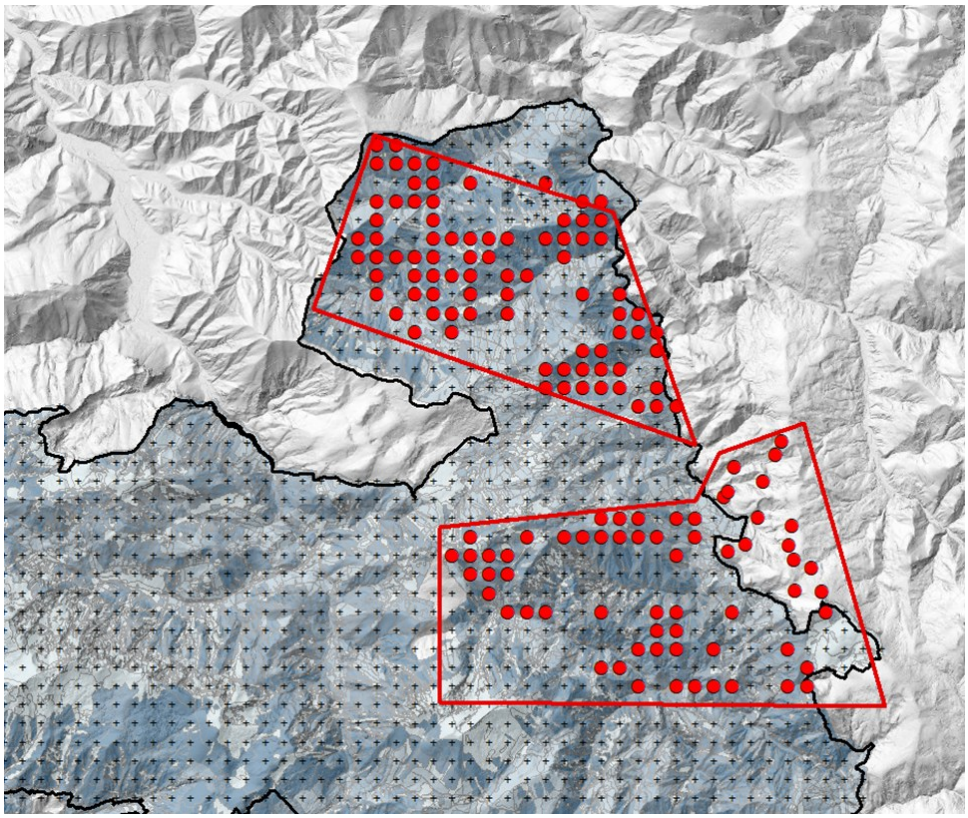


Figure 3: Delineation and field design Kalkalpen (Austria)

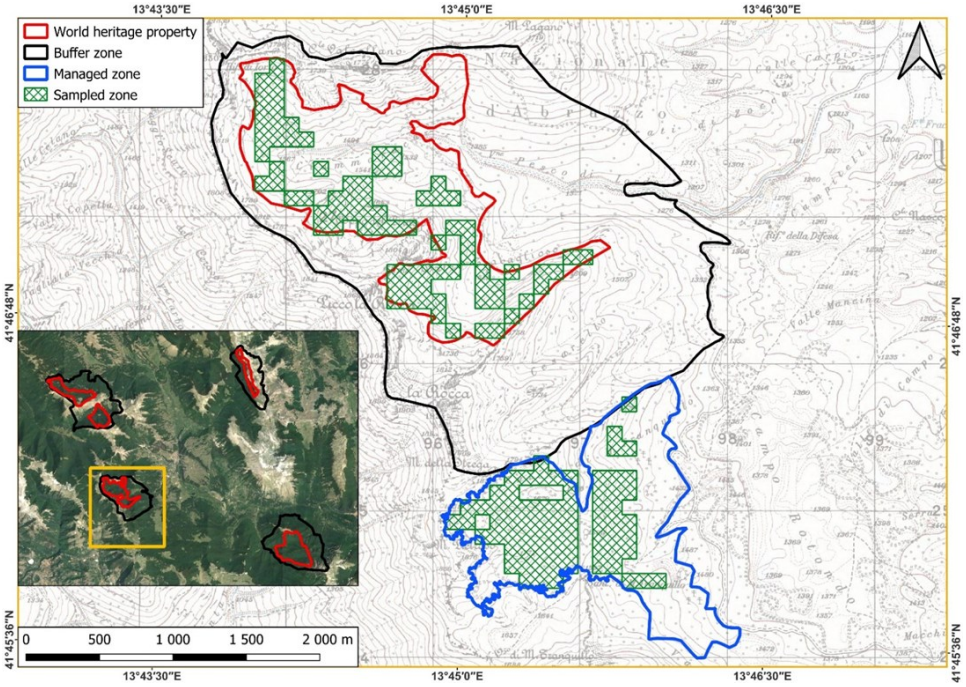


Figure 4: Delineation and field design Abruzzo National Park (Italy)

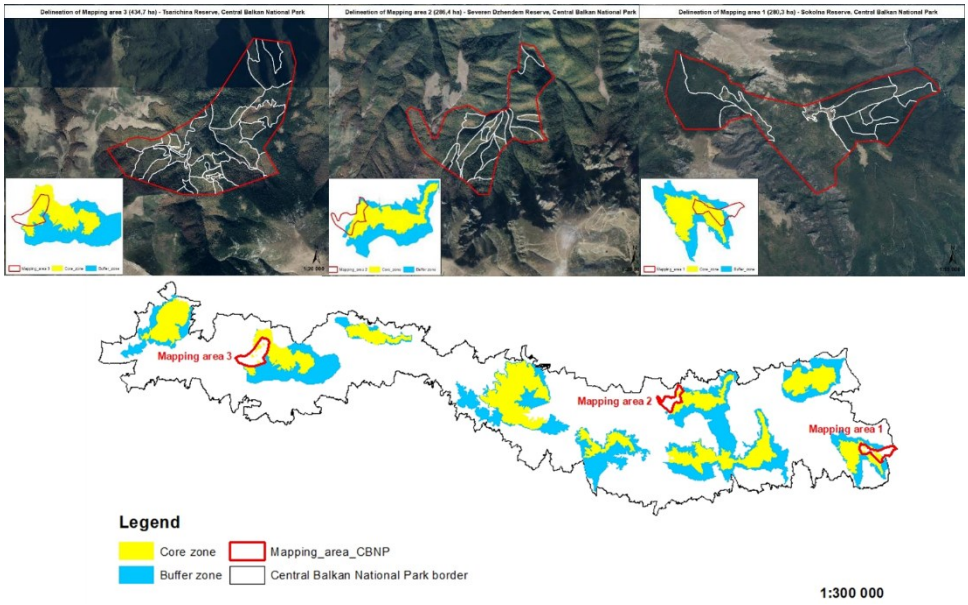


Figure 5: Delineation Central Balkan National Park (Bulgaria)

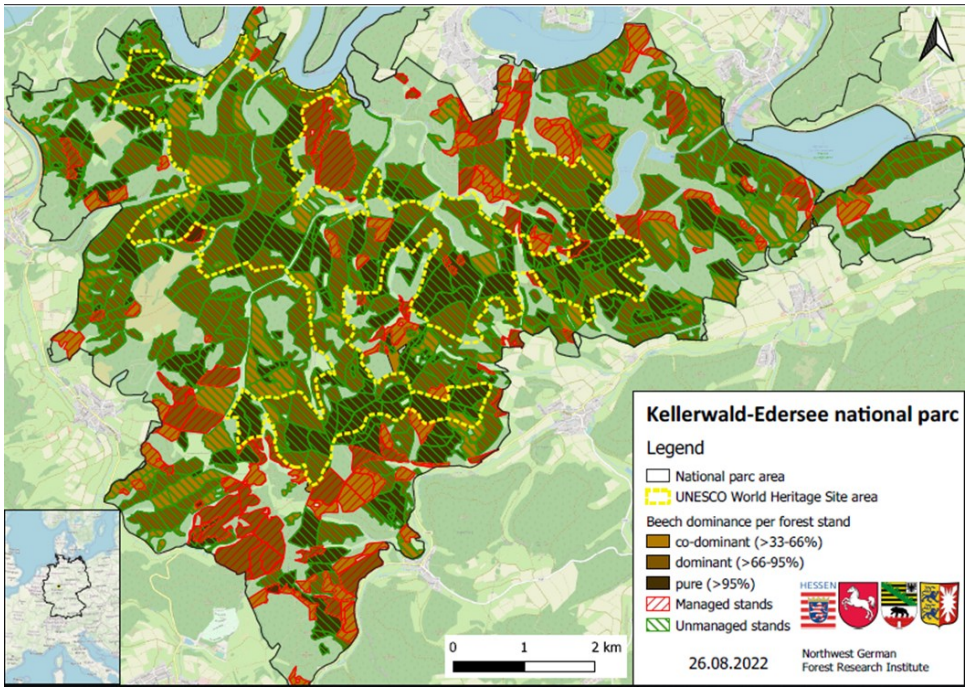


Figure 6: Delineation Kellerward-Edersee National Park (Germany)

Output

Milestone	Responsible partner	Deadline	Actual completion
Mapping guidelines for fieldwork ready	ECO	31/05/2022	01/04/2023
Training workshop of field experts in May 2022 according to the mapping guideline	ECO	31/05/2022	31/05/2022
Fieldwork performed	ECO	31/08/2022	31/08/2024*
Delivery of digital result maps	ECO	31/12/2022	31/012/2024

* The delay to late summer 2023 was meant to allow for the sites of Chornohora and Hainich to be included in the dataset. Most measurements in the other sites were completed by December 2022. For Chornohora, however, this delay did not resolve the issues.

Deliverable	Responsible partner	Deadline	Actual completion
Delivery of digital result maps	ECO	31/12/2022	31/12/2024

Complementary actions outside LIFE

Additional datasets, not originally foreseen in the project, were made available by CULS for the sites Klenovsky Vepor and Stara Planina. This is data from the REMOTE project. Any Mary and Catalin Petritan also kindly provided data for Sinca forest. These datasets were also transformed to the standard format of Prognoses and added to the full dataset.

After LIFE Project Perspectives

The field mapping and assessment protocols that have been developed and extensively tested during the project are also published open access on the INBO website and are available for further application all over Europe in other sites and forests after the end of the project (e.g. in all component parts of the UNESCO World Heritage Site (WHS)). This can become an important tool for mapping and evaluation of the occurrence and quality of primary and OGFs (especially beech forests) in Europe.

A.1.22 Evaluation of existing datasets

Status	Completed		
Responsible	ECO		
Partners	ECO		
Foreseen start date	01/01/2022	**Actual start date**	01/08/2023
Foreseen end date	31/12/2022	**Actual end date/anticipated end date**	30/06/2025

Description of the action and progress

This action compared the results of the field mapping and assessment (A.1.21) with the existing primary and OGF maps for the selected areas. This allowed us to review the existing maps and deliver the field data for the RS package (A1.23).

For the analysis, the EPFD, the polygon maps from forest management plans and the plot data from the field survey (1.21) have been compiled in a database.

The data from the forest management plans need to be harmonized for the indicators management type, age class, beech dominance, admixed species and canopy structure.

We intersected the GIS positions of the field plots with the EPFD polygons and the polygons from the forest management plans. Based on the intersection we got a table with information from the field survey, inclusion in the EPFD (yes/no) and the standardized classification of management type and age class from the forest management plans. The Information on the old-growthness index (OGI) was included for all plots, which have been included in a "stand" by spatial-statistics (see paper on OGI). This table was statistically analysed, and a report was prepared instead of a scientific paper. The report can be found in Annexe **Error! Reference source not found.**.

Modifications and difficulties

As the field assessment was still ongoing by the end of 2022, this action encountered some delay. The work started in summer 2023, as soon as the field data and mapping results were available.

In the analysis we got aware on several difficulties which lead to the decision to make only a technical report instead of a scientific paper.

1. Several information on management history and age class has been derived from the forest management plans and was used in attributing the plot data from the field survey. This has led to data that is not independent and a cross check between the field survey and the forest management plans has limited significance.
2. Classification of old-growthness with the old-growth indicator (OGI) of Meyer et al. (2021) is only possible for forest stands with a sufficient number of plots (minimum 10). In several sites this minimum number was not available. EPDF polygons only partly overlapped with the test sites of Prognoses. Uholka is completely included in the EPFD, and no managed plots are available for comparison. In Kalkalpen the EPDF polygons only roughly represent the very heterogeneous spatial pattern.
3. Several correlations did not show significant results, and deeper analysis would be needed to find out the main drivers of the variability.

Output

Milestone	**Responsible partner**	**Deadline**	**Actual completion**
Data on the quality and accuracy of existing maps delivered	ECO	31/08/2022	30/04/2025

Deliverable	**Responsible partner**	**Deadline**	**Actual completion**
Technical report instead of a scientific publication on the results	ECO	31/12/2022	30/06/2025

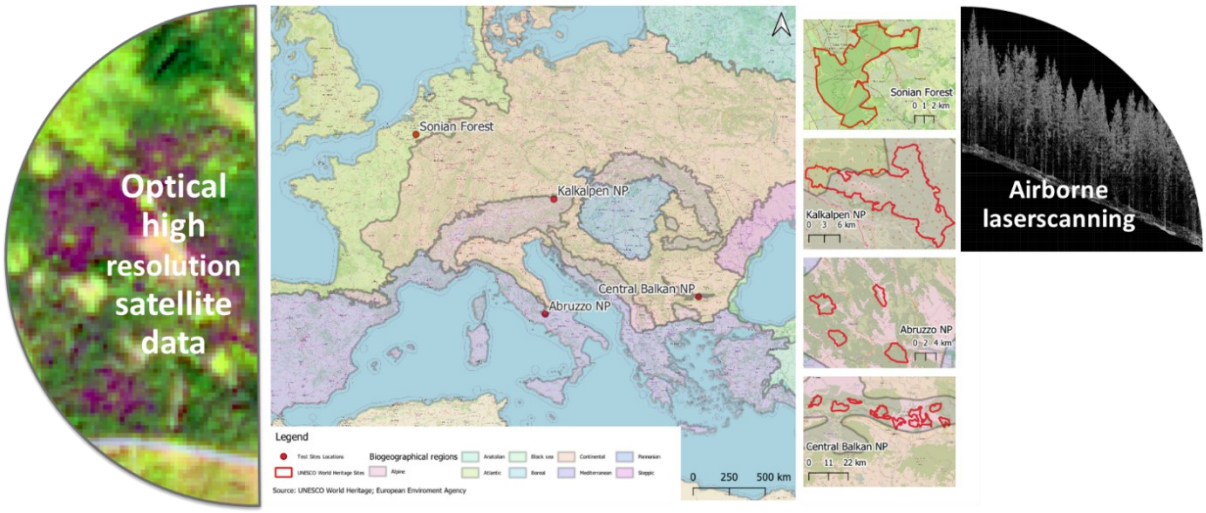
A.1.23 Application of the RS approach

Status	Completed		
Responsible	JORE		
Partners			
Foreseen start date	01/04/2022	**Actual start date**	01/12/2022
Foreseen end date	31/09/2023	**Actual end date/anticipated end date**	30/06/2025

Description of the action and progress

Within this action, a RS approach was developed, tested and calibrated to distinguish young and mature versus old-growth beech forest ecosystems. The methodology is based on the results of the literature study in action 1.13. The 'ground truth data' to calibrate and evaluate the method is derived from (i) data collected by the partners for the individual sites and (ii) the data sampled in action 1.21. This subdivision was needed to provide independent validation data. As these both data sets were becoming available approximately a year later than planned, the timing of this action was had to be postponed too. As laid out in the proposal, three sites in four bio-geographical regions of Europe were to be mapped. This is important because we wanted to be as representative as possible. For the selection of sites, input data availability played a major role in the selection process. A questionnaire was sent to all partners to assess the availability of both RS as well as in-situ data for this exercise. As airborne LiDAR (ALS) is the most promising input data source, we selected two sites with available LiDAR data: Sonian forest (BE, Atlantic region) and Kalkalpen National Park (AT, Alpine region, see Figure A). To complete the site selection and to assess the reachable mapping accuracy without ALS data, Abruzzo National Park (IT, mediterranean region) and Central Balkan National Park (BG, Alpine region) were added to cover the variability of ecosystems. in Europe.

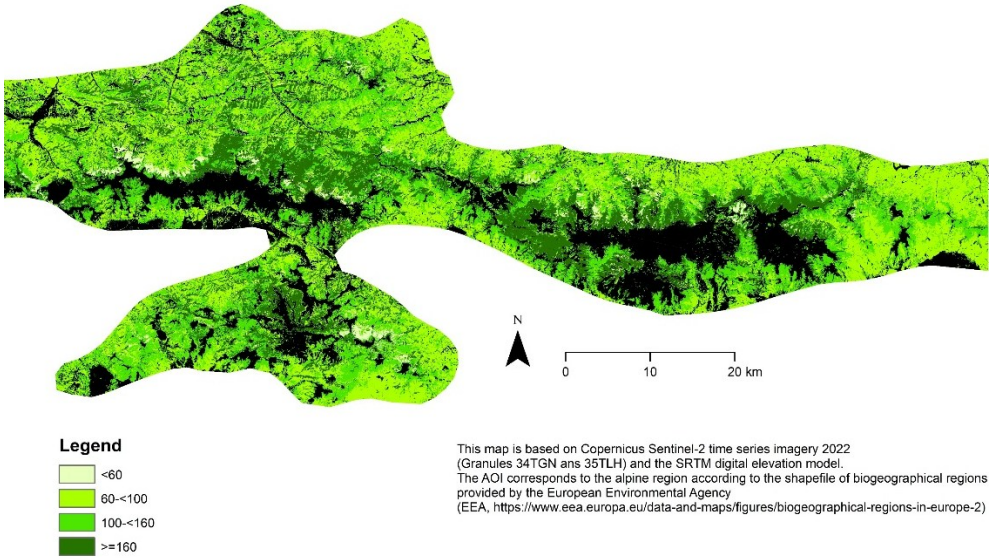
Figure A: Location of study sites and available data



All input data (Sentinel-2 data, ALS data, digital elevation data) and reference data (age maps, management maps, field assessments) were pre-processed for further classification. Preprocessing steps included: reprojection to a common spatial projection system and common spatial scale (10x10m in our case); atmospheric and topographic correction of satellite data; translation of attributes to English and ensuring the correct meaning of various attributes, etc. Next, input features were calculated: based on literature review, spectral, temporal, topographic and textural features from Sentinel-2 as well as 3D features for ALS data were prepared, altogether forming a set of 160 features. For the processing task itself, the machine learning tool Random Forest Regression was employed. Feature importance analysis revealed that in all test sites, elevation was the only feature consistently ranked within the top eight most important variables. As expected, its influence was lowest in SOFO with mainly flat terrain (rank 8 and 6 resp.), but much more important in mountainous areas: rank 6 for NPCB, rank 4 for NPAB and rank 3 in both cases of NPKA. In contrast, Sentinel-2 texture metrics ranked very high for SOFO (all top 3 ranks for SOFO without ALS, rank 3 for SOFO with ALS) and NPAB (ranks 3, 5 and 6). So it seems. that texture is not equally important in different

bio-geographical regions or topographic contexts. As for the spectral features, there is no clear model preference across all sites. An example of the resulting map is shown in Figure Y below: it is the result of the age classification for NPCB. When overlaying this age map with existing protected areas, it is easily possible to spot patches of potentially old-growth forest, that is not yet under legal protection.

Figure Y: Age classification map for NPCB



Modifications and difficulties

See above: this activity was postponed to 2023, as the delivery of the ground truth data was delayed (for Abruzzo only available in January 2025).

Output

Milestone	Responsible partner	Deadline	Actual completion
Setup of input data (calibration data from the field and existing databases as well as satellite and/or airborne data) in an appropriate GIS environment by end of 2022.	JORE	31/12/2022	01/12/2024
Test run with first maps based on the remote sensing approach delivered for evaluation in Action 1.24. Mapping for at least 4 World Heritage component parts and their buffer zones (min. 100.000 ha)"	JORE	30/06/2023	30/06/2025

Complementary actions outside LIFE

Based on the LIFE project, a bi-lateral cooperation between UNIL and JORE was established to make use of Slovenia's new nation-wide LiDAR data coverage. A master's thesis (Annika Aichholzer – University of Graz) is currently processing the LiDAR data to identify potentially OGFs in Slovenia using the software and methods developed within LIFE Prognoses.

An EU Horizon project proposal was also developed by some of the partners and based on the cooperation experience gained in LIFE. The EU Horizon project FORBeST is currently ongoing.

After LIFE Project Perspectives

Both the complementary activities (project FORBeST and the bi-lateral cooperation with UNIL) are ongoing and expected to produce joint publications improving the knowledge on the location and condition of OGFs in Europe. The results of the RS analysis are promising to discriminate young beech stands from mature and old-growth forests with relatively high accuracy, thus discriminating areas with 'potential' for primary and old-growth forest if sufficient training data is available. High-quality results can be expected, if ALS input data is available in addition to Copernicus satellite data. This method may allow to narrow down the area to be assessed in the field. Thus this could become a very valuable tool to map potential OGFs in Europe (or at least for beech and other broadleaved temperate forests).

A.1.24 Evaluation of Remote Sensing Results

Status	Completed		
Responsible	JORE		
Partners			
Foreseen start date	01/04/2022	**Actual start date**	01/04/2022
Foreseen end date	31/09/2023	**Actual end date/anticipated end date**	30/06/2025

Description of the action and progress

The output of this action, a scientific paper evaluating the developed RS method, was merged with the output of action 1.23, which is a scientific report about the development of a methodology for RS-assessment of old-growth and stand age in beech forests (See above).

The maps were visually evaluated iteratively by the respective partners. JORE held bi-lateral meeting with NPKA and NPCB to discuss previous versions of the mapping results. For Sonian Forest, feedback was given by SOFO (K. Vandekerkhove), for Abruzzo, results were compared to maps provided by partner NPAB and discussed with colleagues from University of Tuscia. The quantitative evaluation was done in two ways: first, as a model evaluation calculating the root mean square error (RMSE) for the 20% left-out of the training data set. This led to the following RMSE values:

- SOFO: 52.5 years using Sentinel-2 data only, and 47.9 years when combined with airborne laser scanning (ALS) data
- NPKA: 50.0 years (Sentinel-2 only) and 40.8 years (Sentinel-2 + ALS)
- NPCB: 41.3 years (Sentinel-2 only)
- NPAB: 41.2 years (Sentinel-2 only)

Second, an independent evaluation was done using the field plots collected by the partners within the project. The achieved accuracy values (overall accuracy (OA), recall and precision) are given in Table 2 below.

Table 2: Quantitative assessment of the remote sensing results (blind/plausibility)

		SOFO (S2)	SOFO (ALS&S2)	NPKA (S2)	NPKA (ALS&S2)	NPAB	NPCB
OA	5 classes	0.60/0.81	0.70/0.87	0.53/0.72	0.55/0.78	0.26/0.53	0.31/0.56
	2 classes: NOGF, OGF	0.66/0.88	0.78/0.94	0.61/0.80	0.69/0.88	0.37/0.64	0.34/0.59
Recall	5 classes	0.27/0.36	0.29/0.37	0.24/0.35	0.22/0.41	0.16/0.32	0.19/0.28
	2 classes: NOGF, OGF	0.68/0.90	0.73/0.92	0.60/0.79	0.67/0.88	0.36/0.65	0.49/0.71
Precision	5 classes	0.24/0.32	0.30/0.36	0.20/0.28	0.19/0.49	0.10/0.21	0.19/0.25
	2 classes: NOGF, OGF	0.66/0.86	0.80/0.95	0.61/0.81	0.67/0.87	0.36/0.64	0.49/0.65

For the results of this action and action A.1.23 together, a scientific paper is made of which the manuscript can be found in Annexe **Error! Reference source not found.**.

Modifications and difficulties

In a first step of the quantitative evaluation, a fully blind evaluation was done, which yielded poor results. One reason could be found in the small plot size compared to the geolocation accuracy of the field inventory. A geolocation error of 10 m for a 12.5m plot would potentially lead to high error margins. Therefore, we included a plausibility analysis in the error estimation. All details are given in the manuscript of the paper. Additional difficulties involved the problems. with availability of knowledgeable personnel for the evaluation of the results and limited understanding of the mapped information. An example should be used to better illustrate this: in NPKA, responsible personnel told us that the map was wrong in a certain place, which we classified as young forest. The personnel emphasized that the specific area had not been managed for a long time. Indeed, both pieces of information are correct: an avalanche had hit the area leading to a (natural) disturbance and subsequently young trees in an undoubtedly long untouched and therefore old-growth forest. These issues make the mapping and evaluation of OGFs so difficult.

Output

Deliverable	Responsible partner	Deadline	Actual completion
Scientific paper on the remote sensing methods and evaluation	JORE	31/12/2024	30/06/2025

Complementary actions outside LIFE

Equivalent to A1.23

After LIFE Project Perspectives

Equivalent to A1.23

A.1.25 Compilation of Final Outputs

Status	Completed		
Responsible	NPKA		
Partners			
Foreseen start date	01/04/2022	**Actual start date**	01/05/2024
Foreseen end date	31/09/2023	**Actual end date/anticipated end date**	21/02/2025

Description of the action and progress

This action centralised the major outputs of WP1, that provide an overall 'state of knowledge':

- A clear set of definitions, criteria, and indicators,
- determination of benchmark values for the delineation of different degrees of old-growthness for beech forests,
- standardised protocols for mapping and evaluation and resulting detailed mappings of 10 important test areas in Europe (all part of the UNESCO WH composite site of Ancient and Primeval beech forests).
- An evaluation of existing and published mapping results.

The resulting report can be found in Annexe **Error! Reference source not found.**.

Modifications and difficulties

Due to the delay in the field sampling, as well as the reorientation of A.1.12 to avoid redundant work regarding the compilation of existing maps, this action was also postponed. The extension of the project implementation was needed for the evaluation of the RS approach. As a consequence, the results of this evaluation could not be integrated into the report summarizing the outputs of WP 1. However, a separate report on the evaluation of the RS approach can be consulted (see A.1.24).

Output

Milestone	Responsible partner	Deadline	Actual completion
Final report summarising the results of WP A.1	NPKA	31/12/2022	21/02/2025

Complementary actions outside LIFE

This work is complementary to the Europe-wide stock-taking exercise on existing old-growth inventory and mapping exercises, initiated by DG-Environment and coordinated by the JRC.

A.2.01 Assessing the influence of forest management on microclimate

Status	Completed		
Responsible	UNIE		
Partners	CULS		
Foreseen start date	Contracts: 01/09/2021 Measurements: 15/05/2022	**Actual start date**	Contracts: 01/10/2021 Measurements: 15/05/2022
Foreseen end date	Contracts: 31/08/2023 Measurements: 31/10/2022	**Actual end date/anticipated end date**	Contracts: 31/09/2023 Measurements: spring 2023

Conducted Activities

Activity	Partners	Description
Drafting the research design	UNIE	Selection of the sampling sites and developing a sampling protocol
Purchasing of 250 temperature loggers (Onset Hobo Pendant data-logger) and 250 protective shields	Internal	Purchasing of 250 temperature loggers (Onset Hobo Pendant data-logger) and 250 protective shields
Administrative set-up, co-financer (additional funding)	Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Consumer Protection (BMUV)	Successful negotiations for additional funding of 25.500,00 € for additional 125 loggers to measure relative humidity at every second temperature measurement point
Call for tender and purchasing of 125 relative humidity loggers (Onset Hobo ProV2 data-logger) and 125 protective shields	Budget and Procurement Division of UNIE (internal)	Preparation and publication of procurement for data loggers and protection cover, purchasing
Exploration of the four research sites where on-site measurements will be realized (Kellerwald, Hainich, Serrahn, Grumsin) (January - February 2022)	In cooperation with site managers; the core team of UNIE	Trip to the sites, where we had meetings and joint evaluations with site managers considering the suitability of different settings in the forests
Refining the research design (March - April)	Internal	Evaluation of the different settings and of potential research designs that could allow for answering the research questions; adaptations of the initial and ideal research design idea due to actual real settings and circumstances in the field
Preparation of the data-logger installation (April)	Internal; in cooperation with site managers	Selecting and flagging the final 250 measurement points in all four research sites based on the refined research design
Installation of the data loggers (May, June)	Internal; in cooperation with site managers	Installation of 250 wooden poles to which 250 temperature data loggers and 125 relative humidity loggers were attached and collection of canopy cover data
Data collection	Internal	Until the end of 2022, four trips were made to each test site to

		download the microclimate data and to maintain the loggers
Online meetings facilitated by E.C.O. as lead partner of WP A.2	E.C.O., UNIT, UNIE	Discussion considering the methodology and research design and data exchange in the working group. Progress reporting and room for discussions etc
Online meeting with EU LIFE Prognoses partners, not connected with WP 2.01	Peter Meyer and colleagues (NW-FVA)	Discussion and quest for synergies, joint challenges and approaches for the realization of the fieldwork
Continuation of measurements	Site managers (Kellerwald, Hainich, Serrahn, Grumsin)	Communication and coordination with site managers to continue the measurements until spring/mid-2023

Description of the action and progress

Five potential sampling sites, Kellerwald, Hainich, Grumsin, Serrahn and Jasmund, were selected and evaluated concerning the suitability for the study. The locations of the selected sampling sites are shown in Figure 7. Eventually, only four out of these five sites were finally chosen as test sites (see section "Modification").

A research design and field protocol were developed for which 250 temperature data loggers are needed Additional funding for supplementary 125 data loggers that measure relative humidity was provided by the co-financer.

Possible RS approaches were analysed: RS maps of the five test sites could be produced and served as a basis for the drafting of the research design.

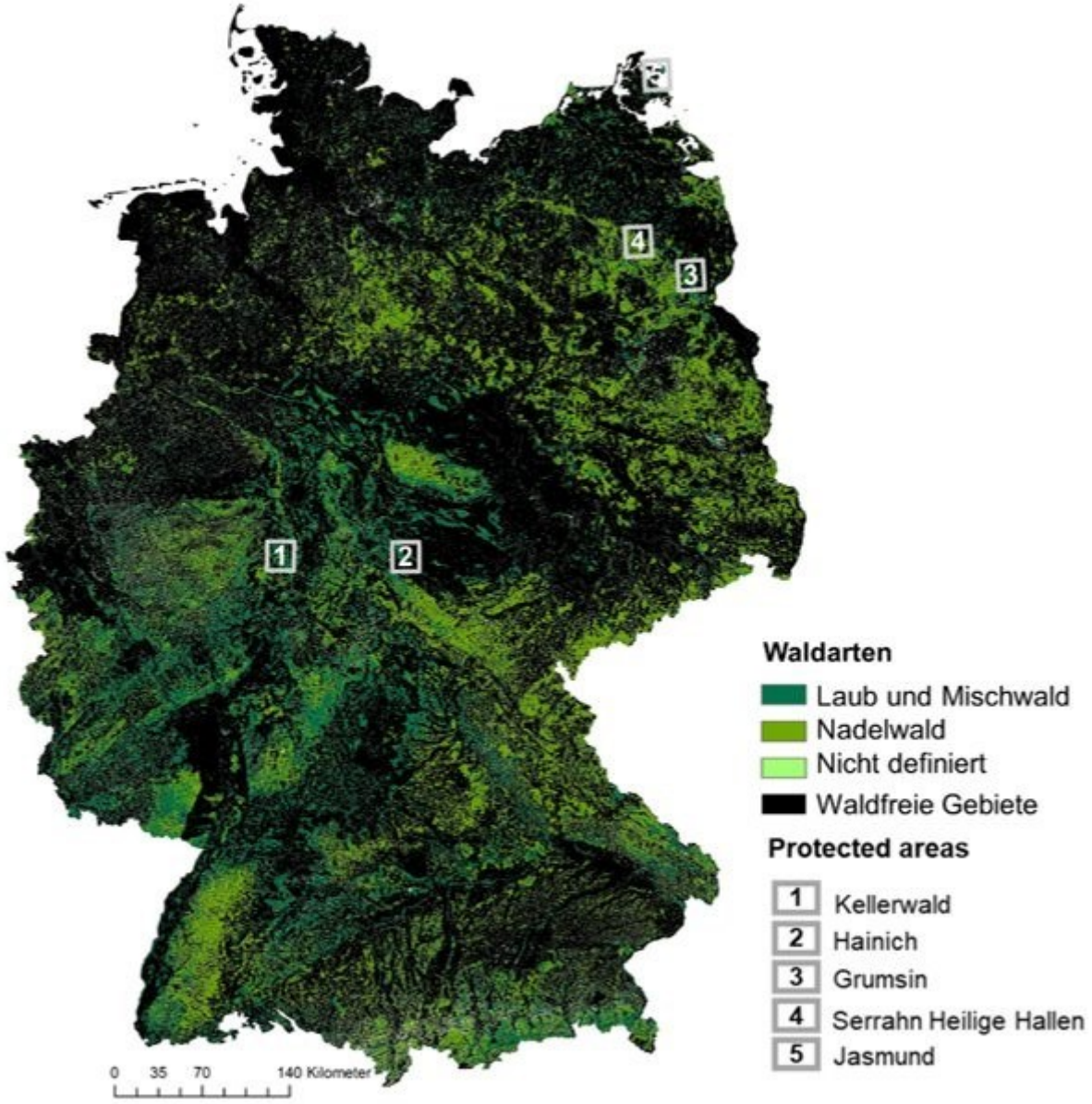


Figure 7: Initially envisioned sampling sites for the assessment of the microclimate. Jasmund National Park was excluded from on-site measurements due to the influence of the proximity of the sea on the microclimate.

Additional funding and acquisition of material

In 2022, substantial progress has been made. Besides the final steps in the internal administration at the UNIE early this year, negotiations with the co-financer Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Consumer Protection led to an increase in the budget of 25.500,00 € for 125 additional relative humidity data loggers.



Figure 8: Temperature data logger



Figure 9: relative humidity data logger

Research Design

In January and February 2022, a trip to the four forests was conducted to meet the site managers and to see different potential sites for the measurements. This allowed the elaboration of preliminary research design proposals for each of the four on-site test sites (Kellerwald, Hainich, Grumsin, Serrahn). Given that these research design proposals also included private forests in some cases, they had to be amended time and again until all parties involved agreed to the design. This work step was finalized by a trip to the sites in order to flag the individual measurement points and make small adjustments to the final research design in April. The actual installation of the loggers was conducted in May and June 2022. The methodology report describing the research design has been annexed to the Midterm report.



Figure 10: Research design in the WHS component part Grumsin.

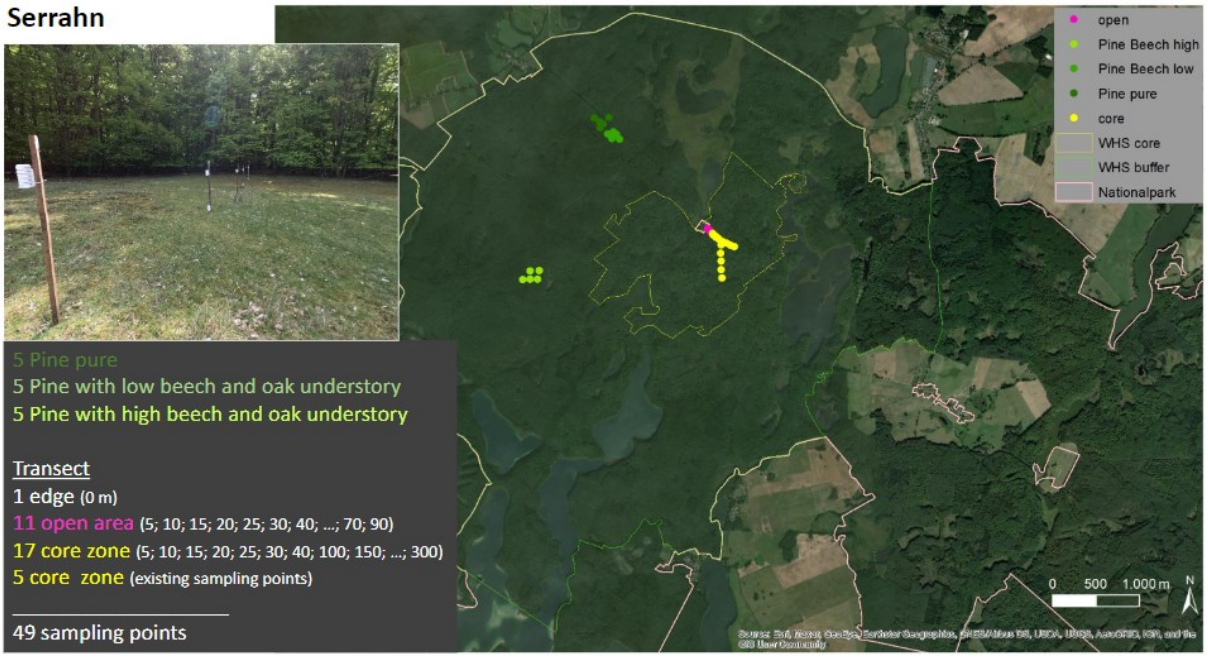


Figure 11: Research design in the WHS component part Serrahn.

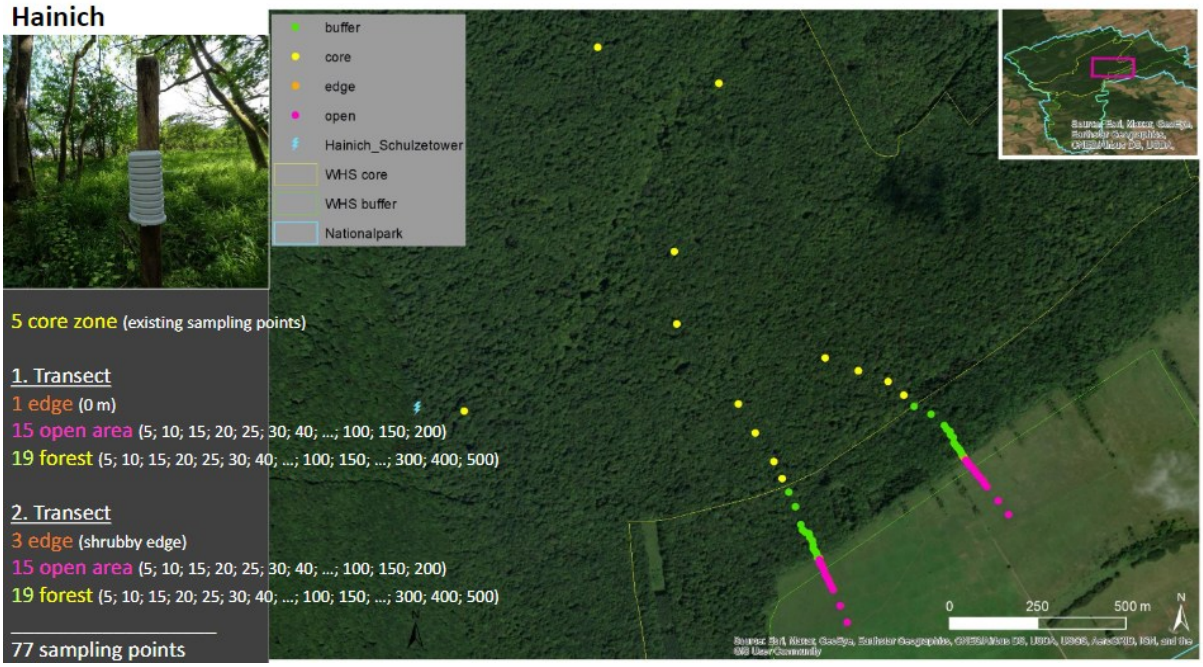


Figure 12: Research design in the WHS component part Hainich.

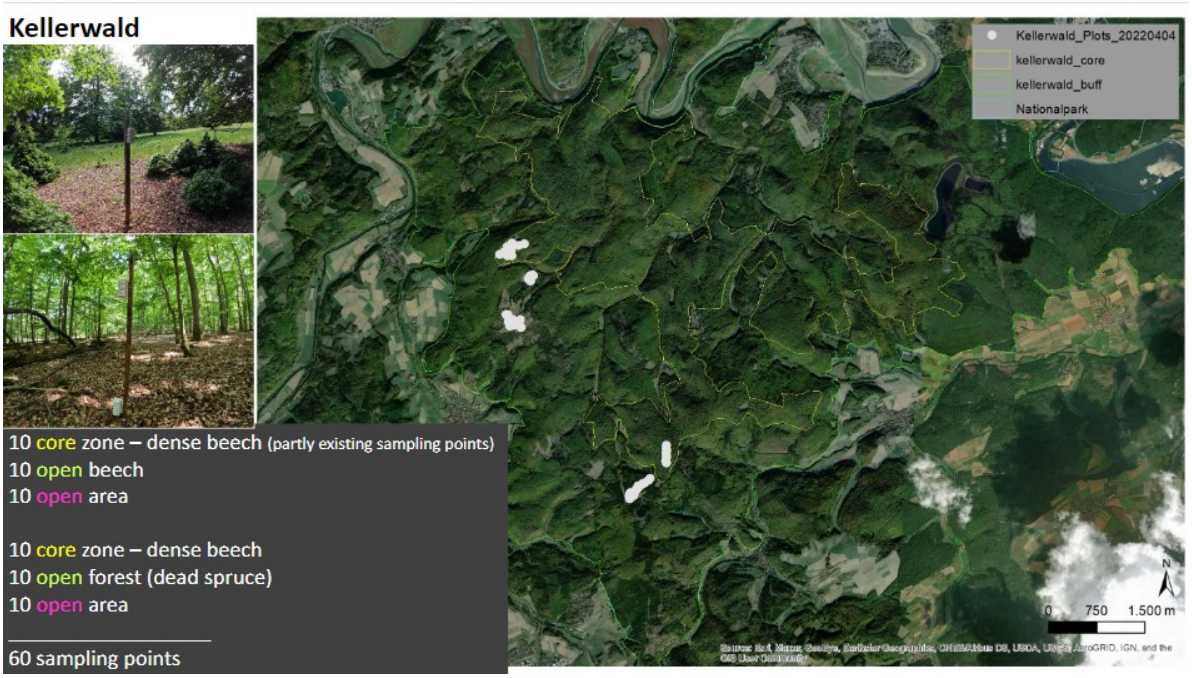


Figure 13: Overview of the research design in the WHS component part Kellerwald.

There are temperature loggers at every of the 250 measurement points, whereas there are relative humidity loggers only at every second measurement point. They are attached to the pole in a protective shield that prevents a direct exposure to sunlight, rain, ice and snow. The temperature loggers are installed at a height of 1,3m and the relative humidity loggers at a height of 0,1 m. They make simultaneous measurements every 10 minutes and locally store the data.



Figure 14: *Wooden poles with temperature data loggers (1,3m height) and relative humidity loggers (approx. 0,1 m height) in different sites.*

Data collection

In the course of the installation of the data loggers, canopy cover was measured at all measurement points in all four sites.
Between May/June and December 2022, a total number of four trips to the test sites were made to collect the microclimate data. Overall, the first months of data collection were successful and only minor problems. occurred with resulting gaps in the continuous time series: in the open land in Hainich, sheep have pushed several poles that had to be reinstalled again. In Grumsin, some loggers were lost on agricultural land during harvest.



Figure 15: Damages caused by sheep in the open land at Hainich.

A total of 250 data loggers were purchased and deployed in four pilot areas in Germany: Grumsin (64), Serrahn (49), Hainich (77), and Kellerwald (60). The logging period ran from May–June 2022 through spring 2023. Further methodological details are available in the report for Action A.2.01 (annexed to the Midterm Report).

Table 3: Number of loggers per pilot area

Grumsin	64
Serrahn	49
Hainich	77
Kellerwald	60
Total	250

Modifications and difficulties

The first contact with the managers of the test sites revealed that they had not been aware of the EU LIFE Prognoses project. Therefore, we joined the meeting of the national coordinating committee for the WHS in Germany in November 2021 to present the project and the planned fieldwork in their sites. This caused a slight delay in the planning and drafting of the methodology and the research design. We exchanged intensively with the site managers and the associated scientific staff to decide upon the realization of the project in their WHS. This work was finalized in early 2022. Yet, this slight delay did not have an impact on the timing of the fieldwork, and hence, on the progress of the project as such.
The land surface temperature maps show that Jasmund National Park, surrounded by the sea, is unfit for microclimatic measurements. The cooling effect of the sea might have a very strong influence on the local temperature regime. During the meeting in Brussels in November 2021, the LIFE project partners confirmed our presumption. Since including this site does not promise insightful results on the ecosystem service microclimate regulation in OGFs, it was excluded as a test site. We will still conduct geo-data analyses using RS data and existing geo-data on the Jasmund National Park.
There were no major changes to the project plan, the above-described alterations did not have an impact on the positive development of the project.

Publication

From the collected data, two scientific papers were drafted and published. The microclimatic performance of forests under different management regimes has been analysed. The results have been published in *Nature's Scientific Reports* and *Ecological Indicators*. The papers can be found in Annexe **Error! Reference source not found.** & **Error! Reference source not found.**. The corresponding datasets can be found on Zenodo (via the DMP).

Extension of the measurement period

Additional funding by the co-financer (Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and Consumer Protection) allowed us to overcome all

budget constraints and all activities could be conducted as planned. What is more, it allowed us to extend the measurement period beyond the planned end date of October/November 2022 until approximately spring/mid-2023. The decision was made in communication with the site managers. The extension of the measurement allows the collection of microclimatic data for a whole year including all four seasons. Because of this extension, the dataset has been finalised later than planned. To not hinder the activities depending on this data, the measurements stopped mid-2023. The analysis of RS data including land surface temperature and NDVI was conducted at the beginning of 2023.

Output

Milestone	Responsible partner	Deadline	Actual completion
Methodology drafted and finalized (see attachment)	UNIE	31/12/2021	February/March 2022
Temperature data and maps ready	UNIE	31/12/2022	Data collection was completed mid-2023

Deliverable	Responsible partner	Deadline	Actual completion
Methodology report (see attachment)	UNIE	31/03/2022	07/03/2022

Complementary actions outside LIFE

The new evidence of temperature gradient between managed and unmanaged as well as from beech forest into open land will also support the design of appropriate buffer zones for effective protection of primeval and old-growth beech forests (e.g. for the World Heritage of Ancient and Primeval Beech Forests of the Carpathian and other Regions of Europe).

After LIFE Project Perspectives

The corresponding datasets are available on Zenodo, thus remain available for future research and analysis.

A.2.02 Assessing the influence of forest management on carbon storage

Status	Completed		
Responsible	UNITUS		
Partners	ECO, CULS		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/03/2022	**Actual end date/anticipated end date**	31/03/2022

Conducted Activities

Activity	Description	Partners
Literature review	A scientific background from the literature available on quantifying forest carbon and selecting a sampling strategy to be applied to European forests.	UNITUS, INBO, NW FVA, E.C.O.,
Development field protocol	A measurement scheme to quantify carbon stocks in the field was developed to be able to compare managed and primary/OGFs. The sampling approach included living and dead biomass plus the organic component in the soil.	
Field Test of Field Protocol (together with Action A1.21, and A2.03)	The jointly developed field protocol for OGF and ESS field data acquisition was tested in the National Park Kalkalpen.	
Mapping and data harvesting (within task 2.05)	The mapping of all eco-system services started in the summer of 2022	All partners
Technical Workshop on soil samples (together with Action A2.05)	Expert meeting in National Park Kellerwald to discuss and further develop the soil carbon assessment (19.9.2022)	E.C.O., INBO, NW FVA, UNITUS,
Field Test of Field Protocol (together with Action A1.21, and A2.03)	The jointly developed field protocol for OGF and ESS field data acquisition was tested in the National Park Kalkalpen.	

Description of the action and progress

Preliminary Literature Review
A thorough literature review regarding existing methods for sampling forest structure and soil for carbon quantification was conducted by UNITUS, ECO and CULS and compared to existing methods already implemented in the field in existing monitoring efforts by all Project Partners. Special attention was given to the comparability of results coming from different sampling sites spread over the different climatic regions within Europe. The literature review and methodology report was annexed to the Midterm report.

The field sampling protocol for the assessment of carbon in old-growth forests was developed jointly with the field sampling protocol for the old-growth status assessment and the protocol for the assessment of biodiversity. More information about the development of the overarching 'Mapping Guideline and Field Survey Protocol' can be found under A.1.21.

Data Collection - Field Survey for Living - Dead Trees and Soil

During the growing seasons 2023 and 2024 all beneficiaries of the project were active in collecting field data necessary for the Action. Partners not included in the original set of beneficiaries were included in the network by providing data from interesting case studies including primary forests (Ukraine) or both primary and managed forests (Romania, Slovakia).

Fieldwork for the carbon assessment was conducted in parallel with old-growth forest indicator mapping at the following sites in 2022: Kalkalpen NP (AT), Sonian Forest (BE), Abruzzo NP (IT), Snežnik (SI), Krokar (SI), Central Balkan NP (BG), and Kellerwald/Edersee NP (DE). Due to the war in Ukraine, field data could not be collected for Chornohora; these data were substituted with WSL (Switzerland) datasets for Uholka NP.

Soil and organic layer samples were collected for carbon quantification in both managed and unmanaged stands in a subset of sites and plots. Soil sampling (WP 2.05) was conducted at most sites in summer 2023 by local experts. Chemical analyses were performed at INBO (Belgium) in 2024, measuring Total Organic Carbon (TOC), Total Inorganic Carbon (TIC), and bulk density from undisturbed Kopecky ring samples. The dataset was complemented with existing soil data for Klenovský Vepor (SK). In Italy and Bulgaria was also conducted an (optional) tree coring to explore how wood density and growth rates varied within beech trees of different size in managed vs. primary forests.

Table 4: The number of plots in which soil samples - at different depths - or organic layer samples (OL) were collected for the different forest categories (m = managed, s-a = set aside, l-u = long untouched, p = primary) at each site, with brief description of the sampling method at the site and indicated whether bulk density (BD) was determined and whether the organic layer was sampled entirely (LFH) or split into separate layers

	no plots									**sampling per plot**		
	history				**for soil depth (cm) or organic layer**							
site	**m**	**s-a**	**l-u**	**p**	**0-10**	**10-30**	**30-60**	**60-100**	**OL**	**method**	**BD**	**OL** [i]
Abruzzo NP	9	7	-	15	31	31	17 + 4 [d]	4 + 3 [e]	31 / 4 [f]	1 minipit 30 cm x 30 cm or 50 cm x 50 cm	yes	LF, H
Kalkalpen NP	9	3	18	-	30	29 [b]	-	-	-	composite of 2 samples with Edelmann auger	-	-
Kellerwald NP	10	-	9 [a]	-	19	19	-	-	19	composite of 3 samples with auger; humus pot 593.96 cm²	yes	LFH
Klenovský Vepor	7	-	-	7	14	14 [c]	-	-	14	2 pits 70 cm x 70 cm	- [h]	L, FH
Sonian forest	23	7	-	-	30	30	30	30	24 [g]	composite of 3 samples with auger; 25 cm x 25 cm for OL	yes	LFH

[a] 1 of the 10 sampled long-untouched plots was excluded from analysis due to exceptionally low bulk density and low dry weight organic layer

[b] 1 of the 10-30 cm samples of a set-aside plot got lost

[c] soil depths 10-20 and 20-40 cm sampled instead of 10-30 cm

[d] 4 samples did not reach the full depth: 30-40 cm (2), 30-45 cm (1), 30-50 cm (1)

[e] 3 samples did not reach the full depth: 60-70 cm (1), 60-77 cm (1), 60-80 cm (1)

[f] 31 plots with dry weight; 4 plots with chemical analysis of the organic layer: 1 plot with L & H sampled separately, 3 plots with L sampled

[g] missing or surprisingly high dry weight organic layer for 6 samples; excluded from the dataset

[h] weight of fine soil (< 2 mm) per surface area

[i] organic layer (OL): litter layer (L), fragmentation layer (F), and humus layer (H) either sampled separately or together (LFH)

Data analysis and comparison

Carbon Stocks in Primary vs. Formerly Managed Forests

In all study areas, either formerly managed or primary stands showed consistently higher C stock (106-346 MgC/ha; Table 1) than the average EU forest (51.2 mgC/ha aboveground, 12.8 mgC/ha belowground; Forest Europe, 2020; Figure 16). Within each study area C stock generally increased from managed to unmanaged stands, even if there wasn't necessarily an increase from set-aside to long-untouched or primary forests. Primary forests, where present,

showed the highest amounts of carbon (Table 1). Kalkalpen NP (Austria) was the only study area where managed forests showed higher biomass than unmanaged ones, suggesting the present of important differences in local fertility between managed sites and set-aside ones. Romanian forests and Krokar in Slovenia were the forests with highest C stock in living and dead trees (300-350 MgC/ha; Table 5).
Dead biomass represented on average 11.4% of overall tree biomass (living + dead) but showed highly different values according to the naturalness degree. In general, the share of dead biomass increased by 50-100% from managed to unmanaged stands. The minimum values were measured in managed stands (0-2%), and the maximum in the Slovak primary forest (42%) or the Romanian managed stand (37%). Similarly to living biomass, there was not necessarily an increased from set-aside or long-untouched to primary forests within the same study area.

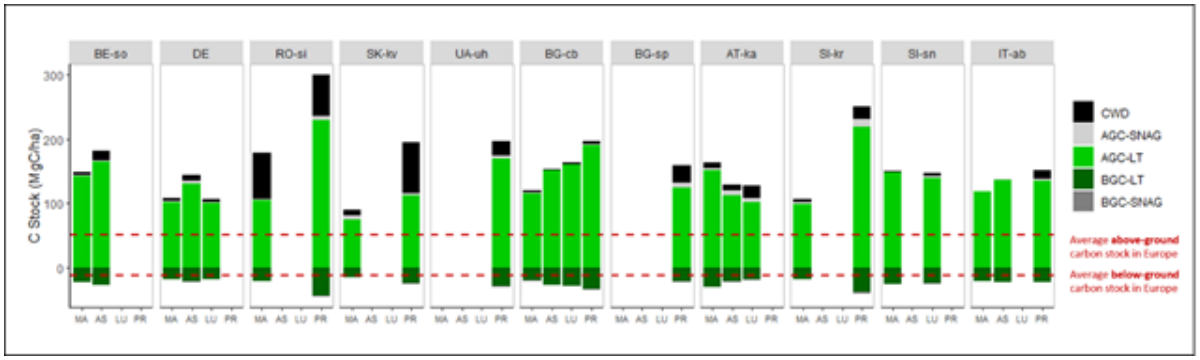


Figure 16: Aboveground and Belowground C Stocks in living and dead trees from forests with different naturalness in each study area (MA: Managed; AS: Set-Aside; LU: Long-Untouched; PR: Primary). Dotted red line: average C stock in European forests from Forest Europe (2020).

In study areas with soil samples (Belgium, Germany, Slovakia, Austria, Italy), Soil Organic Carbon in layers 0-30 cm (SOC30) accounted on average for 32.6% of the tree (living + dead) biomass (Figure 17, Table 5). However, values varied greatly among study areas: from 15-20% in central Europe (Belgium, Germany) to 61% in Italy. Such big differences could be related to soil type and chemistry, besides past management activities.
Overall forest C stock including soil (down to 30 cm) varied greatly among study areas (Table 5). Importantly, adding SOC 0-30 cm increased site stock by minimum 60-70 MgC/ha up to a more than 200 MgC/ha. The biggest increases were observed in primary forests.
Given the large differences in biomass per site, we used relative figures to compare how within-area biomass changes according to past management (Table 5). In general, there was an increase in biomass (living + dead) from recently managed to set-aside stands (+20-30%), even if the passage from set-aside to long-untouched didn't necessarily provide increases in biomass: the increase was clear especially in Bulgaria, but in most cases the increase was null or only slight (e.g. Germany, Slovenia). However, when present, primary forest provided 60-130% increases in biomass compared to managed stands (Table 5). Kalkalpen NP (Austria) as already mentioned, represented an exception to these figures, having the highest values in managed stands probably for local fertility, and the smallest in long-untouched forests.

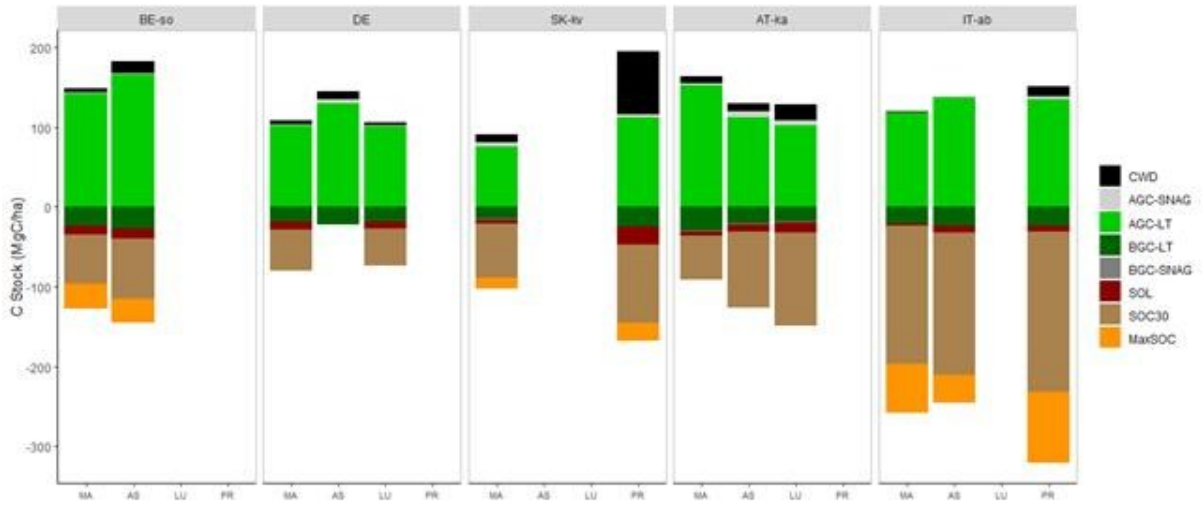


Figure 17: Overall Carbon Stock (Aboveground and Belowground Carbon in Living and Dead Trees, Soil). MA: Managed; AS: Set-Aside; LU: Long-Untouched; PR: Primary.

Table 5: Average Carbon Stocks per study area and naturalness degree in (a) Living and Dead Biomass (b) Biomass + SOC 0-30 cm and (c) Biomass + SOC 0 to maximum available depth. MA: Managed; AS: Set-Aside; LU: Long-Untouched; PR: Primary.

(a)

	MA (MgC/ha)	AS (MgC/ha)	LU (MgC/ha)	PR (MgC/ha)	ΔAS (%)	ΔLU (%)	ΔPR (%)
BE-so	171.5	209.5			22.2		
DE	127.2	166.9	124.5		31.2	-2.1	
RO-si	199.7			344.8			72.7
SK-kv	106.0			220.8			108.3
UA-uh				225.9			
BG-cb	141.3	180.9	192.9	231.6	28.0	36.5	63.9
BG-sp				181.3			
AT-ka	194.9	152	148		-22.0	-24.1	
SI-kr	125.7			291.8			132.1
SI-sn	176.4		172.7			-2.1	
IT-ab	139.7	161.9		175.1	15.9		25.3

(b)

	MA (MgC/ha)	AS (MgC/ha)	LU (MgC/ha)	PR (MgC/ha)	ΔAS (%)	ΔLU (%)	ΔPR (%)
BE-so	244.9	297.2			21.4		
DE	188.4		180.1			-4.4	
SK-kv	179.0			340.3			90.1
AT-ka	255.1	255.1	276.8		0.0	8.5	
IT-ab	315.7	349.0		383.2	10.5		21.4

(c)

	MA (MgC/ha)	AS (MgC/ha)	LU (MgC/ha)	PR (MgC/ha)	ΔAS (%)	ΔLU (%)	ΔPR (%)
BE-so	276.2	327			18.4		
IT-ab	376.7	384.4		472	2.0		25.3

Soil Depth distribution of Organic Carbon

In two sites (Sonian Forest, BE, and Abruzzo NP, IT) the soil sampling effort allow to reach the maximum soil depth available locally (but ≤ 100 cm). Given that soil depth varied greatly within-site, we compared how much the overall SOC distributed along different depths in primary and formerly managed stands (Figure 17).
Sampling soils beyond 0-30 cm allowed to add important amounts of carbon to the overall C stock of each site, i.e. +30 MgC/ha in Belgium and +40-80 MgC/ha in Italy (Table 5).
When analysing how C distributed among different soil depths, no differences were found in Belgium forests, but in Italy there was especially a difference in distribution in deeper soil samples (0-100 m), with an even C distribution in primary forest soils compared to formerly managed ones (Figure 17).

Within-Site Variability in Carbon Stocks: Tree Community and Soil
C stocks within each forest pool were highly variable among the plots sampled at each forest, showing strong effects of within-site ecological variability on local biomass and soil. However, the statistical sampling implemented in most study sites helped to cover large part of this variability and represent it to numerous sampling plots.

Scientific Paper on Carbon ESS

Using compiled aboveground and belowground carbon stock data, a scientific paper has been drafted. The manuscript of this paper can be found in Annex **Error! Reference source not found.**. The amount of data collected regarding forest distribution in different carbon pools will probably allow the development of at least another paper, in the future.

Modifications and difficulties

Adaption of the timetable: The action will not be finalized until the first quarter of 2021 but instead continue until mid-2023. This is due to the supervision of the outcomes and data of the field works in summer 2022, which is also part of action 2.02 (see description of action 2.05).
Given the situation in Ukraine, the sampling in the sites located over there was cancelled.
Although similar sampling schemes were available or shared for different study sites, major difficulties were encountered during data analysis due to the persistence of differences in basic standards used during filed surveys, especially: (a) minimum diameter used for sampling living or dead trees (e.g. 7, 10 or 20 cm), (b) method used to quantify necromass (i.e. full sampling, line intersect, other methods), (c) soil sampling (one mini-pit or multiple soil cores). Regarding (a), it was solved by adopting larger diameter thresholds, which especially for snags (minimum shared DBH = 20 cm) implied losing an interesting number of smaller elements useful to describe site features. For (b), it was possible to compare sites, although line intersect method provided less data resolution than full sampling to further understand plot-level dynamics. Regarding soil data (c), there were no particular problems except than developing different sample management and data elaboration approaches.

Output

Milestone	Responsible partner	Deadline	Actual completion
Literature review analysed	UNIT	31/12/2021	31/12/2021
Field protocol ready	UNIT	31/12/2021	01/04/2022

Deliverable	Responsible partner	Deadline	Actual completion
Literature Review Report	UNIT	31/12/2021	31/12/2021
Methodology report		01/04/2022	

A.2.03 Assessing the influence of forest management on biodiversity

Status	Completed		
Responsible	UNITUS		
Partners	CULS		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/03/2022	**Actual end date/anticipated end date**	31/03/2022

Conducted Activities

Activity	Description	Partners
Literature analysis of biodiversity of beech forests	European literature analysis on biodiversity and the linkage of rare species to specific microhabitats and structures of the OGF will give insight into the important microhabitats and key structures in beech forests that indicate high biodiversity, the threshold quantities of these microhabitats and key structures to maintain a typical beech forest species biodiversity, and what species indicate the existence and long-term continuity of primary and old-growth structures of the forest stand.	UNITUS & CULS
Development of standardized field protocol	Based on the literature analysis, a list of structural indicators and microhabitats will be developed and implemented in a standardized field protocol and survey setup. This protocol will be applied for all test sites, to provide adequate data for the ESSs assessment.	UNITUS & CULS, ECO
Field Test of Field Protocol (together with Action A1.21, A2.02, A2.05)	The jointly developed field protocol for OGF and ESS field data acquisition was tested in the National Park Kalkalpen.	E.C.O., INBO, NW FVA, UNITUS
Mapping and data harvesting (within task 2.05)	The mapping of all eco-system services started in the summer of 2022	All partners
Technical Workshop on soil samples (together with Action A2.05)	Expert meeting in National Park Kellerwald to discuss and further develop the soil carbon assessment (19.9.2022)	E.C.O., INBO, NW FVA, UNITUS,

Description of the action and progress

Literature review and methods

The methodology of the biodiversity assessment through structural parameters like dead wood and Tree-Microhabitats (TREM) was harmonized and further developed within spring 2022 and led to the joint field mapping protocol covering all indicator assessments for Actions A1.21, A2.02 and A2.03).

Data collection

Fieldwork for the biodiversity assessment was conducted in parallel with old-growth forest indicator mapping at the following sites in 2022: Kalkalpen NP (AT), Sonian Forest (BE), Abruzzo NP (IT), Snežnik (SI), Krokar (SI), Central Balkan NP (BG), and Kellerwald/Edersee NP (DE). Due to the war in Ukraine, field data could not be collected for Chornohora; these data were substituted with WSL (Switzerland) datasets for Uholka NP.

The biodiversity assessment of the indicators of living and dead biomass, vertical and horizontal structure and tree microhabitats was also implemented within the field data acquisition of Action 2.05.

Data analysis
An **Index of Biodiversity Potential (IBP)** was calculated using structural attributes (tree richness, canopy layers, deadwood, TreMs, very large trees) with scoring schemes adapted for large-scale comparability. Analytical methods included:

- Non-metric multidimensional scaling (NMDS) to explore structural heterogeneity and its relation to climate, topography, and management variables,
- Bayesian hierarchical models to assess the influence of environmental and management factors on IBP, accounting for site-level variability.

Statistical analyses were conducted in R, using the vegan package for ordination, brms for Bayesian modelling, and ggplot2 for visualization. This integrative approach enabled a systematic assessment of structural complexity and biodiversity potential, linking field inventories with advanced statistical modelling. A scientific paper based on these results is finalized and ready for submission. The manuscript of this paper can be found in Annexe **Error! Reference source not found.**.

Output

Milestone	Responsible partner	Deadline	Actual completion
Field protocol ready	UNITUS	31/12/2021	01/04/2022

Deliverable	Responsible partner	Deadline	Actual completion
Literature review report	UNITUS	31/12/2021	31/12/2021
Methodology report	UNITUS	31/03/2022	Update 18.02.2023

A.2.04 Assessing the influence of forest management on recreation and tourism

Status	Finalized		
Responsible	ECO		
Partners	CBRE, NPKA, NPAB, SOFO		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/03/2022	**Actual end date/anticipated end date**	31/12/2022

Conducted Activities

Activity	Description	Partners
Mapping and data harvesting guideline	A guideline explaining the questionnaire, how it should be communicated, who should do the interviews and how the data collected during the interviews shall be analysed and put into the provided database for submission to the lead partner for further analyses	ECO
Development protocols and questionnaires	Questionnaires in all languages have been developed, randomized and sent to all partners conducting interviews in their protected area	ECO
Interviews	With the questionnaire, interviews have been conducted with visitors in the old-growth forest regions on three locations (Sonian forest, Belgium; Abruzzo, Italy; Kalkalpen NP, Austria) in the summer of 2022	SOFO, NPAB, NPKA

Description of the action and progress

To assess the influence of forest management on recreation and tourism, a literature review took place and served as a basis for the development of a proper methodology (see methodology report annexed to the Midterm report). According to the literature review, a questionnaire has been developed which has been translated into all languages and used for interviews in all participating protected areas. The questionnaire serves as the basis for the monetary calculation of the ecosystem service recreation and tourism (see Action A.2.05).

In the first year of the project,

- an online survey took place to understand the possibilities and existing structures in the protected areas involved in the collection of data on tourism and recreation,
- the questionnaire was developed together with experts from the Technical University in Vienna and according to the online survey,
- a draft version of the guideline for collecting the base data was developed and discussed with the involved partners in a workshop in March 2022.

Both, the draft questionnaire and the draft guideline were presented at the Kick-Off Meeting of the project in Brussels, in November 2021.

In the second year of the project,

- the questionnaire was finalized, translated, and submitted to all interviewing partners. The English version was annexed to the Midterm Report.
- the guideline for the collection of the base data, the conduction of the interviews and the input of the answers into a database was finalized and submitted to all interviewing partners,
- several meetings took place to discuss the questionnaires, present the guideline and ensure a common approach to conducting the interviews,

- a methodology report was created and annexed to the Midterm Report.

Online survey

The online survey took place in May/June 2021 and dealt with the existing data about recreation &tourism in the protected areas/regions/countries participating in the survey (Kalkalpen National Park, Austria (NPKA), Sonian Forest, Belgium (SOFO), Abruzzo, Lazio and Molise National Park (NPAB) and Carpathian Biosphere Reserve, Ukraine (CBRE)),

- the possibilities and existing infrastructure to be used during the survey, which will take place in the four protected areas during summer 2022, and
- existing literature and research about ESSs, especially on recreation & tourism as well as touristic maps and infrastructure in the protected areas.

The outcomes of the survey were discussed with all partners individually, all collected material (literature, research data, tourism data etc.) was sifted and the most important outcomes were included during the development of the final questionnaire.

Questionnaire

The questionnaire that was used to conduct the interviews in 4 protected areas during the summer of 2022 was developed by E.C.O. in cooperation with the University of Vienna during November/December 2021. At the end of December 2021, a preliminary version was ready for review and discussion with the involved partners.

The questionnaire consists of

- Instructions for the interviewer and an introduction
- Basic information about the interviewee
- Questions on the visit and the visits to the forest in general
- Transportation used to come to the protected area.
- Preferences in landscape and infrastructure
- Scenarios (old growth/seminatural managed/moderately managed/intensively managed forest), their increase/decrease and the willingness to pay for it (randomized)
- Socioeconomic data

The questionnaire, its wording, and the used pictures and maps were discussed with all involved partners in several online meetings and feedback circles. The questionnaire was then finalized in English and translated (by the partners) into all necessary languages (German, Italian, Dutch, French, and Flemish).

After their finalization, the questionnaires were laid out for all partners and randomized (the amounts for the willingness to pay questions) and finally submitted to all partners at the end of May 2022.

Data Harvesting Guideline

In addition to the online meetings and briefings, a data harvesting guideline, giving information about the base data, the questionnaire and the conduction of interviews was developed. The guideline was submitted to all partners to ensure a common approach and results. The conduction of interviews started in June/July 2022 and ended in October 2022. A total of 670 questionnaires were collected—fewer than the planned 2,000—due to the complex nature of forest types and scenarios, which required intensive interviewer support.

Data analysis

The value of old-growth forests for recreation and tourism was assessed by TU Wien, subcontracted by the project, using the data collected with the questionnaires. Despite the limited sample size, TU Wien developed an appropriate methodology for data interpretation. A scientific article reporting the results has been drafted and submitted to the *Journal of Landscape and Urban Planning*; it is currently under review. A manuscript of the paper can be found in Annexe **Error! Reference source not found.**.

Modifications and difficulties

The protected areas in which the questionnaires were conducted vary highly, going from the Sonian forest, located a few kilometres from the centre of Brussels to secluded wilderness areas in the mountains, such as the Carpathian Biosphere Reserve in Ukraine. Therefore, the economic valorisation of the developed scenarios must be adapted accordingly. Also, the

number of visitors is rather different in the participating protected areas (about 2.000.000 per year in the Sonian Forest, about 100.000 in Kalkalpen National Park), therefore it was discussed with all partners how the total number of 2.000 answered questionnaires can be divided between the protected areas to still have a statistical reliable outcome (see methodology report for details).
Because of the ongoing war in Ukraine, it was not possible to identify catchment and/or test sites in the Carpathian Biosphere Reserve (Ukraine). Therefore, no finalized questionnaire could be developed for Ukraine.
Another issue in this action is the low number of answered questionnaires which could be collected, see Action A 2.05 for details.

Output

Milestone	Responsible partner	Deadline	Actual completion
Questionnaire ready	ECO	31/12/2021	31/12/2021

Deliverable	Responsible partner	Deadline	Actual completion
Methodology report	ECO	31/03/2022	31/12/2022

A.2.05 Collection and compilation of ecosystem information from test sites

Status	Completed		
Responsible	ECO		
Partners	NPKA, INBO, NPCB, CULS, UNIE, NW-FVA, UNITUS, UNIL, CBR		
Foreseen start date	01/01/2022	**Actual start date**	01/01/2021
Foreseen end date	31/12/2023	**Actual end date/anticipated end date**	28/02/2024

Conducted Activities

Activity	Description	Partners
Harmonisation of methodology for the collection of ecosystem services (A 2.01-A2.04) and needed types of data and structure of collected data	To harmonize the developed methodology for data harvesting with the needed types and structures of data from test sites, ECO discussed these issues with all partners involved in developing the methodology for the collection of information on ecosystem services from the test sites	ECO
Field Test of Field Protocol (together with Action A1.21, A2.02, A2.03)	The jointly developed field protocol for OGF and ESS field data acquisition was tested in the National Park Kalkalpen.	E.C.O., INBO, NW FVA, UNITUS
Mapping and data harvesting	The mapping of all ecosystem services started in summer 2022	All partners
Database creation	Creation of an Access-Database to store the field data for OGF and ESS assessment. Later on, the data was converted to Excel spreadsheets (INBO)	E.C.O., INBO
Technical Workshop on soil samples (together with Action A2.03)	Expert meeting in National Park Kellerwald to discuss and further develop the soil carbon assessment (19.9.2022)	E.C.O., INBO, NW FVA, UNITUS,
Field mapping performed according to the field protocol	INBO, UNITUS, ECO, NW-FVA, CULS, UNIL, NPCB	Field mapping during the summer season of 2022 and 2023

Description of the action and progress

The data collection for all ecosystem services commenced in the summer of 2022 and continued until the beginning of 2024. The methodologies developed under Actions A.2.01–A.2.04 were communicated to all partners to ensure a standardized approach across all sites.

Data collection dendrometrics for OGF indicators

Field teams. carried out the required measurements, or, where available, supplemented the dataset with recent data (maximum age: five years).

For five sites, measurements were conducted directly under the LIFE Prognoses project following the protocol of Kirchmeir et al. (2023, Action A.1.21): Abruzzo National Park (IT), Central Balkan National Park (BG), Kalkalpen National Park (AT), Krokar (SI), and Snežnik-Ždrocle (SI) (Table 2).

At sites with existing local monitoring programs, recent survey data were adapted to fit the structure of the LIFE Prognoses database. Where feasible, additional data were collected to complement the existing surveys, including:

- soil samples (Kellerwald National Park and Sonian Forest),
- additional plots in managed stands (Sonian Forest), and
- tree-related microhabitats (Sinca Forest and Sonian Forest).

The minimum plot radius was 10 m (see Table 2). Detailed information on plots and data collection procedures can be found in *Methods and Site Descriptions* (Vanhellemont, 2025). Field sampling of aboveground features (WP 1.21) was largely completed by the end of 2022.

Table 6: The number of plots, plot radius and data collected at each site. Plots lay in either managed (currently or up till 25 years ago) forest, forest that had been set aside for > 25 years, forest that had been untouched by management for > 75 years or in primary forest. The data comes from the Life Prognoses project (white background) or existing local monitoring (grey background). All sites have data on dendrometry, i.e., standing trees, lying deadwood, and tree microhabitats. Soil samples and tree cores for carbon determination have been collected in a subset of the sites.

	plot	no plots					data			
site	radius (m)	total	managed	set aside	long untouched	primary	origin [a]	year	soil [b]	wood [c]
Abruzzo NP	10 [d]	151	50	21	-	80	prognoses	2022	30	85
Central Balkan NP	10 [d]	120	17	41	16	46	prognoses	2022-23	-	54
Hainich NP	12.62	393	-	393	-	-	existing	2020-21	-	-
Kalkalpen NP	10 [d]	146	13	18	115	-	prognoses	2022 [f]	30	12
Kellerwald NP	12.62	979	895	-	84	-	existing	2018 [g]	19	-
Klenovský Vepor	21.85	14	7	-	-	7	existing	2019, 2022 [h]	14	-
Krokar	10	30	10	-	-	20	prognoses	2022	-	-
Sinca forest	[e]	20	8	-	-	12	existing	2023, 2024	-	-
Snežnik	10	30	9	-	21	-	prognoses	2022	-	-
Sonian forest	12	145	133	12	-	-	existing + prognoses	2020, 2023 [i]	30	104 [i]
Stara Planina	21.85	42	-	-	-	42	existing	2022	-	-
Uholka forest	12.62	238	-	-	-	238	existing	2019	-	-

[a] prognoses protocol: Kirchmeir et al. (2023); existing protocols: Meyer et al. (2021) for Hainich NP and Kellerwald NP, Petritan et al. (2015) and Braga et al. (2023) for Sinca forest, Stillhard et al. (2019) for Uholka forest, Vandekerkhove et al. (2021) for Sonian forest, Zemlerová et al. (2023) and Ralhan et al. (2024) for Klenovský Vepor and Stara Planina

[b] number of plots with soil samples

[c] number of trees cored

[d] radius of the plot in the field, corrected for slope afterwards

[e] square plots with side 35 m (primary) or 50 m (managed)

[f] soil samples collected in 2024

[g] soil samples collected in 2022

[h] 2019 for primary plots, 2022 for managed plots

[i] existing data from 2020; additional Life Prognoses data and plots in 2023

[i] wood cores from Verschuren et al. (2023, unpublished data)

Data collection for ESS

The collection of data for the ecosystem services carbon stock and biodiversity was conducted jointly with the data collection for the assessment of old-growth status and began in summer 2022. The specificities of the data collection for the respective ESS can be found under the descriptions for A.2.01 (microclimate), A.2.02 (Carbon), A.2.03 (Biodiversity) and A.2.04 (Tourism and recreation).

Modifications and difficulties

The timeline for this action left little room for unforeseen circumstances. Preparatory work began in 2021 to mitigate risks; however, several factors delayed field data collection, including adverse weather conditions and the war in Ukraine. A six-month project extension was granted to accommodate delays.

Specific challenges included:

- Chornohora (Ukraine): Fieldwork was impossible; WSL (Switzerland) data were used for Uholka NP instead.
- Klenovský Vepor (Slovakia): Additional soil data were integrated. Although located in the Carpathians, this site is not part of the UNESCO World Heritage Series.
- Sinca Forest (Romania): Samples were collected in 2023–2024. Methodology consistency ensured full integration into the LIFE Prognoses dataset.

Output

Milestone	Responsible partner	Deadline	Actual completion
Start of the data collection	ECO	01/04/2022	01/01/2024

Deliverable	Responsible partner	Deadline	Actual completion
Database ecosystem services delivered	ECO	31/12/2023	30/6/2025

After Life Perspectives

The datasets resulting from this field work are very valuable, for future scientific purposes. Several scientific papers based on the results of the fieldwork have already been published, and several others are being drafted or are currently under review.

All datasets from the project are published in a scientific repository (Zenodo). Some of them in open access, so immediately available for scientists, others (in particular the raw data) under restricted access (requiring a request towards the data manager, and agreement from the partners for delivery.

An overview of all datasets and where to find them has been compiled in a Data Management Plan, which is also published and easily retrievable from the INBO-website: Doi: https://pureportal.inbo.be/nl/publications/life-prognoses-data-management-plan-version-1

A.2.06 Calculation of the Ecosystem Services

Status	Completed		
Responsible	ECO		
Partners			
Foreseen start date	01/04/2022	**Actual start date**	01/01/2024
Foreseen end date	31/09/2023	**Actual end date/anticipated end date**	30/06/2025

Description of the action and progress

This work package focused on the analysis and quantification of ecosystem services (ESS)—microclimate regulation, carbon storage, biodiversity, and recreation & tourism—in old-growth and managed forests. In addition to ecological assessment, the project aimed to monetize the value of these ecosystem services.

Monetization of Ecosystem Services

A scientific report on the monetary valuation of ESS in old-growth forests has been prepared and can be found in Annexe **Error! Reference source not found.**.

The ESS analysis for microclimate aimed to evaluate the economic impact of climate-change-related damages in forest ecosystems (e.g., tree dieback, pest outbreaks, reduced regeneration due to drought) and the mitigation costs associated with temperature increases, such as irrigation in adjacent agricultural areas.

Modifications and difficulties

The timeline for this action was affected by the **delays in field data collection** caused by adverse weather and geopolitical issues. The start of the analysis was postponed to 2023, and the completion of scientific outputs and database delivery has been extended to mid-2025.

Output

Milestone	Responsible partner	Deadline	Actual completion
Analysis and quantification of ecosystem services ready	ECO	30/06/2024	30/6/2025
Submission of scientific papers	ECO	31/08/2024	30/6/2025

Deliverable	Responsible partner	Deadline	Actual completion
Database to be delivered	ECO	1/04/2024	30/6/2025

B.3.00 Project communication

Status	Completed		
Responsible	Caroline Celis		
Partners	SOFO		
Foreseen start date	01/07/2022	**Actual start date**	01/02/2021
Foreseen end date	31/06/2024	**Actual end date/anticipated end date**	30/06/2025

Conducted Activities

Activity	Description	Partners
Active Twitter account	Twitter account is active	SOFO
Active Instagram account	Instagram account is active	SOFO
Active Facebook account	Facebook account is active	SOFO
Project website is online.	Project website is active	SOFO
16 Newsletters have been sent.	16 Newsletters were sent	SOFO
8 Press articles have been sent	8 press articles were sent	SOFO, NPKA, CBRE

Description of the action and progress

Social media
The cumulative reach of all social media channels, including those of the LIFE Prognoses partners who shared news about the project (websites, Facebook, Instagram, YouTube), amounted to 724,733 people.

The project maintained a Facebook and Instagram page and a Twitter account, providing real-time information and enabling interactive engagement. Users could ask questions, provide comments, post pictures, and share experiences. Social media proved to be a cost-effective and interactive tool for involving the public, particularly local communities, announcing events, sharing newsletters, and collecting feedback. The accounts were launched within six months of the project start, and the hashtag #lifeprognoses was introduced to facilitate communication. By the end of the project, the accounts had 246 followers on Facebook and 166 on Twitter.

Project website

At the start of the project, an English-language website was created, including a translation tool. The website comprised five main sections:

- Project overview,
- Project partners,
- Detailed description of work packages,
- Documentation centre with expertise on European old-growth forests and ecosystem services,
- Outputs of the project.

The website incorporated a tool to collect all social media posts using the hashtag #lifeprognoses from Facebook, Twitter, and Instagram. The website is planned to remain online for five years after project completion. Following a hacking incident in July 2024, the website was converted from a dynamic WordPress site to a static website to enhance security. For this reason the documentation centre cannot be continued after the project implementation period: scientific findings change rapidly, and the static nature of the website will not allow for frequent updates of this information.

Newsletters

Each project year, four newsletters were sent to project partners, providing updates on ongoing activities, summaries of finalized actions, and information about upcoming work. Newsletters also informed partners in detail about expectations for monitoring visits, steering committees, and other communication and coordination-related activities.

Press releases

Existing contacts with local and national press were leveraged extensively. The project partner NPKA released six press releases in two local newspapers (OÖ Nachrichten and Bezirkszeitungen). CBRE published eleven press releases through the National Park newsletter, the Green Carpathians magazine, and regional and federal publications. Combined efforts of the project and partners reached a total of 1,193,086 people through press releases.

Modifications and difficulties

Following the hacking of the project website in July 2024, the website was converted from a dynamic to a static platform to ensure security and continuity of online communication.

Output

Milestone	Responsible partner	Deadline	Actual completion
Active Twitter account	SOFO	31/05/2021	31/07/2021
Active Instagram account	SOFO	31/05/2021	31/07/2021
Active Facebook account	SOFO	31/05/2021	31/05/2021
Project website is online.	SOFO	31/05/2021	31/05/2021
Contract videoclip	SOFO	01/01/2022	01/02/2022
16 Newsletters have been sent.	SOFO	31/12/2024	31/12/2024
8 Press articles have been sent	SOFO	31/12/2024	31/12/2024

Deliverable	Responsible partner	Deadline	Actual completion
Communication plan	SOFO	30/06/2021	30/06/2021

After LIFE Project Perspectives

Website will stay active 5 years after completion of project.

B.3.01 Development of a communication and awareness-raising strategy and implementation instruments

Status	Completed		
Responsible	CANG		
Partners	SOFO		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/06/2024	**Actual end date/anticipated end date**	31/06/2024

Conducted Activities

Activity	Partners	Description
Awareness-raising survey	CANG	An online questionnaire was developed and sent to all participating organizations as well as to all management authorities of the WHS Ancient and Primeval Beech Forests of the Carpathians and Other Regions of Europe. This is to collect the baseline data about the actual communication activities and formats
Development of the Inspiration Book for awareness raising	SOFO	From the answers to the survey several aspects in the development and implementation were identified that could benefit from support. With these objectives in mind an inspiration book was developed, including a literature review and a multitude of case studies and step-by-step plan for implementation.

Description of the action and progress

The survey was developed by CANG and distributed to the target audience on 22 October 2021. A total of 34 respondents from 31 organisations across 15 countries completed the questionnaire. The results were presented to project partners during the LIFE meeting in November 2021 and subsequently served as the primary data source for SOFO in developing the Inspiration Handbook.

The methodology proved appropriate and cost-efficient, enabling the collection of relevant information while ensuring an effective design, implementation, evaluation, and presentation of results. Participation was considered satisfactory, reflecting a broad spectrum of institutions involved in the management of World Heritage forests, including national parks, universities, state nature conservancies, ministries, municipalities, NGOs, public enterprises, and educational institutions. Notably, 15 of the 18 countries hosting World Heritage Beech Forests were represented.

The survey provided valuable insights into stakeholder expectations and needs, ensuring that the handbook's content aligned with practical demands. As a direct outcome, the Inspiration Handbook was developed, inviting all project partners and organisations included in the World Heritage Series Ancient and Primeval Beech Forests of the Carpathians and Other Regions in Europe to submit exemplary case studies of their awareness-raising activities for Europe-wide dissemination.

SOFO complemented the collected cases with a literature review on effective awareness-raising strategies, highlighting the factors that foster nature-positive behaviour and methods to evaluate the success of presented activities. Each case study was presented step-by-step to guide organisations in selecting and implementing suitable initiatives.

The handbook was highly successful, leading to the organisation of the awareness-raising webinar (B.3.03) and extending its influence beyond the project network. For instance, the USA Old-Growth Forest Network requested access to one of the showcased products, demonstrating its broader international relevance and potential for dissemination. The handbook can be found in Annexe **Error! Reference source not found.**.

Output

Deliverable	Responsible partner	Deadline	Actual completion
Guideline ready	CANG	30/09/2021	30/09/2021
Inspiration book	SOFO	30/09/2024	30/11/2023

B.3.02 Local and national awareness-raising

Status	Completed		
Responsible	ECO		
Partners	SOFO, NPKA, NPCB, CANG, NPAB, MESP, UL, CBRE		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/06/2024	**Actual end date/anticipated end date**	31/05/2025

Conducted Activities

Activity	Partners	Description
Organization of "European Day of the Primeval and OGFs"	SOFO	Activities for visitors during the Sonian Forest Day: guided tours, exhibitions, workshops, awareness-raising actions, children's animations.
Press releases (regional, national, federal)	CBRE, NPKA	3 press releases in CBRE's regional newsletter (~1.000 readers each) and 3 in the national magazine *Green Carpathians*. In 2022: 5 press releases at federal (454.000 readers) and regional level (145.000 readers each), plus 1 national article (331.000 readers).
Social media and websites	CBRE, NPCB	Regular updates on project progress published via social networks and partner websites.
Educational excursions (NPCB)	NPCB	6 bilingual excursions of different difficulty levels, presenting beech forests and ecosystem services. In 2022: 4 additional guided tours with >85 participants nationwide. Awareness materials produced (T-shirts, souvenirs).
Theatre show "Una Giornata Qualunque"	NPAB	3 performances in August 2021 in Villavallelonga, Civitella Alfedena, and Pescasseroli.
Information boards	All partners	On-site information panels in strategic locations, displaying the LIFE and Natura 2000 logos.
Educational excursions and tours (CANG)	CANG	Between 10/2022–11/2024: 5 excursions for local residents and 2 for specific target groups (focus on ESSs). Also developed 2 interactive info stands and held multiple stakeholder meetings.
5-day school programme	CANG	Educational programme on WH Beech Forest (Grumsin component) developed and published on CANG's website.
Local school–forest partnership	CANG	Concept and yearly programme developed with local schools and actors. Piloted in 2023/24 with 12 forest days; continued implementation in 2024/25.
Information stands at public events	CANG	Interactive stands presented at public events to raise awareness about WH Beech Forests and ESS.
Excursions for stakeholders, locals, visitors	NPAB	Excursion with the Italian Alpine Club (CAI) Castel di Sangro group, 12 June 2022.
Expert workshop (national level)	MESP/UL	Workshop on 22.11.2022 to inform national stakeholders about WHS and expand national forest reserve network.
Expert workshop (international level)	UL	International EuFoRIa researchers' workshop, 16–19.06.2025.
Excursion tour (UA, EN)	CBRE	5 excursion programmes developed in Ukrainian and translated into English.
Educational meetings with local communities	CBRE	2 meetings with local authorities (April and June 2022).

Description of the action and progress

SOFO: Organization of "European Day of the Primaeval and OGFs"

The Day of the Sonian Forest was first held on 17 October 2021 with the contribution of 70 partners, including 6 municipalities and 3 regions, alongside 16 forestry representatives. Together, 65 diverse activities—guided tours, exhibitions, workshops, awareness-raising

sessions, children's events, and sports activities such as cycle tours and horse-riding—were offered at 7 gateways to the forest. A total of 140 facilitators welcomed visitors, guided activities, answered questions, and provided information about the UNESCO WHS and the LIFE project. The combination of interactive experiences, direct contact with rangers and managers, and tailored programmes for different audiences fostered awareness of ecosystem services and forest protection.

In 2022, the concept was repeated with even greater impact. A total of 58 partners and more than 150 staff contributed to 86 activities, supported by 7 municipalities and 3 regions. Activities included nature walks, exclusive tours, exhibitions, children's activities, a UNESCO bike ride, and local food experiences. Panels informing visitors about the WHS and the LIFE project were also installed at forest entry points. These days created valuable opportunities to engage diverse groups in forest appreciation and responsible use. Also in 2023 and 2024 the activity was repeated, each time with a focus on another special aspect of the forest. The visited themes were the importance of cooperation and commitment of the multiple visitors and 'users' of the forest to its conservation status (2021 & 2022), the natural world heritage in the forest and its old-growth character (2023), and the forest as a hotspot of specialized biodiversity (2024). The activity will be continued after the project completion.

NPCB: Educational Excursions
In July 2021, the Park Directorate announced three guided excursions of different difficulty levels (low, medium, high) on its website, supported by bilingual participation forms. A total of 53 applications were received, representing 75 participants. Selection was based on preferences, experience, and group requests. Between August and September 2021, three excursions were conducted:

- Medium-level route (28 participants): Kordela–Kostina, including interpretive talks, games, and information on WH beech forests, biodiversity, and forest management. Participants received lunch packs, T-shirts, souvenirs, and brochures.
- Low-level route (25 participants): Vidimsko Praskalo eco-trail.
- High-level route (15 participants): Panitsite–Ray chalet.

In 2022, four additional guided tours were organised, engaging more than 85 participants nationwide. Advertising materials included 460 T-shirts and 496 magnetic souvenirs. Across both years, participants deepened their understanding of biodiversity, WH significance, and protected areas as instruments of nature conservation.

NPAB: Theatre Show "Una Giornata Qualunque"
In August 2021, three performances of the theatre production Una Giornata Qualunque were staged in Villavallelonga, Civitella Alfedena, and Pescasseroli. The narrative depicted the dependence of everyday human life on ecosystem services, with a special focus on forests and old growth. Despite the complexity of the theme, the theatre company successfully communicated its importance through emotion and storytelling. The show was streamed live on Facebook, widening its reach beyond in-person audiences.

CANG: Educational Excursions
From October 2022 to November 2024, CANG organised five excursions for local residents and two tours for specific professional groups in the WH component part Grumsin and Angermünde city forest. Target audiences included:

- elementary school children (holiday programmes in 2022 and 2024),
- staff of the sheltered workshop Uckermärkische Werkstätten,
- members of Angermünde's youth council,
- administrative staff of the city, and
- staff of kindergartens and after-school care centres.

Educational methods included a pantomime game on ecosystem services and a structured forest project day led by a forest pedagogue. Excursions were co-organised with the Biosphere Reserve ranger service and certified nature and landscape guides.

CANG also created two interactive information stands, presented at public events such as the city festival and children's day, featuring games developed with UNESCO educators.

Complementary communication included annual stakeholder letters, web updates, presentations to national authorities, and materials on WH beech forests.



Figure 18: Educational excursion for children and for youth council.



Figure 19: Cards developed for pantomime game of ESSs of the OGFs:

The specific target groups of the educational tours implementing the marketing and communication concept of CANG regarding the WH were (1) administrative staff of the city of Angermünde and (2) staff of kindergartens and after-school care centres.

The excursions and tours were implemented in cooperation with the local ranger service (Naturwacht) of the Biosphere Reserve Schorfheide-Chorin as experts on education for sustainable development as well as in cooperation with the certified nature and landscape guides for the World Heritage Beech Forest Grumsin.

Additionally CANG elaborated 2 information stands about the WH Beech forest and the educational offers were offered at the children´s day to inform teachers and at the city festival of Angermünde with a special game developed by an UNESCO-teamer engaged.







Figure 20: Information stands at City Festival and Children's Day

Further during the project lifespan CANG invested into diverse communication activities: informed the stakeholder group via yearly information letters, published information regularly in the website, contributed to the local working group of WH education of component part `Grumsin`, initiated a meeting with the German Steering Group of the WH, presented the project at a meeting of the Federal Ministry for Europe and Finances and produced information material for public awareness.

CANG: Five-Day School Programme

CANG developed and published a structured five-day school programme linked to the WH Grumsin forest: Angermünde

Activities were prepared in collaboration with the local education working group, which provided daily modules. A dedicated handout on WH educational offers was printed and distributed for the first time: Flyer_Grumsin_2024.cdr

CANG: School–Forest Partnership

In cooperation with a local elementary school and regional education actors, CANG designed a long-term partnership model with a yearly programme of 12 forest days: Concept_local_school_forest_partnership_annual_programme.pdf

Piloted in 2023/2024, the programme was evaluated and confirmed for continuation in 2024/2025 and beyond the LIFE project lifespan.

NPAB: Development of Excursions

On 12 June 2022, NPAB organised an excursion in collaboration with Club Alpino Italiano (CAI) Castel di Sangro group. As Italy's oldest and largest hiking association with over 300,000 members, CAI promotes hiking, eco-tourism, and nature conservation, offering a valuable multiplier for outreach.

MESP/UL: National Expert Workshops

Two national expert workshops were held in Slovenia.

2022 November 2022: 40 participants (ministries, NGOs, researchers) attended 10 presentations and engaged in debate on expanding the national reserve network.

2023 workshop: 36 participants and 15 students attended 8 presentations and discussions, leading to a consensus on identifying and protecting additional old-growth areas.

Both workshops fostered multi-stakeholder dialogue and built momentum for policy development.

MESP/UL: International Expert Workshop

From 16–19 June 2025, UL hosted an international workshop with 35 researchers from the EuFoRIa (European Forest Reserves Initiative) network. Participants shared long-term monitoring results on forest dynamics, visited a WH component site, and disseminated LIFE project findings across Europe.

Modifications and difficulties

ECO: Given the large number of partners and activities, maintaining coordination and knowledge exchange is critical. To address this, two common meetings per year are organised throughout the project, serving as networking platforms. for planning, sharing experiences, and aligning awareness-raising actions.

SOFO: Reaching a broad and diverse public in an accessible way remains a challenge. Collaboration with municipalities has proven effective, but further engagement of sports associations and youth groups is planned for upcoming editions. A feedback mechanism with participants has been established to refine the event handbook. In 2022, the handbook was successfully tested, requiring only minor layout adjustments for future use.

In 2022 we used the handbook as a base to organize this year's edition and had some feedback moments with the participants. We can now conclude the handbook is ok. We just need to adapt some layout issues.

CANG: For long-term impact, ecosystem services communication must be integrated into the daily activities of local rangers and environmental educators. As CANG has no authority over these actors, cooperation is key. Jointly delivered activities, such as excursions and educational games, increase the likelihood of continued implementation beyond the project's lifespan. To strengthen this effect, CANG is also developing a dedicated environmental education project within the city administration, given the limited capacities of other local actors.

Output

Deliverable	Responsible partner	Deadline	Actual completion
Information boards installed	ECO	31/12/2023	31/12/2023
All communication activities implemented	ECO	31/08/2024	31/05/2025

Complementary actions outside LIFE

NPAB will launch the film *Una Millenaria storia di battiti* ("A Millenary Story of Heartbeats"), a documentary that highlights the interconnection between humans and the old-growth beech forests.

CANG has been particularly active in broadening the outreach of World Heritage Forest education. It launched the first dedicated website for the Grumsin component part, which not only introduced the site to a wider public but also made educational offers digitally accessible for the first time. In parallel, CANG developed a forest classroom in the city forest of Angermünde under another project. This infrastructure provides a permanent space for environmental education activities, ensuring that awareness-raising and learning about ecosystem services can continue sustainably beyond LIFE PROGNOSES.

After LIFE Project Perspectives

Most of the Prognoses partners are committed to continue their awareness-raising activities beyond the project implementation time. For example, SOFO continues the yearly organisation of the day of the Sonian Forest and NPCB continues its excursions. Other ways of continuation and amplification have also been secured: CANG created and implemented an additional educational programme for multipliers, specifically targeting teachers, guides, and other professionals involved in nature interpretation. By equipping these actors with tailored materials and training, the programme multiplies the impact of LIFE activities and fosters long-term integration of forest-related education into local institutions.

B.3.03 European awareness-raising

Status	Completed		
Responsible	SOFO		
Partners	ECO, CULS, UNIE, NW-FVA, UNITUS, MESP, UL		
Foreseen start date	01/01/2021	**Actual start date**	01/01/2021
Foreseen end date	31/06/2024	**Actual end date/anticipated end date**	31/06/2025

Conducted Activities

Activity	Description	Partners	Reach / Participants
Video Film	Developed a video showing the value of OGFs and how individuals can contribute to their protection. Translated into 9 languages (CZ, NL, FR, EN, DE, IT, SK, SL, UA) and shared via YouTube, Facebook, Instagram, and beneficiaries' websites.	SOFO & all beneficiaries	~5,000 people reached; 132 recorded views across languages
Webinar 1 + Stakeholder meeting: awareness raising	Based on the findings from the survey and the Inspiration Handbook, an online workshop was organised about awareness raising. The Life Prognoses partners NPCB, SOFO, and NPAB presented a case study of one of their activities.	SOFO, NPCB, NPAB	27
Webinar 2: scientific progress	Scientific results communicated at academic conferences and webinars in 6 European regions + Canada.	SOFO & all beneficiaries	Not quantified (multiple occasions)
Webinar 3: scientific results	Co-hosted with EUROPARC on 3 June 2025; focused on scientific results of LIFE PROGNOSES. Recorded for dissemination.	SOFO & all beneficiaries	267 participants
European Conference, Brussels	Presented four years of research on old-growth beech forests, their ecosystem services, and protection methods. Integrated science, policy, and practice. Panel discussion with external discutants.	SOFO & all beneficiaries	38 participants
Policy Brief 1	Summary of the Panel Discussion of the European Conference about the Science-Policy Interface for old-growth forest protection.	SOFO, UNIL	Disseminated among participants and network of world heritage series: 38 + people reached
High-Level Stakeholder Meeting, IUCN Bruges	Thematic session *"Bridging Science and Policy for the Protection of Europe's Old-Growth Forests"*. Presentations and field excursion to Sonian Forest.	SOFO & all beneficiaries	26 participants (session) + 42 participants (excursion)
Policy Brief 2	Developed *"Identification, Mapping and Protection of European Old-Growth Forests"* to inform policy-makers and conservation practitioners.	SOFO & all beneficiaries	Distributed to European policy-makers and stakeholders

Description of the action and progress

Video clip

A video film for a broad public was developed with the help of all partners in the reviewing and translation process. The video aims. to sensibilize the visitors by showing the unique value of OGFs and emphasizing how individuals can contribute to their protection. The video was translated into 9 different languages (Czech, Dutch, French, English, German, Italian, Slovakian,

Slovenian and Ukrainian). The video film is available on YouTube[3] The aim of this video was to reach 5.000 people. The video clip has 132 views in YouTube: Czech (54), Dutch (31), French (46), English (150), German (100), Italian (31, Slovakian (3) Slovenian (13) and Ukrainian (4). Most projections were done for a public. If we estimate an average public of 40 people, the target for this activity was reached.

Webinar 1 & stakeholder meeting: Online awareness-raising workshop
A webinar was organised for and by awareness raising experts, mainly from national parks across Europe. Three Prognoses partners (NPAB, CANG, and NPCB) presented a case study of an awareness raising activity. In a second part of the workshop, the participants discussed actual and relevant themes regarding awareness raising in smaller groups. Their ideas were gathered in a Padlet session by the moderators of the groups. The discussed themes were the significance of target groups, how to achieve stakeholder engagement, and the challenges and opportunities of the digital age for awareness raising.

Webinar 2: substituted for dissemination at scientific conferences
On at least 9 occasions—mostly academic conferences—the scientific insights of the project were communicated to fellow scientists. Audiences in at least 6 different countries were reached, covering the mediterranean, Atlantic, continental, alpine, and boreal European regions, as well as North America (Canada).

Table 7: Overview of the presentations given about the results of the Life Prognoses project in a scientific context.

Title and occasion of the presentation	Involved partner
Waldmonitoring im Nationalpark Kalkalpen '. LTSER Plattform Eisenwurzen Vernetzungstreffen. Manuela Hirschmugl. Online. 01.06.2021. (No. of attendees: ~ 25)	JORE
'Potential and Challenges for GI Sciences in the context of Long-Term Ecosystem, critical zone and socio-ecological Research (eLTER)'. Manuela Hirschmugl. GI_Salzburg22, Salzburg, 5.7.2022. (No. of attendees: ~ 50)	JORE
'Assessment of potential old-growth Beech Forests in the Kalkalpen National Park by Means of Remote Sensing'. Manuela Hirschmugl. Presentation at LTER conference, Wien. 11.11.2022. (No. of attendees: ~ 35)	JORE
"Structure and Change: Some Insights in Current Remote Sensing-based Forest Monitoring Trends in Europe". Manuela Hirschmugl. UBC Lunch Seminar Series, Vancouver, BC, Canada, 14.02.2023. (No. of attendees: ~ 70)	JORE
'Conservation strategies for large old trees to promote natural forest restoration and climate-change mitigation'. Alfredo Di Filippo. IBC XX International Botanical Congress 2024, Madrid, Spain. 21.07.2024-27.07.2024.	UNIT
'A Method to Assess the Level of 'Old-Growthness' in European Beech Forests: Results from a Network of World Heritage Beech Forests'. Kris Vandekerkhove. Poster presentation. IUFRO World Congress, Stockholm, Sweden. 23-29.06.2024.	INBO
'Potential Carbon Accumulation in European Forests: insights from a network of old-growth beech forests covering widely different environmental conditions within the UNESCO World Heritage Site 1133'. Poster presentation. Alfredo Di Filippo. IUFRO World Congress, Stockholm, Sweden. 23-29.06.2024.	UNIT
'Changes in carbon accumulation, tree microhabitats, structural complexity according to naturalness degree and environmental gradients in old-growth beech forests in Italy'. Alfredo Di Filippo. IUFRO World Congress, Stockholm; Sweden. 23-29.06.2024.	UNIT
Presentations on the topic old-growth and the scientific findings of Life Prognoses during workshops and courses for practitioners and stakeholders.	NW-FVA

[3] https://www.youtube.com/@lifeprognosesproject3338

Webinar 3: Joint Webinar with Europarc Federation - Characteristics, ecosystem services and protection of European old-growth beech forests - Insights from the pan-European research project Life Prognoses

On June 3rd, 2025, the LIFE Prognoses partners cohosted a scientific webinar with the Europarc Federation. Participants had the opportunity to gain deeper insights into the scientific work and results of the LIFE Prognoses project. The session featured expert presentations by:

Kris Vandekerkhove – Senior Researcher in forest ecology and forest management at the Institute for Nature and Forest Research (INBO), Belgium

Peter Meyer – Head of the Forest Ecosystem Conservation Department at the Northwest German Forest Research Institute

Manuela Hirschmugl – Researcher at the University of Graz and JOANNEUM RESEARCH, Austria

Klaus Steinbauer – Senior Researcher on Sustainable Management of Conservation Areas at the UNESCO Chair and the Institute of Ecology (ECO), Austria

These presentations offered valuable perspectives on defining, assessing, and monitoring old-growth and primary beech forests across Europe.

European conference in In Brussels 2/10/24

The final conference of the Life Prognoses was project was titled 'Characteristics and Ecosystem Services of European Old-Growth Beech Forests' brought together leading scientists, policy-makers at the European level, and national experts in the field of forest management and conservation.
During this conference, we presented results of four years of research into the characteristics of old-growth beech forests in Europe, their ecosystem services (recreational assets, carbon stock and biodiversity), and the methods to identify and delineate the forests that can be defined as 'old-growth' at the European level. We also discussed the implementation of old-growth forest protection with EU policy-makers, regional field managers and other stakeholders. The conference contributed to a critical understanding of old-growth forest protection in Europe by integrating science, policy, and practice.



The following topics were presented:

'What is an old-growth forest? Towards a Europe-wide definition of "old-growth"'. Kris Vandekerkhove (INBO).

'Identifying European old-growth forests based on field data: The old-growth indicator'. Peter Meyer (NW-FWA).

'Identifying European old-growth forests with remote sensing techniques'. Manuela Hirschmugl (JORE).

'Carbon stock and sequestration in European old-growth forests. Alfredo Di Filippo (UNITUS).

'Tree-related microhabitats in European old-growth forests: a proxy for biodiversity?'. Hanns Kirchmeir (ECO).

'The significance of European old-growth forests for recreation and tourism'. Hanns Kirchmeir (ECO).

Policy brief 1: Summary of the Panel Discussion Final Conference LIFE Prognoses
The first policy brief was substituted by the summary of the report about the panel discussion organised during the final conference. This panel discussion connected science, policy and on the ground implementation by bringing together experts from all three fields to discuss questions regarding old-growth forest protection in Europe. The panel discussion was moderated by Prognoses partner UNIL, the participants came from the European Forest Institute, DG-Environment, the JRC, NW-FVA, and service Publique de Wallonie. The resulting summary can be found in Annexe **Error! Reference source not found.**.

High level stakeholder meeting 30.09.2024 & 03.10.2024

From 30.09.2024 to 03.10.2025, IUCN held its regional conference for Europe, North and Central Asia in Bruges (Belgium). We applied for hosting a thematic session and a field trip with the LIFE Prognoses partners for the participants of this meeting. Our proposals were selected: on 30.09.2024, we hosted the thematic session 'Life Prognoses: Bridging Science and Policy for the Protection of Europe's Old-Growth Forests' in the BMCC in Bruges (Conference building). Presentations were done by. Alfredo Di Filippo, Caroline Celis, Hanns Kirchmeir, Kris Vandekerkhove & Manuela Hirschmugl. (No of attendees: 26).

Moreover, we organised an excursion to the Sonian Forest, Brussels, for the participants of the IUCN regional meeting on 03.10.2024. During the excursion, multiple presentations were given by the Prognoses partners concerning old-growth indicators and awareness-raising. (No of attendees: 42)



Policy Brief 2
A Policy brief "Identification, Mapping and Protection of European Old-Growth Forests" was developed based on the scientific findings and developments of the project. The policy brief was presented to Mr. Tistan of DG-ENV for feedback and will be published on Knowledge for Policy webpage of the EC. The document can be found in Annexe **Error! Reference source not found.**.

Modifications and difficulties

Video clip

The estimated prices of some of the production houses under consideration were received only in the second half of January 2022. Therefore, a final decision was only made by the beginning of February 2022. This delay had no impact on the deadline for the finalization of the video.

Webinars

Instead of three webinars, one per European region (West, Central and East), all webinars have been organised at (total) European level. The first webinar concerned an awareness-raising workshop, the second webinar was substituted by dissemination at scientific conferences, and the third webinar about the scientific research and results was realized in cooperation with Europarc, ensuring a broad European reach.

High level stakeholder meeting

As the IUCN Regional Meeting 2024 was organised in Bruges, with the opportunity for external organisations to be selected for a side-event and hosting an excursion, the Final Conference of Life Prognoses was organised in Bruges too. The foreseen high-level stakeholder meeting

was implemented as a side-event to the IUCN Regional Meeting and an excursion to the Sonian Forest.[4]

Output

Milestone	Responsible partner	Deadline	Actual completion
Start contract for video clip	SOFO	01/01/2022	01/02/2022
Video clip uploaded on video-sharing platforms. (YouTube, Vimeo...) and social media	SOFO	01/06/2022	1/06/2022
Video clip shared with 5000 people	SOFO	30/11/2023	30/11/2023
Stakeholder meeting: awareness raising	SOFO	30/09/2023	31/11/2023
Webinar 1: awareness raising	SOFO	31/03/2024	31/11/2023
Webinar 2: participation scientific conferences	All scientific partners	30/04/2024	30/06/2025
Webinar 3: Europarc federation	SOFO	31/05/2024	3/06/2025
Final conference in Bruges (Belgium)	SOFO	31/10/2024	2/10/2024
High level stakeholder meeting: IUCN regional meeting	SOFO	31/10/2024	30/09/2024

Deliverable	Responsible partner	Deadline	Actual completion
Video clip	SOFO	30/11/2023	30/03/2022
Policy brief 1.	SOFO	30/11/2023	30/11/2024
Policy Brief 2	SOFO	31/03/2024	30/06/2025

After LIFE Project Perspectives

To ensure the project output, such as the mapping approaches, are used to the benefit of old-growth forest protection, the project scientist commit to a continued involvement as independent experts in the development and facilitation of the EC strategies. Furthermore, the scientific results of the project and the results obtained after further analysis of the database will be communicated during conference presentations and through published scientific articles. UNIL will cooperate with the Slovenian government and regional field teams. in their application for European projects to cover the costs of the mapping of old-growth forest and compensation for private owners. CULS will support local NGOs with similar applications for funding. ECO and JORE will work on the national old-growth forest mapping of Austria, especially with remote sensing products and cross-checks. This way, they will also improve the remote sensing algorithm that has been developed during the project implementation period.

Finally, the partners will continue to work on the harmonization of the mapping approach developed during the project implementation period with the data from already existing monitoring schemes to optimize the assessment of old-growth and avoid double work.

[4] https://engage.iucn.org/group/europe-north-and-central-asia-rcf-30-sept-3-oct-2024/about

B.3.04 Networking with other European projects

Status	Completed		
Responsible	Caroline Celis		
Partners	SOFO		
Foreseen start date	01/07/2022	**Actual start date**	01/02/2021
Foreseen end date	30/06/2024	**Actual end date/anticipated end date**	30/06/2024

Conducted Activities

Activity	Date / Location	Partners	Description
Joined Beech Power social media campaign	2021	SOFO, UNIE	Communicated ESS and characteristics of old-growth beech forests and WHS components in cooperation with Interreg Beech Power.
Beech Power workshops	24–25 Mar & 17 Jun 2021	SOFO	Participated in workshops on sustainable forest management and buffer zone management.
Outreach to Waddensee project	Apr 2021	SOFO	First contact established with Waddensee project representatives.
Meeting with Life Lynx	Apr 2022, Ljubljana	SOFO	Organised meeting during field visit.
Biodiversa+ dialogue event	28–29 May 2024, Paris	SOFO	Presented Life Prognoses insights to support Nature Restoration Law implementation.
Life Enable Project – Module 1	13–17 Feb 2023, Schneverdingen, Germany	SOFO	Participated in first training module with 59 Natura 2000 and protected area managers from 24 countries.
Life Enable Project – Forest Management Training	25–29 Sep 2023, Klagenfurt, Austria	SOFO	Attended 3-day face-to-face training on forest management.
Life Enable Project – European Nature Academy Workshop	4–8 Dec 2023, Schneverdingen, Germany	SOFO	Special workshop for future trainers on European Nature Academy initiatives.
Life Enable Project – Future of European Nature Academy	14–16 May 2024, Castelfranco Veneto, Italy	SOFO	Explored future directions with 60 participants from 10 countries.
IUCN Regional Conference	30 Sep–3 Oct 2024, Bruges	SOFO + all partners	Presented project outcomes in thematic session; field trip to Sonian Forest organised.
Last project webinar	3 Jun 2025	SOFO + all scientific partners	Scientific webinar on project research outcomes for scientists, park managers, and policy makers; co-hosted with EUROPARC Federation.

Description of the action and progress

The networking and outreach activities of the Life Prognoses project began with a first meeting between the Beech Power project and Life Prognoses representatives on 12 February 2021, followed by additional meetings on 20 May and 2 November 2021. The project coordinator participated in workshops organised by Beech Power: on 24–25 March focusing on sustainable forest management, and on 17 June covering management of buffer zones.

From August 2021, a strategy for a joint social media campaign was drafted. Posts highlighting the ecosystem services (ESS) and characteristics of old-growth forests (OGFs) were developed and shared alternately on the Beech Power Facebook page and the Life Prognoses Facebook, Twitter, and Instagram pages. By 31 December 2021, Life Prognoses released 12 posts, and Beech Power released 13 posts, which were shared or retweeted to maximize reach and visibility.

On 22 April 2022, a meeting was held in Ljubljana with representatives of the Life Lynx project, discussing strategies for awareness raising, public engagement, and outreach to hard-to-reach audiences.

In 2023, Life Prognoses actively participated in multiple modules of the Life Enable project (EUROPARC Federation), strengthening the project's network of Natura 2000 and protected area practitioners across Europe. Activities included:

- February 2023: first module in Schneverdingen, Germany, gathering 59 managers from 24 countries.
- September 2023: 3-day forest management training in Klagenfurt, Austria.
- December 2023: European Nature Academy workshop in Schneverdingen, Germany.
- May 2024: future planning workshop in Castelfranco Veneto, Italy, with 60 participants from 10 countries.

At the policy level, Life Prognoses engaged in networking activities in 2024, including participation in the Biodiversa+ dialogue event (28–29 May, Paris) to support the implementation of the Nature Restoration Law, and presenting project outcomes during the IUCN Regional Conference (30 September–3 October, Bruges), including a field trip to the Sonian Forest.

Finally, in 2025, the project concluded its outreach efforts with the final scientific webinar, co-hosted with the EUROPARC Federation, reaching a broad audience of scientists, protected area managers, and policy makers across Europe.

Additionally, at least 10 occasions were documented (see Table 7, Annexe **Error! Reference source not found.**) where LIFE Prognoses partners collaborated with external experts. These interactions included co-authoring scientific publications, sharing datasets, and joint initiatives for awareness-raising, significantly expanding the project's network and impact beyond the immediate consortium.

Occasion for Collaboration	**Project Partner(s)**	**External Partner(s) / Stakeholders**
Joint publication: *Protect old-growth forests in Europe now* (Science, 2023)	CULS, UNIT	Lund University, Humboldt-Universität zu Berlin, KU Leuven, others
Publication: *Managing old near-natural deciduous forests* (AFZ-Der Wald, 2024)	NW-FVA	European Forest Institute, University of Freiburg, University of Wuerzburg, others
Policy report: Scientific Advisory Board on Forest Policy (2023)	NW-FVA	Scientific Advisory Board on Forest Policy, Germany
Associated partner: Healthy Forest Regions project	SOFO	Nature and Geopark Styrian Eisenwurzen (AT), National Forest Centre (SK), Slovenia Forest Service (SI), others
Project Group "Naturwälder"	NW-FVA	FVA Baden-Württemberg, LWF Bavaria, FWAF Rheinland-Pfalz, others
Scientific Advisory Board for Forest Policy	NW-FVA	German Federal Ministry for Food and Agriculture

Occasion for Collaboration	Project Partner(s)	External Partner(s) / Stakeholders
Collaboration on potential new forest reserves	UNIL	University of Zagreb, Forestry Faculty, Croatia
Educational awareness-raising activities	CANG	12 environmental/educational stakeholder organisations
Joint social media campaign on ESS and OGFs	SOFO, UNIE	Beech Power Project (Interreg)
Collaboration with Biosphere Reserve Grumsin	CANG	Biosphere Reserve Grumsin, UNESCO Germany, Info Center Grumsin, WH component Blumberger Mühle

Modifications and difficulties

The project coordinator, Caroline Celis, planned to attend the final conference of the Beech Power project on 29 and 30 March in person. However, this conference eventually took place online.

Complementary actions outside LIFE

At least 9 new projects were developed, of which some granted already, inspired by the insights of the Life Prognoses project and as a result of the collaboration and professional connections established in the context of the project.

Cfr impact assessment (Annexe **Error! Reference source not found.**) for more details.

Project	Partners	Status
RestorEO – Nature Restoration, focus on deadwood	JORE, ECO	Started Sep 2022
HabitAlp 2.0 – Long-term Forest monitoring, National Park Gesäuse	JORE	Started
BESTNATURE – Boosting EU Biodiversity Strategy via higher education curricula	UNIT, ECO, UNIBologna, others	Started Nov 2023
EO monitoring ecosystem change in Alpine protected areas (BIODIVERSA+, 2nd joint call)	UNIT, TU Munich, WSL, Uni Torino	Submitted (not funded)
FORBEST – Safeguarding carbon and biodiversity in European forest ecosystems	UNIT	Submitted
Multi-actor innovation project (HORIZON-CL6-2024-BIODIV-01-8)	UNIT, CULS, INBO, others	Submitted
Old-Growth Forests & Veteran Trees for Biodiversity and Resilient Landscapes (Interreg Europe)	CULS	Submitted
WILDCARD – Horizon Europe	NW-FVA	Started Jan 2024
Identification of old-growth and strict forest reserves in Slovenia, Croatia, BiH	UNIL	In development

After LIFE Project Perspectives

The partners commit to continuously strengthen the European network of old-growth forest scientists, national parks, and other stakeholders. On the one hand, this will be done with view to awareness raising activities by sharing educational materials and by international

collaboration for Erasmus youth exchanges (CANG). Also for the scientific topics, European collaboration will continue by joint projects and through the UNESCO Beech world heritage series.
Cfr Management Plan After Life (Annexe **Error! Reference source not found.**) for more details.

6.2. Main deviations, problems. and corrective actions implemented.

6.2.1. Deviations at project level

The data compilation took longer than foreseen. Not only the summer of 2022, but also the summer, autumn and winter of 2023 were dedicated to the field work. There are multiple reasons for this. The first reason has to do with the nature of the sampling sites and the required methodology. There are stark differences between the different biogeographic regions, but they nevertheless required the same data collection procedure to ensure the retrieved data are comparable. Second, the war in Ukraine caused uncertainty about whether data would be collected at the Ukrainian sites. To keep all options open, it was only definitely decided in 2023 we would proceed with the already-existing 'substitute' data for the site Uholka, Ukraine, instead of sampling ourselves. Third, the field sampling was intensive and often obstructed by weather conditions, especially in the mountainous areas (e.g. Abruzzo, Italy). Therefore, an extension of the sampling period was needed. This longer field sampling resulted in a rather late compilation of the data. The data compilation was an intricate procedure. The inclusion of additional existing datasets would be enriching and provide more robust results for, for example, threshold values for old-growth indicators. However, compatibility issues had to be addressed. Halfway 2024, the main datasets were compiled, but time was too short to extract sufficient information about old-growth ESS and to evaluate the RS methods developed with these datasets. Concretely, the expected manuscripts of scientific papers elaborating on the analyses and results would have to be delivered in a premature state. Therefore, an extension was requested and granted. The scientific team could work six additional months on their analyses and scientific papers. The extension time was a very fruitful period with at least a technical meeting with all scientific partners and coordinators per month and multiple bilateral meetings in between. Much progress was made, and the manuscripts reached a sufficiently informative state by the end of June 2025.

6.2.2. Deviations at action level

- Action A.1.12 tackles the collection and evaluation of existing mapping products of primeval and OGFs in Europe. Equivalent activities have already been executed by the JRC, leaving the actions of Life prognoses redundant. Therefore, in concertation with the JRC (Mr. José Barredo) new ways in which Life Prognoses could contribute to the work the JRC has already finished were found Life Prognoses will cooperate with the JRC providing a validation dataset consisting of field data to test the maps of the JRC obtained by RS. This reorientation was accepted by DG-ENV (Mr. Tistan). Action A.1.22 building on A.1.12 has been postponed to 2023.
- The ongoing situation of war in Ukraine causes a delay in the activities CBRE should execute, mainly the field mapping and the sampling for ESS assessment. Furthermore, the requests for funding at the ministries are evaluated strictly.
    - Action A.1.21: It was impossible to conduct the field sampling in the Ukrainian site Chornohora as planned. An already existing dataset for the site Uholka, Ukraine was provided by WSL Switzerland as a substitute.
    - Action A.2.04: It was impossible to conduct the questionnaire to assess the value of tourism and recreation in old-growth forests in Ukraine.
- Action A.2.01: Thanks to extra co-financing, an extension of the microclimate measurements was possible. This way, data over all seasons instead of only summer and autumn were be gathered and analysed. This caused no impactful delay on other actions. The two scientific papers about microclimate have been published in peer-reviewed journals.

6.3. Analysis of benefits

IMPACT SUMMARY

- At least at 17 occasions the insights and results of the project were shared with policy-makers at regional, national and European level.
- 8 scientific articles were drafted, of which 2 have been published in peer-reviewed journals within the project implementation period.
- 5 scientific reports have been published.
- At least 10 collaborations with partners outside of the project were established for scientific purposes.
- 19 new datasets were created about the features of old-growth forests
- On at least 18 occasions the scientific insights of the project were communicated to fellow scientists.
- At least 1.711.255 people were reached through awareness-raising activities.
- The project offered unique opportunities to enhance the quality and creativity of awareness-raising activities.
- The project inspired the development of at least 9 new projects of which some have started already.
- 751 partners outside of the project got involved for the development of the awareness raising activities.

Cfr impact assessment (Annexe **Error! Reference source not found.**) for more details.

6.3.1. Good governance and protection of European forests

Life PROGNOSES operates in the light of the target to strictly protect 10 % of the European land and the aim to include all primary and OGFs in this 10 % strictly protected land surface as stated in the EU Biodiversity Strategy 2030. Life PROGNOSES is a preparatory project, targeting primarily the policy realm. The project will provide the EC with the required tools to successfully implement a strict protection regime in OGFs.

The developed definition and criteria for OGFs were presented to and accustomed by the working group on forests of the DG Environment. The concept of OGFs, their characteristics and how to delineate them to protect them were discussed during the meetings of the forest group. With the help of the proposed definition and criteria, the link with the legislation was investigated. The parties discussed how to formalize the definition on the one hand in a way that e.g. forest owners that applied close to nature management would not experience disadvantages and that on the other hand, the scope for misuse of the definition is limited.

By the end of the project, also the results of the comparison between managed and unmanaged forests regarding the delivery of ESSs will be available. These results will serve as additional proof of the importance of OGFs for societal well-being and form an incentive for protection. At the moment, the data collection for the assessment of these ESSs is ongoing. For the assessment of the microclimatic effect more funding has been secured, guaranteeing that data can be collected during all seasons. As it might be difficult to collect data on the Ukrainian sites, permission has been asked and granted to use the already existing database for the site Uholka.

A mapping approach in the field has been developed based on the abovementioned definition and criteria. RS methods as an alternative to field mapping for the assessment of old-growthness are in development. The RS approach will be particularly useful for the assessment of old-growthness in large and remote forest areas. Originally, life PROGNOSES would centralize and evaluate the existing mapping products for OGFs. This however has been done already by the JRC of the EC. Therefore, it has been agreed that life PROGNOSES will focus on validating the dataset of the JRC by the use of the data collected in the field.

6.3.2. Awareness raising and sensibilization.

Life PROGNOSES aims. to inform the broad public about the importance of OGFs and the necessity of their protection. Local and national initiatives in several parks targeted the visitors and informed them of the importance of the protection status of the parks and their ESSs. Several partners released press articles to inform a wider audience about the project and the value of the old-growth areas in the country. The social media campaign was set up and a video film was developed to provide accessible information about the value of OGFs, their species and the protected areas throughout Europe and to sensibilize a broad public.

Furthermore, the results of the project will be disseminated to the European public through webinars, a conference and stakeholder meetings.

6.3.3. Strengthening the forest conservation network

The Life Project and the UNESCO heritage series 'Ancient and Primeval Beech Forests of the Carpathians and other regions of Europe' influence each other mutually through information exchange facilitated at the Life and JMC meeting in November in Brussels. The same information exchange happened in cooperation with the Beech Power project. Together with Beech Power, a documentation centre for information on beech forests was developed for the partners of Beech Power, Life Prognoses, the UNESCO beech WHS and other professionals throughout Europe who can use this info and share their own.