SUPERB
Upscaling Forest Restoration

Initial situation assessment

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Assessment reports for 12 demo areas

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0.1	11.01.2023	Demo representatives and WR	WR	First draft description of initial assessment design
0.2	13.10.2023	Demo representatives and WR	WR	Description of initial assessment design
0.9	20.11.2023	Magda Bou Dagher Kharrat	EFI	Internal review of report
1.0	27.11.2023	Sara Filipek, Silke Jacobs	WR	Final version initial situation assessment design for submission

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DISCLAIMER

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Contents

Executive Summary

This deliverable contains the initial situation assessment design reports for 12 demonstration areas. First a general description about the objectives of an initial assessment and the measurements is given which is followed by the initial assessment design reports of each demo area. The initial assessment is important to monitor restoration effectiveness. This deliverable includes the initial assessment design reports for the following demonstration areas: Po Valley (Italy), southern Netherlands, North Moravia (Czech Republic), North Rhine Westphalia (Germany), Vindelälven-Juhttátahkka Biosphere Reserve (Sweden), Queen Elizabeth Forest Park (Scotland), Biosphere Reserve Bačko Podunavlje (Croatia/Serbia cross-border), Făgăraș mountains (Romania), Thy and Nordsjælland (Denmark), Castilla y Leon (Spain), Nouvelle-Aquitaine (France) and coppice forests (Serbia).

Keywords

Demonstration areas, initial state, forest restoration, monitoring, inventory

1 Introduction

In SUPERB 12 demo areas across Europe carry out restoration measures to make an effort to tackle a variety of stressors and challenges. The restoration measures across the demo areas differ due to the nature of forest diversity and social-economic diversity. Each challenge and objective need a different set of measures to develop a desired state of the forest. In order to assess the success of the restoration both in short- and long-term, a consistent monitoring needs to be carried out.

This deliverable describes design setup and methodology for monitoring protocol of the initial situation assessments per demo. Given methodology of the initial assessment, the current state of forest is identified by assessing starting point before and in some cases right after the restoration measures are taken, describing the current state of the forests and restored areas. Detailed planning of the restoration measures is included in the demo workplans deliverable (D7.1). Without knowing the current state of the forest prior to the restoration, it is difficult to evaluate the effectiveness of the restoration measures conducted in each demo. The monitoring protocol used here is in essence similar to the one for chronosequence monitoring in WP6 (see *Protocol for regular forest inventory – Essential-only*). Given that the circumstances in the demo areas vary, the sampling designs are adjusted for the demo needs.

In this deliverable we do not aim to analyse the results of the initial measurements. The results will be evaluated in D7.4 deliverable which will focus on assessment of the restoration effectiveness and lessons-learned. For that deliverable (D7.4) we will also identify indicators and criteria which will be used for such evaluation. Selected indicators and criteria will correspond with measured parameters of the initial assessment.

1.1 Objectives of initial situation assessment

The purpose of the initial assessment is to describe the state of the forest by measuring adult trees, seedlings and saplings, and if desired dead wood and the herb layer. In addition, few demos also include measurements of soil properties like litter layers. Information on the initial state of forest is used to assess future effects (success and failures) of the measures on the ecosystem biodiversity and functions. It is a necessity for the upscaling of forest restoration to know in which areas certain measures might work and which measures will not have an effect or even have an effect that is not desirable.

The observations are conducted and recorded at a plot scale, in a sample design laid out over the restoration sites including several aspects of the stand structure. In case the restoration plot is located within the chronosequence stand (like in the degraded forest in Dutch and Spanish demos), the forest inventory information is retrieved from Task 6.3 (WP6). However, for the restoration stands that are not inside of the chronosequence stand, assessment of the initial forest state is done. The initial assessment measurements are conducted in 2023 and 2024. Some of the demos are already finished like the Netherlands, Czech, Germany, Romania and Denmark. Whereas others like France, Italy and Serbia will do the initial assessment measurements in 2024.

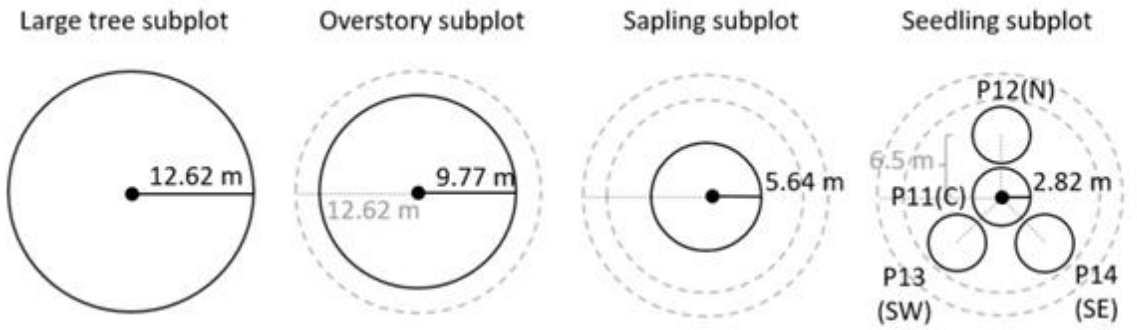
2 Measurements

The recorded data are collected per demo in the Excel spreadsheet (see Appendix 4.1). General information is recorded under the tab ‘Stand’. The tab ‘Stand’ includes information of country, stand, stand size and number of plots for the initial assessment. Second tab ‘Plot’ include the GPS coordinates, specifying in the comments which is the geographical system employed for them (EPSG codes for national systems). Optionally, we record approximate terrain slope and aspect of the site. Relevant observations on the plot environment and location are also recorded (e.g., proximity to roads or infrastructure, recent management interventions, previous land use) in the field ‘Comments’. Additionally, we add approximate percentages of coverage for each of the tree, shrub and the herbaceous layers, assessed visually and expressed separately and not relatively to each other because they can overlap (their sum may therefore be higher than 100%). Tab ‘Species’ includes the species codes that are used across all demo areas.

2.1 Plot design

All the initial assessment measurements are carried out at a plot scale. Selected plots cover range of restoration activities planned for each demo within the project. The plots only have one central sampling point to avoid the bias of the plot sampling locations.

Around each selected sampling point, concentric plots of different sizes are used to measure the different components of forest structure (Figure 2.1.1). Characteristics that require larger effort are measured over smaller plots, whereas larger plots are employed to record rarer events only.



1. One large tree subplot (12.62 m radius) where only large adult trees (>27 cm dbh) will be measured;
2. One overstory subplot (9.77 m radius) where all adult trees (> 7cm dbh) will be measured;
3. One sapling subplot (5.64 m radius) where the smaller trees (saplings) will be measured and deadwood biomass will be assessed;
4. Four seedling subplots (2.82 m radius) where seedlings will be counted.
5. In addition, aground vegetation inventory of non-tree species will be done over 1-m quadrats within seedling subplots.

Figure 2.1.1 Field plot design for multi-layered forest following a circular subplot design.

2.1.1 Adult tree inventory (Large tree and overstory subplot)

The tree inventory includes all the standing, living or optionally dead adult trees (dbh > 7 cm). Intermediate-sized trees (dbh between 7 and 27 cm) are measured on a 9.77 meter radius plot, whereas large trees (dbh > 27 cm) are measured on a 12.62 m-radius plot. In each case, the species and dbh of all the corresponding trees are recorded. If decided to do the optional assessment of dead trees, when the species of dead trees cannot be determined, it should be recorded whether these are hardwood or softwood species.

Tree heights are determined for few living trees (only 3 measurements for each of the dominant species present) trying to approximately cover the full range of tree heights and giving measurement of one small, median and one tall tree. Height measurements are conducted either on the intermediate sized trees from the 9.77 m-radius plots, or on the large trees from the 12.62 m-radius plots. It is however important that each height measurement is linked to a dbh measurement, and thus recorded at the row corresponding to the same tree (the rest of rows can be left empty for height measurement). If dead top broken trees are found within the plot their decay class is recorded according.

2.1.2 Saplings inventory (Saplings subplot)

Trees with dbh < 7 cm are also measured individually and recorded, as long as they are higher than 1.30 m (saplings). These trees are measured only when they are at a distance within 5.64 m from the plot centre, to limit the surveying effort needed for these smaller trees. Individual tree codes for saplings start from “101”, to differentiate them from the bigger trees

and facilitate the combination of overstory and sapling layers. If the height measurement of the smaller tree was taken from one of these saplings, add its corresponding height here alongside its dbh.

2.1.3 Seedlings inventory (Seedlings subplots)

For trees with height below 1.30 m measurement is based on counting each individual. The counting is done on at least 1 subplot of 2.82 m radius. Using a telescopic pole, rapid counts of seedlings is carried out around each subplot centre. Record seedling counts per subplot grouped by species and height class. The height classes only need to be determined approximately: below 20 cm (class 1), 20 – 80 cm (class 2), or above 80 cm (class 3).

2.2 Optional measurements

2.2.1 Richness of ground vegetation using iNaturalist

Each species of non-tree vascular plants (herbs, ferns, shrubs) present in each of the 1 meter quadrats within the seedlings subplots are identified using the iNaturalist application and validated by the demos. To be included in this list, plants can originate either within the quadrat, or outside it, as long as some part of them is present either directly on the quadrat floor, or on its vertical projection, up to a height of 5 m.

2.2.2 Lying deadwood (Saplings subplot)

For all lying deadwood pieces (diameter > 7 cm) found within the 5.64 meter radius in the saplings subplot, the diameter at mid-length, total length, and decay class is recorded. The decay class is determined according to the following categories: 1 –Sound (recently dead); 2 –Intermediate (partially rotten); or 3 –rotten. For pieces of deadwood intersecting the borderline, the criterion for inclusion is whether any part of it within the 5.64 m distance of the plot centre has a diameter > 7 cm. It is recommended to use a tree calliper for measuring lying deadwood diameter.

2.2.3 Other measurements

Other measurements can be included bases on important indicators for specific demos like soil measurements and birds observations.

3 Initial sampling designs

In this chapter the initial assessment designs for each demo area are described.

3.1 Italy, Po Valley

3.1.1 General demo information

The Po Valley demo is located in northern Italy in the Lombardia region, the most populated region in Italy. Within the Italian demo area, 4 sites have been selected for afforestation; Legnano, Villa Cortese, Inveruno, Vittuone. On these sites intensive agricultural practices were taking place.

The initial environmental conditions are very similar across all the sites. The sites are characterised by bare soils with some individual tree remnants of European ash (*Fraxinus excelsior),* Boxelder maple *(Acer negundo)* and black poplar (*Populus nigra).* Most of them are also covered by an herbaceous cover with the presence of shrubs at the edges.

The species selected for restoration planting are part of oak - hornbeam forest type (*Quercus – Carpinus* forest) typical for the Po valley, excluding the ones that are not suitable in the future according to the "Seed4forest" model (Task 6.2), and with some additional species that are drought and heat resistant.

3.1.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 45 plots to cover the Italian restoration sites within the project (Table 3.1.1 and Figure 3.1.1).

Table 3.1.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Legnano	Afforestation	2.90	12
Villa Cortese	Afforestation	4.10	18
Inveruno	Afforestation	1.75	6
Vittuone	Afforestation	3.00	9
Total:	**-**	**11.75**	**45**

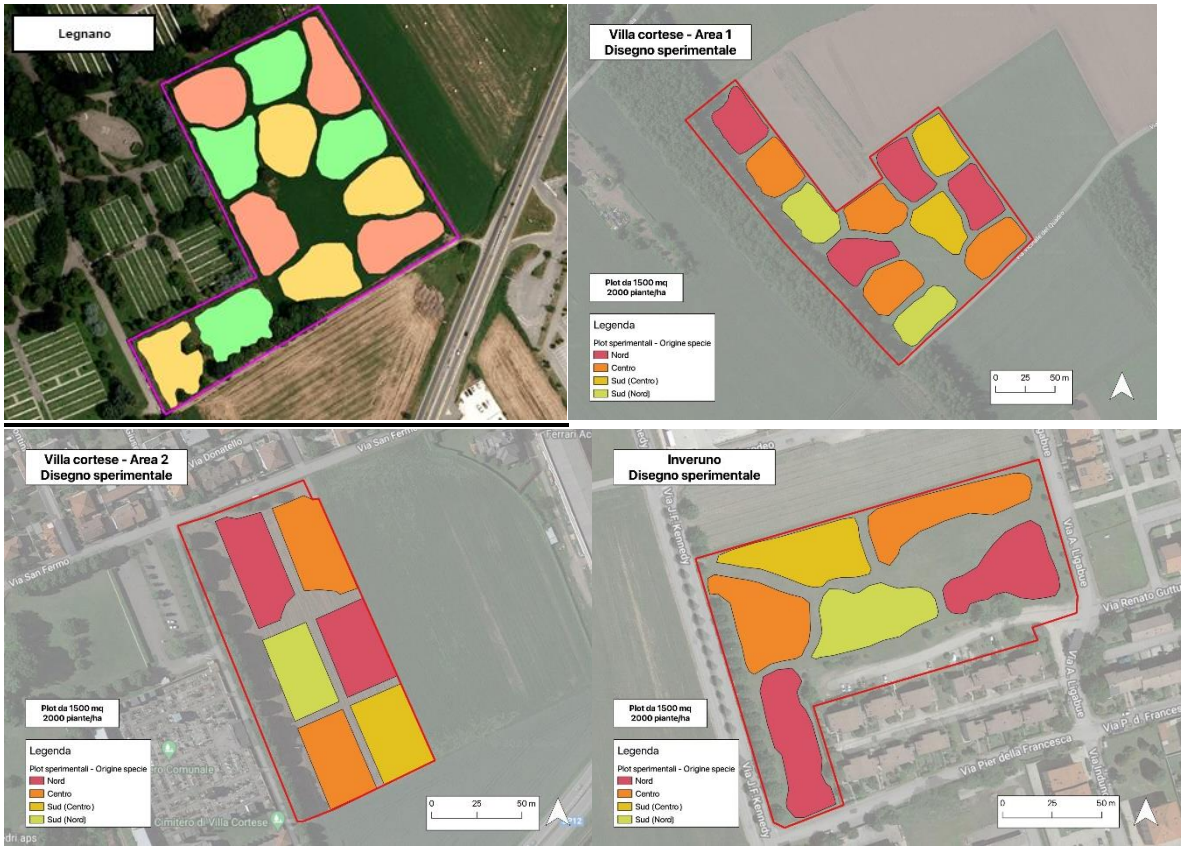


Figure 3.1.1 Forest restoration locations in the Po Valley. Highlighted areas indicate location of initial assessment plots.

3.1.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting the sapling inventory and the seedlings inventory (Figure 2.1.1). The exact methods of those inventories are included in the chapter Measurements. Besides, mentioned measurements we also make additional measurements of soil to assess soil texture, soil carbon and nutrients availability.

3.2 Southern Netherlands

3.2.1 General demo information

Forest restoration will be performed in Horst aan de Maas, in a pine forest on sandy soil. The main tree species is Scots pine (*Pinus sylvestris),* mostly planted around 1950. In some parts of the forest, Corsican pine (*Pinus nigra)* has been planted. A secondary tree layer is developing since the nineties of the previous century, mostly consisting of pedunculate oak (*Quercus robur),* silver birch (*Betula pendula) and* black cherry (*Prunus serotina).* Within the Dutch system on forest habitats, the forest qualifies as N15.02 (pine, oak and beech forest on dry soils, managed as a natural forest) or N16.03 (a similar forest type, with wood production and biodiversity as main forest functions;

https://portal.prvlimburg.nl/viewer/app/default).

In coordination with the forest owners, the following restoration measures will be taken:

1. **Application of rock dust**, in order to replenish minerals that have leached from the topsoil due to soil acidification
2. **Introduction of rich litter species**, in order to enhance the mineral cycling of minerals as calcium, potassium and magnesium. The trees will be planted on locations where mineral richer soil layers are present within the rooting zone (eg, within 2 m below soil surface). With the introduction of these species, the tree diversity in the forest will also increase, most likely leading to a general increase in biodiversity.
3. **Application of rock dust AND introduction of rich litter species.** On locations where loam layers are missing in the subsoil, and forest owners would like to plant extra tree species, we will plant the species in combination with the application of rock dust.
4. **Control sites,** e.g. locations where no measure will be taken.

In total we will restore at least 60 ha (small forest owners are still joining).

3.2.2 Sampling design

The forest is quite homogenous, therefore the initial assessment will be performed in 20 plots to cover the restoration activities conducted within the project (Table 3.2.1).

Table 3.2.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Horst	Control	-	2
	Introduction rich litter species	3.88	5
	Application of rock dust	14.00	6
	Combination: species introduction and rock dust application	46.30	7
	Combination: species introduction and rock dust and chalk	10.00	
Total:	**-**	**74.18**	**20**

We have used the following criteria to select the location of the initial assessment plots:

- Restoration practice
- If possible, sites where soil samples have been taken for soil chemistry are included. These soil samples were taken to assess the locations where rock dust application is needed.
- the plots consists of different dominant tree species, reflecting the stand characteristics. This means that *Pinus sylvestris* is most present.

The location of the initial assessment plots is shown in Figure 3.2.1.

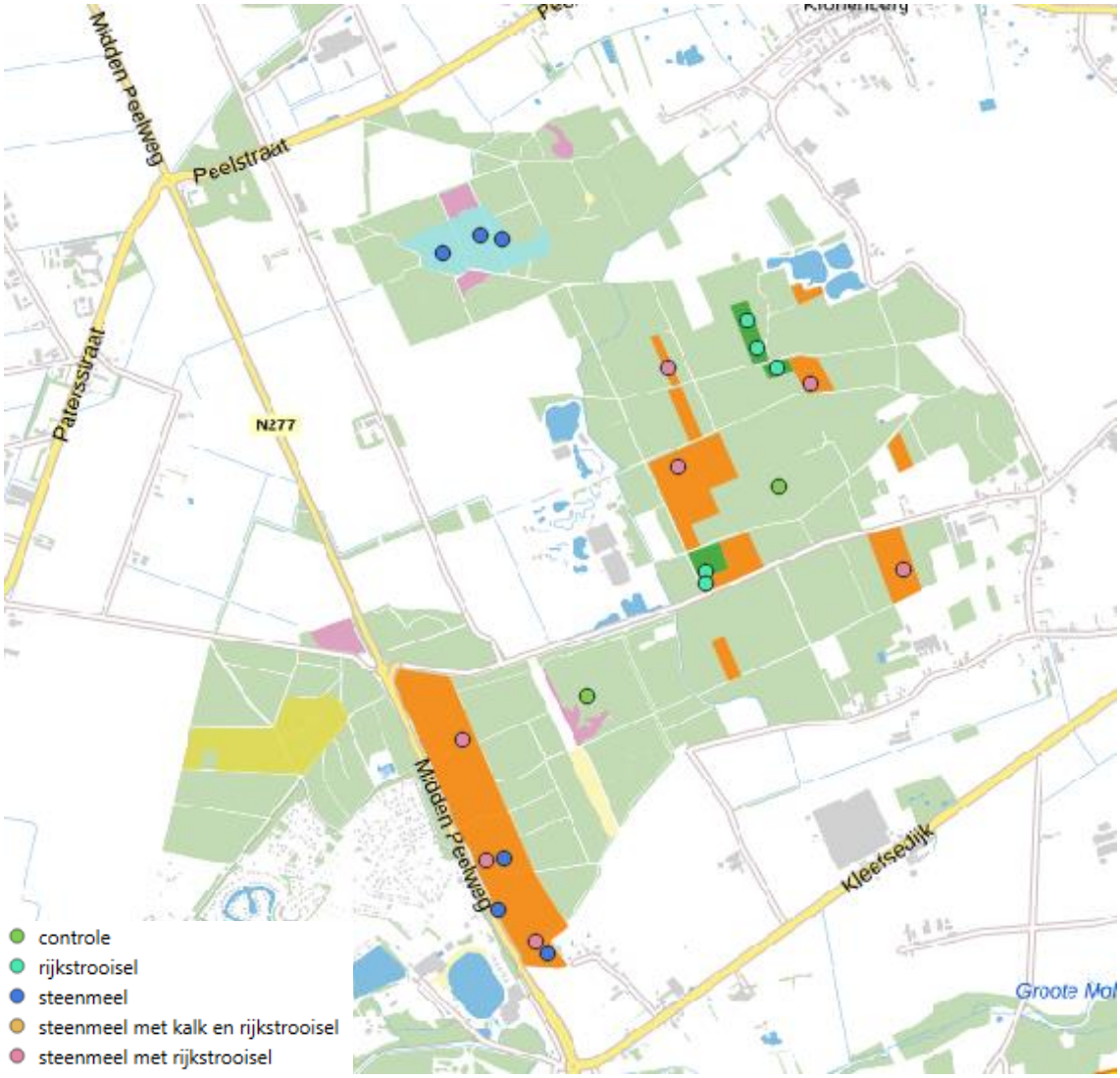


Figure 3.2.1 Forest restoration in Horst aan de Maas. Restoration practices: rock dust application: light blue, introduction rich litter: green, combination: orange, control: purple. Plot NL_11 (control) is also part of the chronosequence.

3.2.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting the large tree, overstory, sapling inventory and the seedlings inventory (Figure 2.1.1). The exact methods of those inventories are included in the chapter Measurements.

3.3 Czech, Vysocina, North Moravia

3.3.1 General demo information

The Vysočina North Moravia demo is located within Vysočina Region, also known as Bohemian – Moravian Highlands. The demo area includes restoration of approximately 100 ha of forests including construction of 4 water retention ponds.

Norway spruce (*Picea abies*) forests in the demo area are heavily affected by calamities of European spruce bark beetle (*Ips typographus*). Therefore, the restoration focuses on regenerating forests by establishing new mixed forest stands (including 3 and more tree species) with increased rate of natural regeneration of pioneer species like birch (*Betula)*, poplar (*Populus)*, alder (*Alnus)* and willow (*Salix)*. Besides, in some stands Norway spruce is be replaced by other tree species: beech (*Fagus sylvatica)*, fir (*Abies spp*.), oak (*Quercus spp.*) and maple (*Acer spp.*). As the bark beetle infestation is one of the consequences of droughts, the restoration also aims to improve forest water retention.

3.3.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 85 plots to cover the restoration activities conducted within the project (see Table 3.3.1).

Table 3.3.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
*Zlatomlýn (LČR)	Planting	7.00	3
*Mrákotín (LČR)	Planting	3.85	2
*Hradecko (LČR)	Planting	5.00	14
*Pavlíkov (LČR)	Planting	5.00	8
*Orlovy (LČR)	Planting	5.00	7
*Čerňák (LČR)	Planting	5.00	10
*Pelestrov (LČR)	Planting	5.00	9
*Bílý kámen (LČR)	Planting	4.00	5
*Kunžak (LČR)	Planting	6.24	3
**Dářko (Kinský)	Planting	7.33	11
**Hamry (Kinský)	Planting	3.12	5
**Peperek (Kinský)	Planting	5.65	8
Total:	**-**	**63.19**	**85**

**Forest of the Czech Republic; Lesy České republiky s.p. (state forest)*
***KINSKÝ Žďár, a.s. (private forest)*

3.3.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting the sapling inventory and the seedlings inventory (Figure 2.1.1). Additionally, in the subplots we are assessing richness of ground vegetation layer and lying deadwood. The exact methods of those inventories are included in the chapter Measurements.

3.4 Germany, North Rhine Westphalia

3.4.1 General demo information

The North Rhine – Westphalia demo is located in western Germany. The demo area includes approximately 40 ha of infested Norway spruce *(Picea abies)* forests for restoration. Norway spruce forests located within the demo area were heavily affected by European spruce bark beetle (*Ips typographus*) calamities since 2018. Therefore, restoration actions focus on forest diversification and ecosystem restoration by using combinations of natural regeneration e.g. birch (*Betula),*willow *(Salix),* maple *(Acer),* rowan *(Sorbus)* and replanting e.g. oak (*Quercus),* beech *(Fagus),* hornbeam *(Carpinus),* lime *(Tilia),* alder *(Alnus*), selecting different site-adapted species (minimum four species), and including where applicable use of pioneer species.

3.4.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 55 plots to cover the restoration activities conducted within the project (see Table 3.4.1).

Table 3.4.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Arnsberger Wald	Planting and seeding	5.70	17
Municipal forest Arnsberg	Planting	6.00	5
Municipal forest Gevelsberg & Private forest “Auf Gut Berge”	Planting and seeding	4.70	6
Private forest FBG Calle	Planting and seeding	6.80	5
Municipal forest Bad Laasphe	Planting	4.70	7
Church forest Wipperfürth	Planting	6.90	10
Private enterprise Salm-Salm	Planting	5.00	5
Total:	**-**	**39.80**	**55**

The random selection of plot positions is secured by choosing a minimum distance from the stand border and between the plots using ArcGIS to eliminate perception bias in the field.

In the German demo where restoration focuses on newly established stands after bark beetle calamity, predominantly an assessment of seedlings is established and recorded. However, on restoration sites with existing natural regeneration we also used sapling subplots. And in a few sites assessment of adult trees was used for accounting single trees e.g. birch (*Betula)* or Scots pine (*Pinus sylvestris*) and standing deadwood that was left on the calamity site.

3.4.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting seedlings inventory, sapling inventory and adult tree inventory (Figure 2.1.1). Additionally, in the subplots we are assessing richness of ground vegetation layer and lying deadwood. The exact methods of those inventories are included in the chapter Measurements.

3.5 Sweden, Vindelaven – Juhttatahkka Biosphere reserve

3.5.1 General demo information

The Swedish demo area consists of the entire area of Vindelälven-Juhttátahkka UNESCO Biosphere Reserve (Gardeström et al. 2018). The Biosphere Reserve covers a 1.3 million ha river catchment from the alpine areas of the Scandinavian Mountain Range at the border to Norway to the coast of the Gulf of Bothnia. The forests within the Biosphere Reserve are naturally dominated by native conifers, mainly Scots pine (*Pinus sylvestris*) in areas with dryer and wetter conditions and Norway spruce (*Picea abies*) in areas with more mesic conditions. Deciduous trees, mainly birches (*Betula pendula* and *Betula pubescens*) but also Aspen (*Populus tremula*), Goat willow and other tree forming Salix species (*Salix caprea et al.*), Rowan (*Sorbus aucuparia*) and Bird cherries (*Prunus padus*) naturally occur within the coniferous forests in different proportions, depending on abiotic conditions but also on natural disturbances and past management

Assessment of restoration success will mainly be focused on restoration site Ume Älvdal, because in this area the aim/goal of the restoration is the same in all stands. We are focusing on birds and bats, because the aim of the restoration is to create good habitat for the umbrella species White backed woodpecker, and thus also other species dependent on, or favoured by deciduous dominated forests, and because the time span for assessing any response from the restoration actions are limited. These two species groups are good indicators for the suitability of the forest for other species groups, for example insects, and they are also often rather quick in their response to habitat change since they are very mobile. We also have access to other background information on the occurrence of both birds and bats in this area, which we do not have for insects and other species groups.

In restoration site Skatan, where we are performing many different restoration actions in different stands with different goals, we will instead do a study on fire mimicking methods, focusing mainly on time consumption, cost etc, because any ecological effect of these kind of actions is not expected within the time frame of the SUPERB project. However, the study will be set up in collaboration with ecologists and in a way so that also the ecological effects can be assessed in a later stage.

In Skatan restoration area we will also set up a pilot study on transplanting tree hair lichens, in collaboration with other researchers. However, as lichens grow slowly, we do not expect to be able to assess the results from this pilot study within the time frame of the SUPERB project.

3.5.2 Sampling design

To conduct the initial assessment, we carefully selected 18 plots to cover the restoration activities conducted within restoration site Ume Älvdal (9 plots in restoration stand, denoted RX and in 9 plots in neighbouring control stands, denoted CX (Table 3.5.1 &

Table 3.5.2).

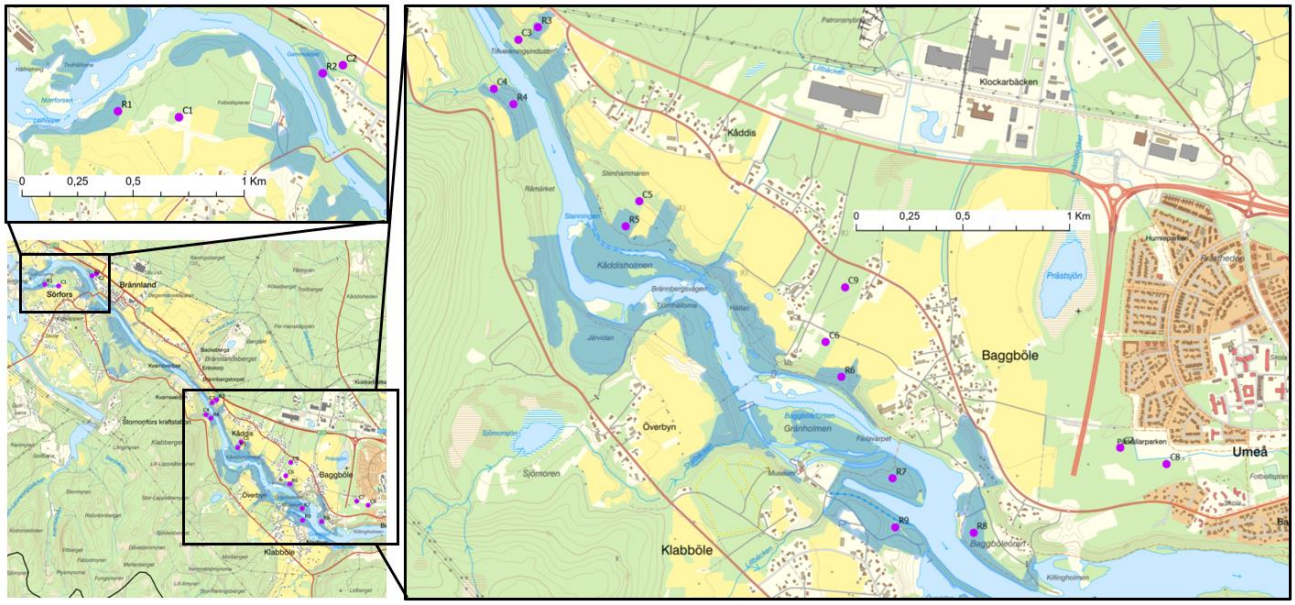


Figure 3.5.1 Maps showing the location of monitored plots in restoration site Ume Älvdal. Plots named RX are situated in restoration stands, plots named CX are situated in neighbouring control stands that will not be restored.

Table 3.5.1 Recording schedule for bird-sounds, before restoration (one week periods). Recordings post restoration will be done approximately the same dates.

Period	C1	R1	C2	R2	C3	R3	C4	R4	C5	R5	C6	R6	C7	R7	C8	R8	C9	R9
230320 - 230327	X	X							X	X					X	X		
230327 - 230404			X	X	X	X							X	X				
230404 - 230411							X	X			X	X					X	X
230411 - 230418	X	X							X	X					X	X		
230418 - 230426			X	X	X	X							X	X				
230426 - 230502							X	X			X	X					X	X
230522 - 230529	X	X							X	X					X	X		
230529 - 230605			X	X	X	X							X	X				
230605 - 230614							X	X			X	X					X	X

Table 3.5.2 Recording schedule for bat-sounds, before restoration (5 days periods). Recordings post restoration will be done approximately the same dates.

Period	C1	R1	C2	R2	C3	R3	C4	R4	C5	R5	C6	R6	C7	R7	C8	R8	C9	R9
230815 - 230820													x	x	x	x	x	x
230820 - 230825					x	x	x	x	x	x								
230825 - 230830	x	x	x	x							x	x						
230830 - 230904													x	x	x	x	x	x
230904 - 230909					x	x	x	x	x	x								
230909 - 230915	x	x	x	x							x	x						

3.5.3 Measurements

To monitor birds and bats in Ume Älvdal we are using passive acoustic recorders (SongMeter MiniBats). Recording is done in 18 plots (9 plots in restoration stands, denoted RX and in 9 plots in neighbouring control stands, denoted CX) (Figure 3.5.1). A first round of acoustic recording has been done in 2023, prior to any restoration action, and a second round of recording is planned for 2025, after the restoration actions in the area is expected to be finalized.

Bird acoustic monitoring are done from the end of Mars to mid-June, to capture the period where the birds in this area are most active in singing/drumming (woodpeckers). Bat acoustic monitoring are done in August-September when both adult and young bats are expected to use the area. See Table 3.5.1 &

Table 3.5.2 for recording schedules for birds and bats and see Table 3.5.3 for MiniBat configurations for birds and bats.

Birds and bats acoustic data will be analysed in collaboration with WP6 (Ruben Valbuena et. al) and validated by local and national experts of birds and bats.

Table 3.5.3 Used MiniBat configurations for birds and bats

	Birds	Bats
Configuration name	Ume Älvdal Birds 10 min continuously	Ume Älvdal Bats continuously
Utrasonic settings	-	Recording format: Full-spectrum Full spectrum sampling rate: 256 kHz Non-triggered recording: Off

		Minimum trigger frequenzy: 16 kHz Maximum recording length: 15 sec Trigger window: 3 sec Save noise files?: Off Left channel gain 12 dB
Acoustic settings	Sample rate: 24000 Hz Maximum recording length: 10 min Right channel gain: 18 dB	-
Location and timezone	Adjusted to each plot and local time	Adjusted to each plot and local time
Delay start	Off	Off
MODE	Acoustic	Ultrasonic
START TIME	Rise - 1	Set + 0
DUTY CYCLE	Always	Always
END TIME	Rise + 4	Rise - 1

To be able to correlate bird and bat fauna and activity with forest structure, we are also doing a forest structure inventory in the same plots as we are doing the acoustic monitoring. The inventory follows a protocol that are used by the national White-backed woodpecker conservation project, to assess the landscape suitability for White backed woodpeckers (see Figure 3.5.2). Following this protocol, we are collecting data on tree species distribution, tree size distribution and volume of both living and dead wood.

A first round of forest structure inventory has been done in 2023 (prior any restoration actions), in all 18 plots (both restoration plots and control plots). In 2025, post the restoration actions, a second round of tree structure inventory will be done in the 9 restoration plots.

A landscape assessment following the methodology and protocol from the national White-backed woodpecker conservation project has been done in this area a few years back, which gives us the possibility to compare our forest structure data to earlier information, but unfortunately, we do only have access to the average summary of the older assessment, because all information on positions of monitored plots has been lost.

As a compliment to the forest structure inventory, WP6 (Ruben Valbuena *et. al*). will assess forest structure in all 18 plots by laser scanning with drones, both prior and post restoration actions.

Habitat assessm. White back - Protocol (side 1/2)	Radie: 9,77 m	Description of stand:	Age (stand):
Date:	ID Plot:		Trees <10 cm:
x-coord:			Schrubbery:
y-coord:			

Tree #	**Tree species**	**Living/dead**	**Type (only dead)**	**Degradat. (only dead)**	**Diam. Whole trees**	**Diam. Cylindrar**		**Lenght**	**Volyme**
	Species	1: Living 0: Dead	HS: Whole, standing HL: Whole, laying CS: Cylinder, standing CL: Cylinder, laying	0: Newly died 1: < 50% bark loss 2: 50-100% bark loss 3: Very soft wood	(cm @ breast hight)	Lower end (cm)	Upper end (cm)	(m)	Calculated at the office

Figure 3.5.2 White backed woodpecker inventory protocol.

3.6 Scotland, Queen Elizabeth Forest Park

3.6.1 General demo information

Queen Elizabeth Forest Park (QEFP) is in Forestry and Land Scotland's (FLS) central region. It comprises of 16 Management Blocks which collectively cover an area of approximately 20,000 ha, of which about 54% is forested. QEFP is owned and managed by FLS. It is embedded within the Loch Lomond and the Trossachs National Park where very diverse land uses are present: large areas are covered by lochs, and by conifer and broadleaves forests, as well as agricultural land and pastures.

The conifer forests in QEFP have always included a large proportion of Sitka spruce *(Picea sitchensis)* monoculture stands to provide timber products and to generate income, a legacy of the post-war forestry policy of the last century. However, management activities planned and delivered by FLS have substantially reduced the extent of these Sitka stands in efforts to diversify the forest and increase species and structural complexity of suitable stands, as well as to support biodiversity and deliver a range of other Ecosystem Services (e.g., flood risk mitigation). Throughout QEFP, Forest diversification is ongoing, with action to increase both species and structural diversity. Riparian zones are being cleared of conifers and replaced with appropriate native species, selected on the basis of the different woodland types.

Restoration activities will take place in three sites: one in the Allt Glas site (restoration of riparian woodland and implementation of Natural Flood Management practices), one near the Honeymoon bridge (high-elevation planting), and one in Achray Forest (transition from pure Sitka spruce to CCF).

3.6.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 54 plots to cover the restoration activities conducted within the project (Table 3.6.1).

Table 3.6.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Allt Glas site	Riparian planting	5.00	20 (10 control plots, 10 plots in restoration site)
Honeymoon bridge	High elevation planting	2.00	14 (4 control plots, 10 plots in restoration site)
Achray Forest	CCF transition site	*ongoing selection of plots	*ongoing selection of plots
Total:	**-**	**7.00***	**34***

In the Natural Flood Management site the sampling and control plots are chosen on the basis of the complex microhabitat structure of the site, and at different locations relative to the establishment of the wooden engineering structures (the leaky dams and the timber bunds) and the flood plain (Figure 3.6.1).

In the High-elevation site, the locations of the sampling plots are based on a regular grid, to cover as much of the area as possible – this is facilitated by the relative small area (2ha) and

high number of sampling plots (10). Note that the locations might change when we go back to the site after winter because the site is prone to landslips (that's one of the reasons it was chosen!) and we might need to reassess the situation (Figure 3.6.2).

In the CCF site, the sampling plots are chosen among the stands will be of thinning age come summer 2024. Assessments of conifer species mixtures, stand ages and previous thinning history (some stands will have been thinned once already, others would not had any previous thinnings at all), and slope differences will inform the selection of the sampling plots to ensure representativeness of the complex landscape in Achray forest.

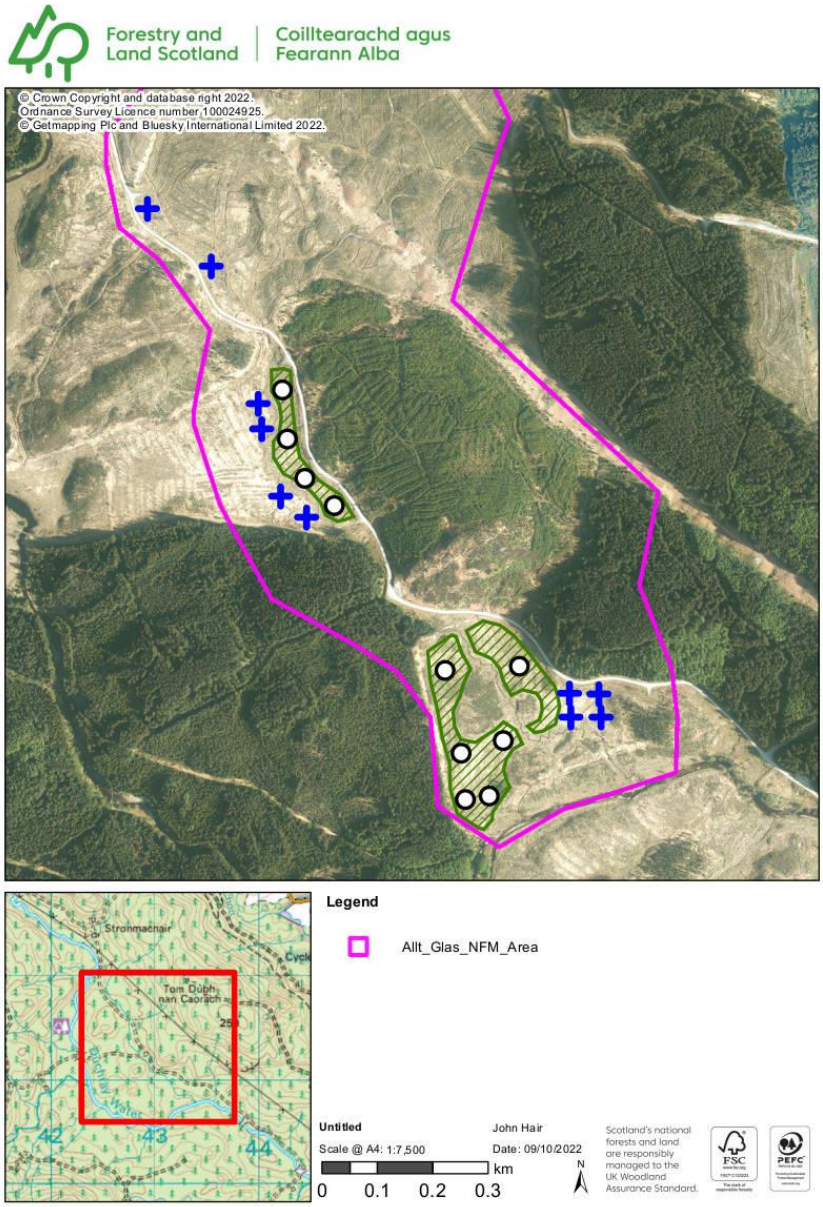


Figure 3.6.1 Map of the Allt Glas Restoration site (boundary marked in purple). Planting area outlined in green. Circles denote locations of restoration plots. Blue crosses indicate the locations of control plots.

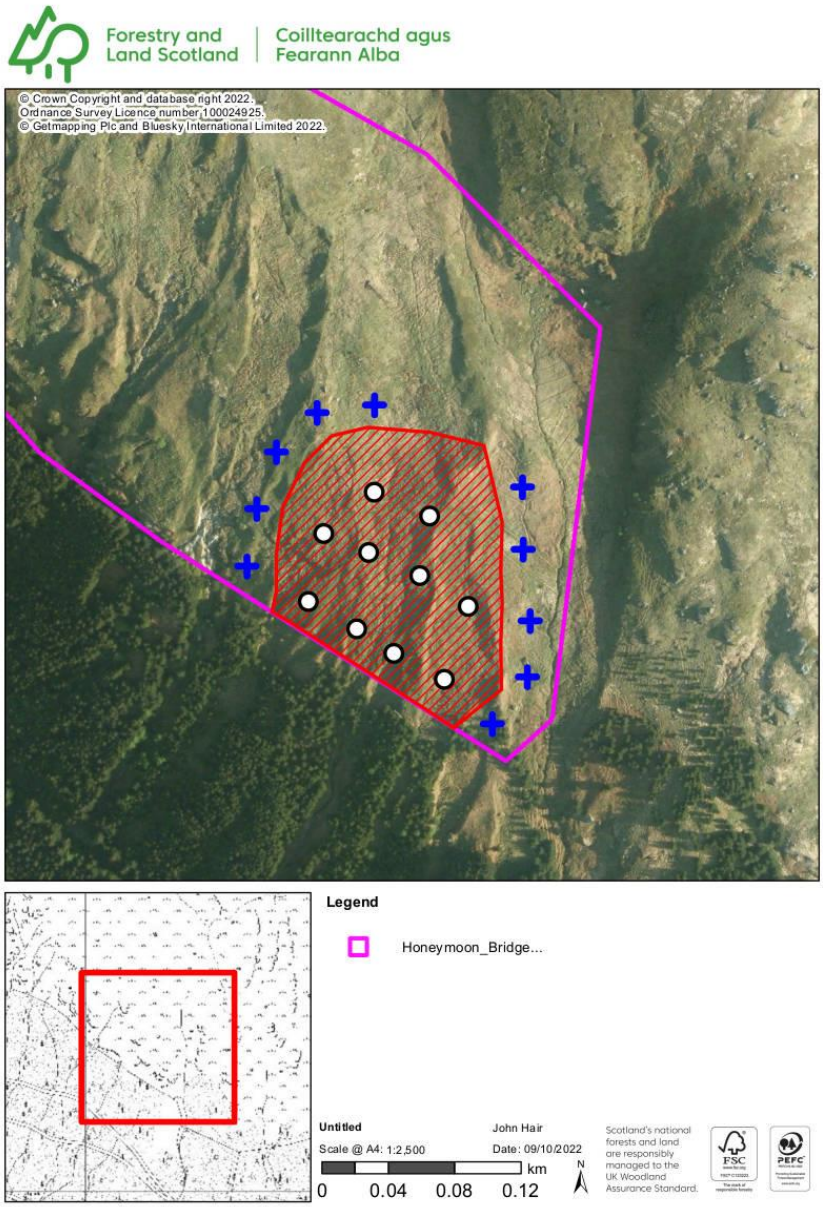


Figure 3.6.2 Map of the Honeymoon Bridge Restoration site (boundary marked in purple). Planting area outlined in red. Circles denote locations of restoration plots. Blue crosses indicate the locations of control plots.

3.6.3 Measurements

To assess the initial conditions of the CCF and Natural Flood Management restoration sites , we are using the general measurements protocol of conducting seedlings inventory, sapling inventory, adult tree inventory, dead wood and ground vegetation inventory (Figure 2.1.1). While there is no forest at the high elevation site, only ground vegetation and seedlings are measured. The exact methods of these inventories are included in chapter Measurements.

3.7 Croatia-Serbia, Croatian part

3.7.1 General demo information

The cross – border demo with riparian forests is located across two countries, Croatia and Serbia. The Croatian part of the demo is situated in fragmented poplar (*Populus*) plantations on alluvial and eugley-amphigley soils. The plantations are surrounded by agricultural land with intensive food production. Due to the extensive land use and damming, vitality of trees declined. Furthermore, some stands were under landmines for a long time and thus they were left unmanaged. Therefore, restoration actions aim to strengthen biodiversity and resilience of riparian ecosystems by restoring poplar plantations into mixed oak (*Quercus*) forests on approximately 54 ha area.

3.7.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 46 plots to cover the restoration activities conducted within the project (Table 3.7.1).

Table 3.7.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Stand 93a	Cutting and planting	31.00	24
Stand 95b	Cutting and planting	22.41	22
Total:	**-**	**53.41**	**46**

The random selection of plot positions is secured by QGIS software. We use grid of plots 80 x 80 meters to randomize plot selection and set number of plots accordingly; <1 ha is 3 plots, 1 – 5 ha is 10 plots, 5 – 20 ha is 20 plots and 20 – 100 ha is 30 plots (Figure 3.7.1 & Figure 3.7.2).

Figure 3.7.1 ***Stand 93a*** *with 24 selected plots for initial assessment*

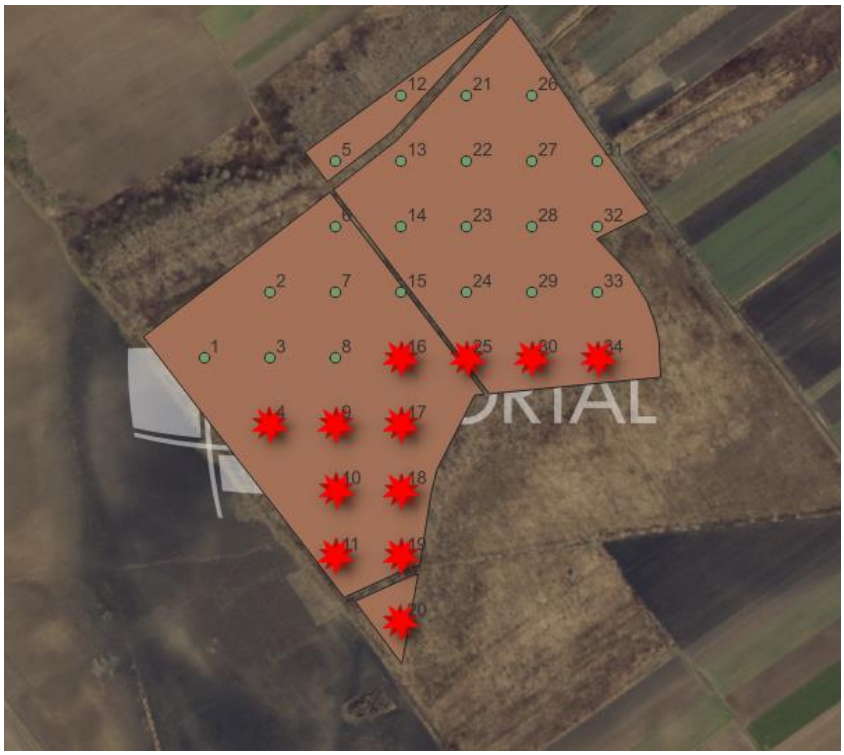


Figure 3.7.2 ***Stand 95b*** *with 22 sampled plots (green). Plots marked with star (red) are locations with high suspicion of landmines.*

3.7.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting seedlings inventory, sapling inventory, adult tree inventory (Figure 2.1.1). In difference to the general protocol, we record height of all individual tree species in the large tree and overstory subplots. Besides, due to the high number of shrub species saplings in some of our plots (over 200 species in 5,64 meter radius), we applied a methodology that is used for seedlings inventory. All the saplings were recorded in a 5,64 meter radius, grouped by species and height class. The height classes were determined using a measuring pole. Height classes were determined as follows: 1,30 – 2,00 m (class 1), 2,00 – 2,30 m (class 2) and above 2,30 m (class 3). On plots with fewer trees in a 5,64 m radius, a dbh and height for each individual species were recorded.

Additionally, in the large tree subplots (with a radius of 12.62 meter) we are assessing lying deadwood. The exact methods of those inventories are included in the Measurements.

Besides, the measurements mentioned in the chapter Measurements we also make additional measurements in large tree subplot and seedlings subplot. Within the large tree, **tree-related microhabitat (TreM)** visual survey is carried out. For each tree, every TreM is recorded based on Kraus et al. (2016)[1] field guide. Within seedlings subplot, the **depth of litter layer** is measured at each of the four subplots (**Error! Reference source not found.**). The measurements were conducted with a spade by pushing the blade down into first centimetres of mineral soil. The spade was then leaned to show and measure the litter layer profile. In addition, the **depth of fine organic matter** found under the leaf litter layer is measured.

[1] Kraus, D., Bütler, R., Krumm, F., Lachat, T., Larrieu, L., Mergner, U., ... & Winter, S. (2016). Catalogue of tree microhabitats: Reference field list.

3.8 Croatia-Serbia, Serbian part

3.8.1 General demo information

The cross – border demo with riparian forests in located across two countries, Croatia and Serbia. The Serbian part of the demo is situated in the protected area of Biosphere Reserve Gornje Podunavlje along the left bank of Danube river. The restoration area of Serbian part is approximately 28 ha of low vitality poplar (*Populus sp.)* plantations. Therefore, restoration actions aim to strengthen biodiversity and resilience of riparian ecosystems by restoring plantations into mixed oak (*Quercus*) forests.

3.8.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 33 plots to cover the restoration activities conducted within the project (Table 3.8.1).

Table 3.8.1 Amount of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Stand 39e	Cutting and planting	28.00	33
Total:	**-**	**28.00**	**33**

3.8.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting seedlings inventory, sapling inventory, adult tree inventory (Figure 2.1.1). Additionally, in the subplots we are assessing lying deadwood. The exact methods of those inventories are included in the chapter Measurements.

3.9 Romania, Făgăraș mountains

3.9.1 General demo information

The Făgăraș Mountains demo is located in south – east side of the mountains on the Upper Dâmbovița valley. The demo area has approximately 2300 ha with 5 km of river course. The landscape is dominated by old growth beech (*Fagus sylvatica*), silver fir (*Abies alba*) and Norway spruce (*Picea abies*) forests, in between 40 – 80 years old spruce monocultures.

Given complex landscape of fragmented primary, restored and degraded forests, restoration actions focus on connecting the remaining old – growth forests and restoring upper timber line of historical Swiss pine (*Pinus cembra)* forests. To increase the naturalness of buffer zones around primary forests, restoration measures are applied to ensure return of the natural mixed forests.

3.9.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 30 plots to cover the restoration activities planned within the project (see Table 3.9.1). Due to the challenging terrain with very steep slopes, the number of plots in the initial assessment was slightly reduced, despite the extensive size of the restoration areas. As most of the restoration activities are scheduled for 2024, we establish several initial assessment stands in areas where the Foundation Conservation Carpathia (FCC) had previously conducted restoration activities in past projects.

Table 3.9.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Dâmbovița, Piatra Craiului, Rucar	Spruce forest with various interventions	413.20	10
Dâmbovița, Izvoarele Dambovitei, Arges Rucar	Alder habitats area	8.10	5
Dâmbovița, Arges Rucar, Tamasu, Izvoarele Dâmbovița, Nord	Clearcut with planting or grass cutting	73.50	9
Upper Dâmbovița valley	Clearcut without planting or grass cutting	24.14	3
Upper Dâmbovița valley, Valley Dragoslăvenilor River	Unmanaged spruce monoculture after natural disturbance	8.20	3
Total:	**-**	**527.14**	**30**

As restoration activities primarily target different management measures in spruce monoculture forests (Figure 3.9.1). We established 10 plots in spruce forests, which received various interventions including thinning, planting and preservation of deadwood. Additionally, we set up 5 plots in areas designated as alder habitats. Another 9 plots were established in

clearcut areas where FCC planted various types of trees and occasionally conducted grass cutting. Moreover, 3 plots were placed in clearcut areas without planting or grass cutting left for natural development. While another 3 plots were established in early seral phases of spruce monocultural forests that had experienced disturbance, such as windthrow. We intend to compare these naturally restored areas with those subjected to human-initiated restoration activities.

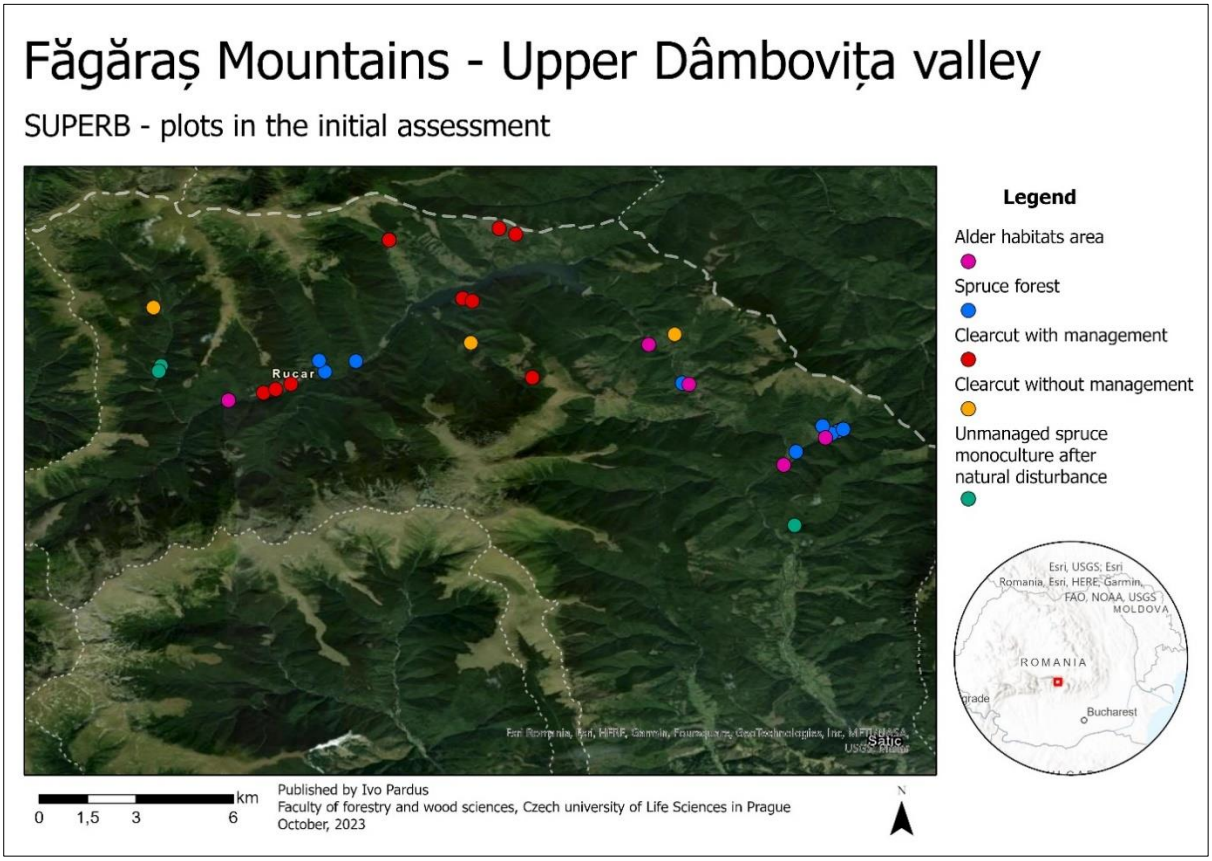


Figure 3.9.1 Map of selected plots for the initial assessment.

3.9.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting seedlings inventory, sapling inventory, adult tree inventory (Figure 2.1.1). Additionally, in the subplots we are assessing richness of ground vegetation layer and lying deadwood. The exact methods of those inventories are included in the chapter Measurements.

3.10 Denmark, Nordsjælland

3.10.1 General demo information

The demo area is a forest complex consisting of three connected forests – Gurre Vang , Horserød Hegn and Klosterris Hegn – with a total area of app. 1200 ha located in the northern part of Sealand rather close to the northern coastal line of Sealand. The forests are embedded within the North Sealand National Park, which covers a wide variety of areas with very different land use.

The forest complex has from 2005 and until recently been managed by close to nature forestry for a range of objectives, but with timber production and recreational purposes being the main objectives. The current vegetation type is deciduous dominated production forest with mostly Beech (*Fagus sylvatica)* and Oak (*Quercus sp.)* but with a pronounced amount of conifers – especially Norway spruce (*Picea abies)*.

A conversion of managed forests to unmanaged biodiversity rich forests will be realised. The restoration goal is open ended with a focus on elevating number of habitats. This will be a challenge due to the fragmented forest landscape and the surroundings, which are mainly intensively used agricultural land. The forest patches are even aged stands with very little variation in tree species compositions and lacking or have very low amounts of dead wood. Besides the little variation in tree species, also shrub species are absent. Furthermore, the demo area has been intensively drained during the years through a network of drainage channels.

A number of restoration activities are planned within the demo area. These activities include grazing, restoration of hydrology and enrichment plantings.

3.10.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 24 plots to cover the restoration activities within the project (See Table 3.10.1). One of the control plots is located within a beech stand, the other is located in a conifer stand.

Table 3.10.1 Number of plots per restoration action assessed within the initial assessment.

Restoration site	Restoration action	Area (ha)	Number of plots
Horserød Hegn, Klosterris Hegn, Gurre Vang	Control	-	2
	Enrichment planting	9.00	10
	Hydrology restoration	52.00	10
Horserød Hegn, Gurre Vang	Grazing	47.00	2
Total:	**-**	**108.00**	**24**

They are selected within the restoration area in such a way that the plot will expectedly be in the centre of the restored area.

3.10.3 Measurements

To assess the initial conditions of the stand, we are using the general measurements protocol of conducting the sapling, seedling and adult trees inventory (Figure 2.1.1). Additional we measured lying dead wood. The exact methods of those inventories are included in chapter Measurements.

3.11 Denmark, Thy

3.11.1 General demo information

The demo area is located in Thy, Northern Jutland and the forests are state owned and managed by the Ministry of Environment of Denmark, Nature Agency Thy.

The current vegetation type is overall temperate forest, with large areas of coniferous forest plantation established for production and protection from sand drift, in the 1810s. Species included in this area are native species like Norway spruce (*Picea abies)* and Scots pine (*Pinus sylvestris)*, but also (and mostly) both non-native and invasive coniferous species as Sitka spruce (*Picea sitchensis),* Lodgepole pine *(Pinus contorta),* Dwarf mountain pine (*Pinus mugo)* and Silver fir *(Abies alba).* Over the years deciduous tree species have been introduced throughout all plantations, including *Nystrup* plantation. This includes species like birch (*Betula sp.), beech (Fagus sylvatica)* and oak (*Quercus sp.).*

The restoration actions include; clear cutting with focus on invasive and non-native species, closing ditches to establish natural hydrology, coherence of open habitats, re-establishment of forest clearings and burning off forest floor, to enhance growth of both native tree and herbal plant species. The overall goal is an open-ended management with focus on elevating the number of habitats and dispersal potential of species; largely done by clearing the uniform even-aged plantings of non-native tree species, and reintroducing a variety of climate change resistant native species, both shrubs, bushes, and deciduous and coniferous tree species. A light open corridor will be established to ensure dispersal possibilities through the forest. Restoring of hydrology by closing man-made ditches will be carried out throughout the corridor, creating a large variation in humidity and light.

3.11.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 48 plots to cover the restoration activities within the project (Table 3.11.1).

Table 3.11.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Vegebjerg	Control	-	1
	Thinning	96.40	17
	Removal of topsoil	3.53	1
	Burning of forest floor	6.75	10
	Clearing and planting	2.20	9
	Clearing	18.40	10
Total	**-**	**127.28**	**48**

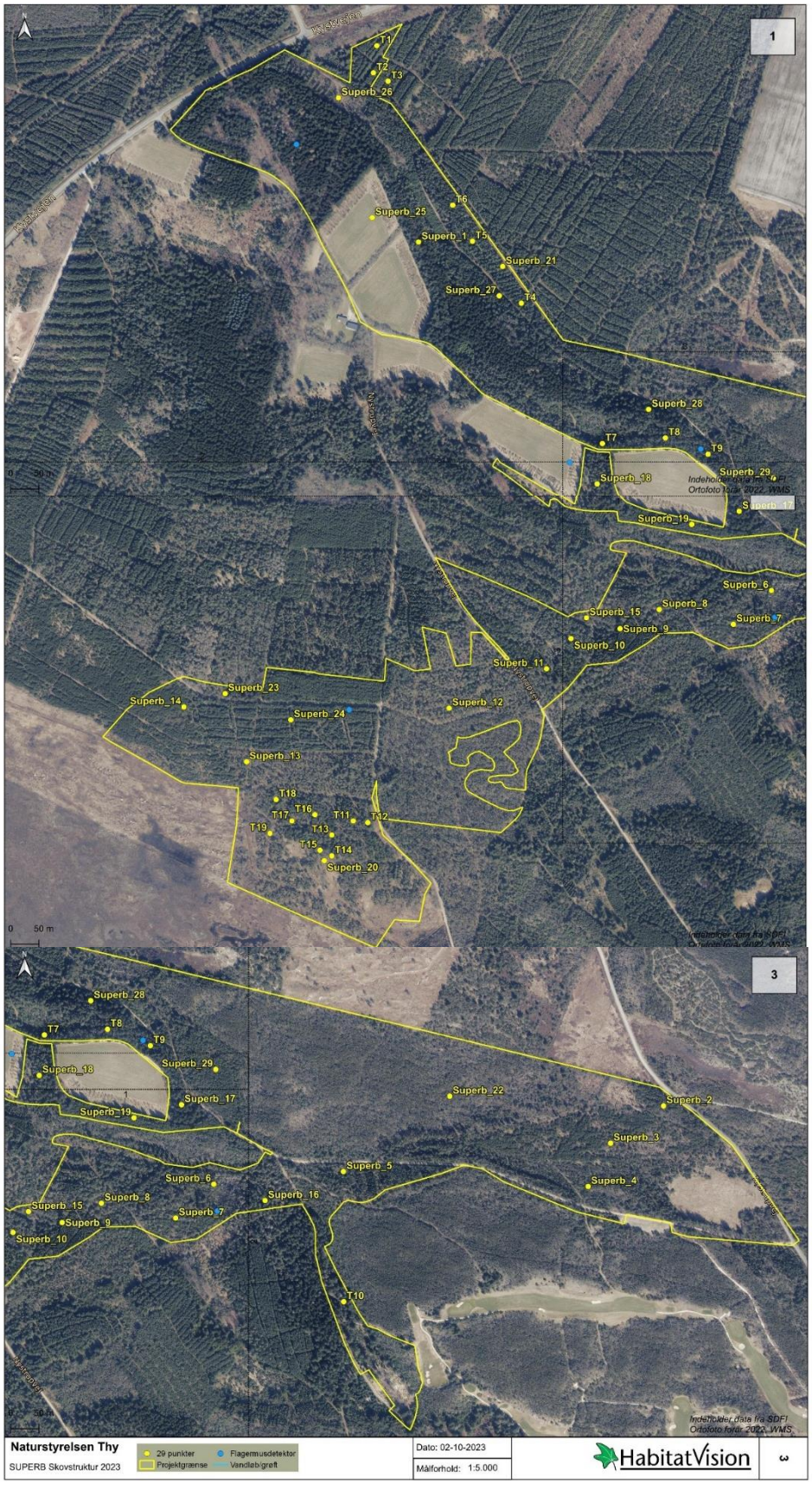


Figure 3.11.1 Map of selected plots for the initial assessment.

3.11.3 Measurements

To assess the initial conditions of the stand, we are using the general measurements protocol of conducting the sapling, seedling and adult trees inventory (Figure 2.1.1). Additional we measured lying dead wood. The exact methods of those inventories are included in chapter Measurements.

As a supplement to this monitoring method, a pinpoint frame (0.5 x 0.5 m) is used where all species are pinpointed (incl. mosses and lichens) in the center of the 5 meter circle. This provides valuable supplementary data about two groups of organisms: mosses and lichens, which have a particular focus in the National Park of Thy. The reason we have carried out an extended monitoring is due to a collaboration with the National Park Thy.

3.12 Spain, Castilla y Leon

3.12.1 General demo information

The demo area is in the northwest of Spain, at the western end of the Cantabrian Mountains in the province of León, bordering Lugo to the west and the Principality of Asturias to the north. The demo area has more than 250,000 hectares covered by forest land, which represents more than 80% of its total surface area, of which around 130,000 hectares are woodlands (approximately 50% of the forest surface area).

According to the Forestry Map of Spain, the vegetation formations are dominated by treeless areas (53%), mostly occupied by ericaceous scrubland, the main source of which is forest fires. In the areas protected from fire, which are difficult to access or have a higher degree of humidity, there are valuable forests, which, in order of abundance, are: “melojo” oak groves (*Quercus pyrenaica*) (14%), Sessile pine forest (*Pinus sylvestris*) (5%), chestnut groves (*Castanea sativa*) (5%), holm oak (*Quercus ilex*) (4%) and mixed native hardwood forests in the Atlantic and Mediterranean biogeographical regions (3% of each). There are also, to a lesser extent, stands of radiata pine, oak woods)(*Quercus robur* and/or *Q. petrae)*, riparian forests, poplar groves (*Populus sp.)*, pine forests (*Pinus pinaster* and *Pinus nigra)*, birch groves (*Betula spp.*), etc.

We have three main problems to solve that are connected: to face the rural abandonment, to change the fuel model of the forest and to improve brown bear habitat.

Restoration activities carried out in the demo area cover a total area of 135.55 has. These restoration activities will consist of the enrichment plantings of native species seedlings, scattered in existing stands and/or bare land. To promote rural development, part of the area will be planted with fruit rich chestnut (*Castanea sativa*) plants, mostly in one of the restoration sites, quite prone to chestnut recollection. Besides this, tending and thinning will be performed in all four restoration sites, mainly in oak (*Quercus pyrenaica*).

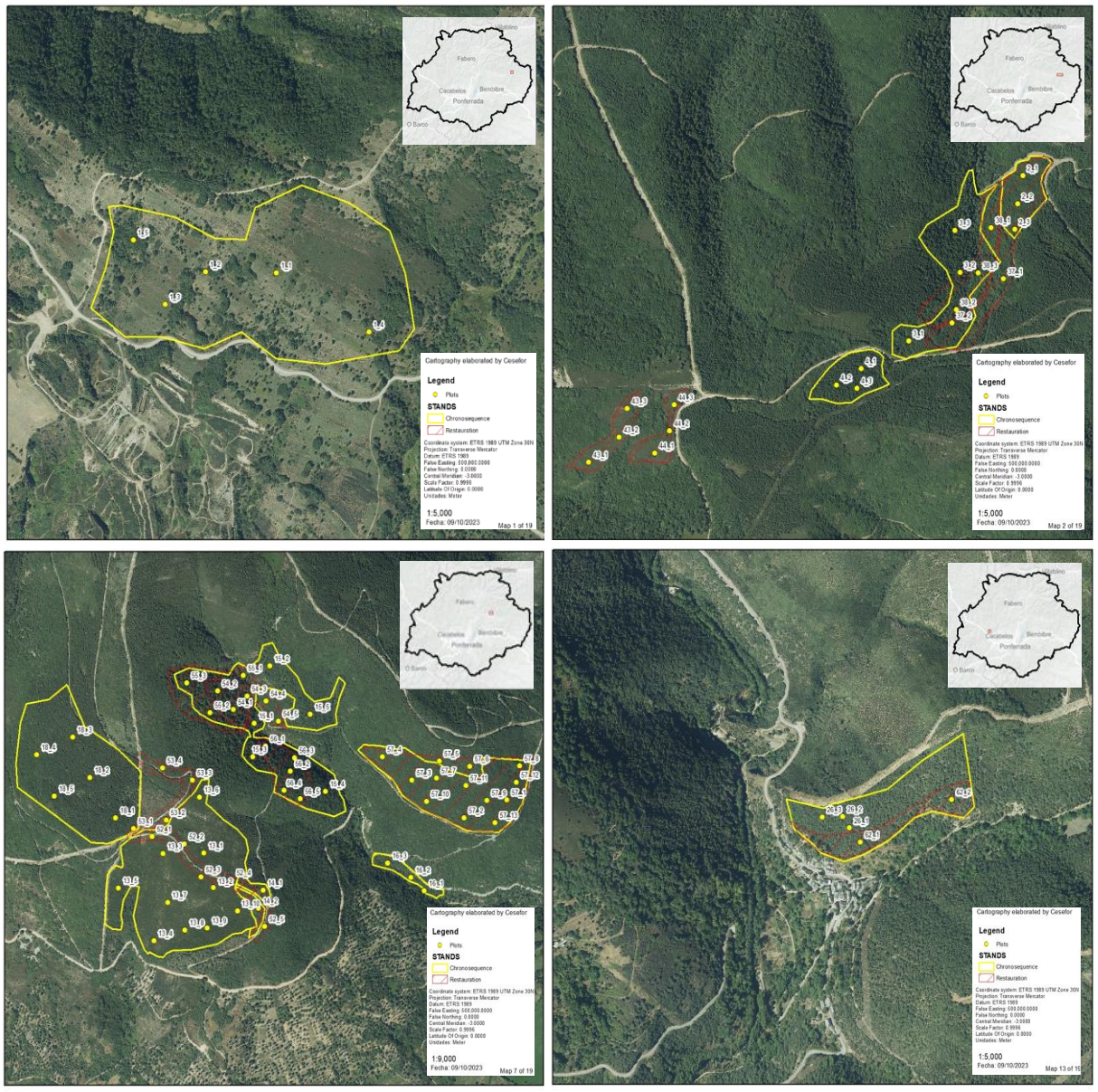
3.12.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 293 plots to cover the restoration activities within the project. The treatments to be carried out are: silviculture, enrichment plantings and chestnut plantations (Table 3.12.1). In addition, control plots will also be considered, which are plots located in stands where no restoration activities will be carried out (these are included in the chronosequence stands). Treatment plots are located in restoration stands (Figure 3.12.1).

Table 3.12.1 Number of plots per restoration action assessed within the initial assessment.

Restoration site	Restoration action	Area (ha)	Number of plots
Corullón, Igüeña, Noceda, Trabadelo	Control	-	150
	Silviculture	101.41	80
	Enrichment plantings	28.51	51
Trabadelo, Noceda, Corullón	Castania sativa plantations	5.63	12
Total:	**-**	**135.55**	**293**

Figure 3.12.1 Maps with sampling plots within the stands. Chronosequence stands correspond to the control and restoration stands to the treatments (4 out of 19 maps).



3.12.3 Measurements

To assess the initial conditions of the stand, we are using the general measurements protocol of conducting the sapling, seedling and adult trees inventory (Figure 2.1.1). Additional we measured lying dead wood in the sapling plots. The exact methods of those inventories are included in chapter Measurements. In addition to the measurements described in the monitoring protocol we also measured **tree-related microhabitats (TreM)** in the large tree subplot. For each tree, every TreM is recorded based on Kraus et al. (2016)[2] field guide.

[2] Kraus, D., Bütler, R., Krumm, F., Lachat, T., Larrieu, L., Mergner, U., ... & Winter, S. (2016). Catalogue of tree microhabitats: Reference field list.

3.13 France, Nouvelle-Aquitaine

3.13.1 General demo information

The demo area is located in the Landes of Gascony Forest in Nouvelle-Aquitaine region of south – west France. The landscape of the demo is dominated by maritime pine (*Pinus pinaster*) plantations with short-rotation forest management. The area suffers from various disturbances like forest fires, windstorms and bark beetle outbreaks. Therefore, restoration actions aim to improve intensive Maritime pine (*Pinus pinaster*) plantations affected by various disturbances through the installation of a network of hedgerows. The objective is to plant 10 km of mixed broadleaved hedgerows along the borders of maritime pine plantations, with birch (*Betula spp.*), rowan (*Sorbus spp.*), oaks (*Quercus spp.*), pear (*Pyrus spp.*) and others, to increase biodiversity and forest resilience.

The specific goals for the initial assessment of the French demo are to follow the survival of the planted broadleaved trees and the development of the maritime pine stand next to a hedgerow. The plot design and measurements as conducted in the plots are tailor made for these specific goals and will be adapted to the local situation.

3.13.2 Sampling design

The number of plots is dependent on the area of the restoration sites, which is not certain yet for the French demo at this stage of the project. We propose to set up 1 plot every 100 m of planted hedgerow (Table 3.13.1).

Table 3.13.1 Number of initial assessment plots per restoration action within the initial assessment

Restoration site	Restoration action	Area (km)	Number of plots
Landes	Planted hedgerows	10	100
Total:	**-**	**10**	**100**

Because of the characteristics of the French restoration activities, we propose to alter the plot design to fit as best as possible to the local situation. In Figure 3.13.1, the dashed line represents the two seedling subplots, with an extent of 25 m by 3 m, to fit with the linear planting scheme. One of the seedling subplots will be placed in the newly planted hedgerow and one will be placed in the neighbouring maritime pine stand. The large tree, overstory and the sapling subplot are omitted, because there will be no adult trees on the site when restoration will start.

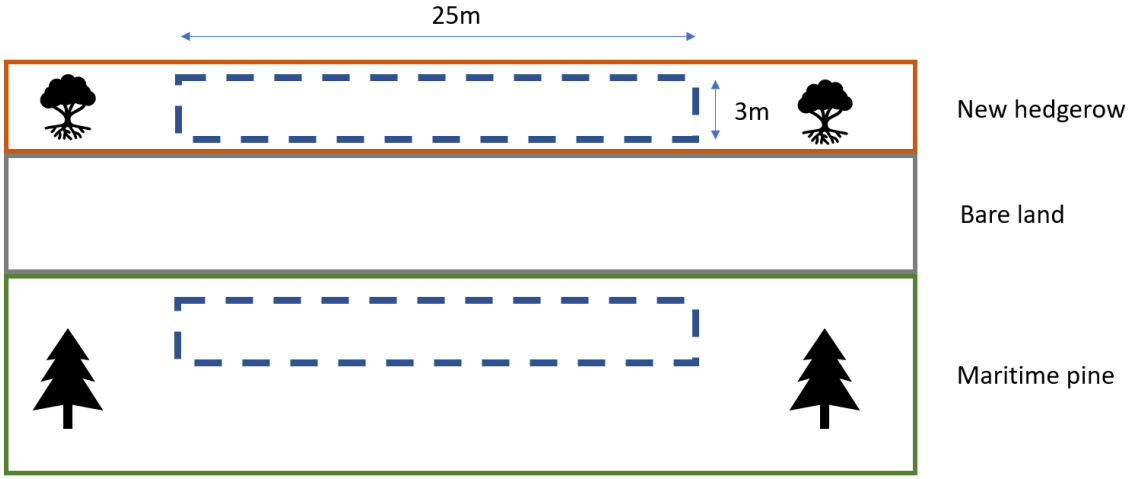


Figure 3.13.1 Proposed design and lay-out of a plot in a French restoration site

3.13.3 Measurements

To assess the initial conditions of the stand, we are using the general measurements protocol of conducting the seedling and overstory inventory (Figure 2.1.1). The exact methods of those inventories are included in chapter Measurements. The most important variables are the assessment of the count and survival rate per tree species.

3.14 Serbia

3.14.1 General demo information

The coppice forests in Serbian demo area are located in several places across the country. The demo includes approximately 280 ha of coppice forests for restoration with varying tree species; sessile oak (*Quercus petraea),* Turkey oak *(Quercus cerris),* Hungarian oak *(Quercus frainetto)*, European beech (*Fagus sylvatica)*. As coppices are neglected in terms of silviculture, the condition of forests is unfavourable for maintaining resilient ecosystem. Therefore, restoration actions aim to improve management and restore ecosystem which can be self-sustaining and can provides benefits for both biodiversity and people.

3.14.2 Sampling design

To conduct the initial assessment field surveys, we carefully selected 50 plots to cover the restoration activities conducted within the project (Table 3.14.1).

Table 3.14.1 Number of plots per restoration action assessed within the initial assessment

Restoration site	Restoration action	Area (ha)	Number of plots
Moravci	Planting, sowing and cutting offshoots	28.34	8
Vujan	Planting, sowing and cutting offshoots	81.03	20
Vraćevšnica	Planting, sowing and cutting offshoots, shelterwood cutting	139.02	20
Žiča	Planting, sowing and cutting offshoots	1.20	1
Cer	Planting, sowing and cutting offshoots	1.50	1
Total:	**-**	**251.09**	**50**

The plots only have one central sampling point to avoid the bias of the plot sampling locations. Location of the centre is randomly determined within the stand and plots are randomly selected within the restoration site. At larger restoration sites (Moravci, Vujan, and Vraćevšnica) where different restoration measures takes place, the assessment plots are randomly selected within those measures.

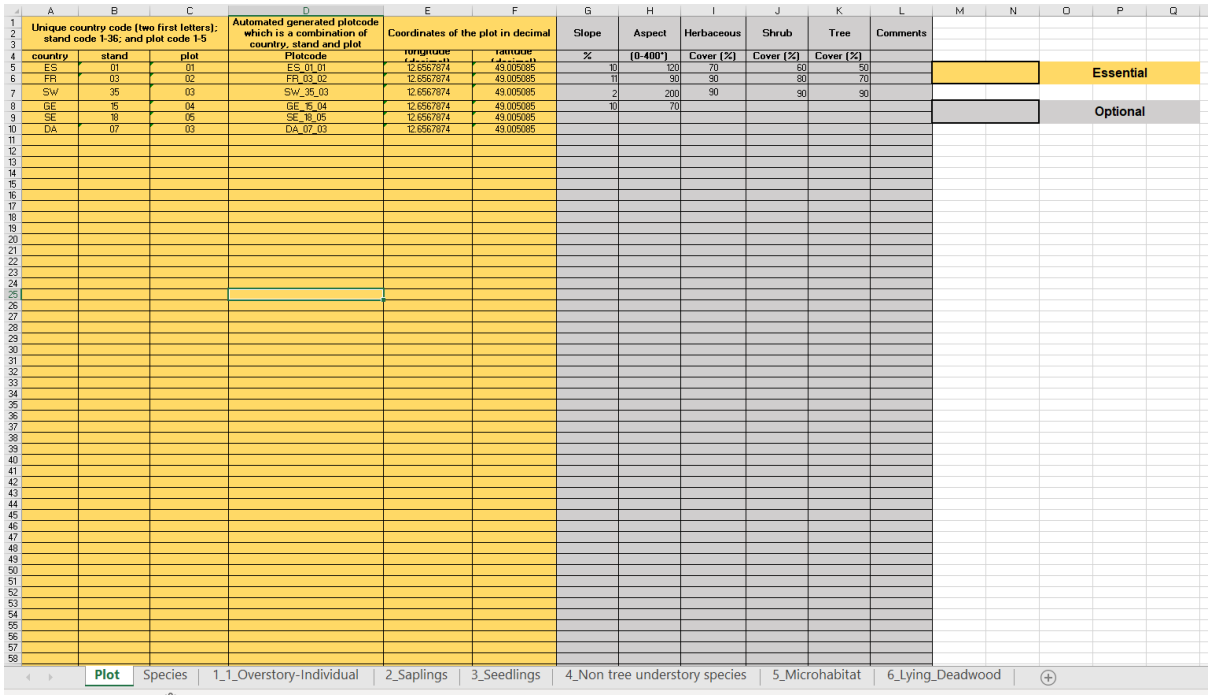
3.14.3 Measurements

To assess the initial conditions of the stands, we are using the general measurements protocol of conducting seedlings inventory, sapling inventory, adult tree inventory (Figure 2.1.1). Additionally, in the subplots we are assessing richness of ground vegetation layer and lying deadwood. The exact methods of those inventories are included in the chapter Measurements.

4 Appendix

4.1 Excel spreadsheet

Table 4.1.1 Plot variables



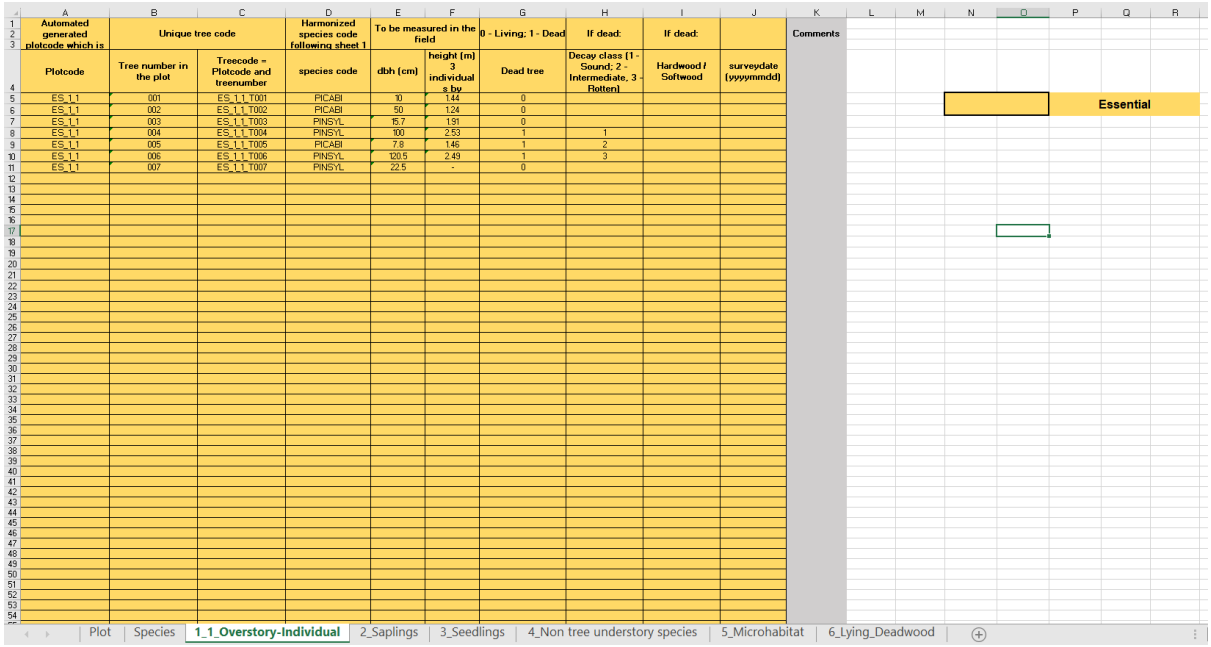
Unique country code (two first letters); stand code 1-36; and plot code 1-5			Automated generated plotcode which is a combination of country, stand and plot	Coordinates of the plot in decimal		Slope	Aspect	Herbaceous	Shrub	Tree	Comments
country	stand	plot	Plotcode	longitude	latitude	%	(0-400°)	Cover (%)	Cover (%)	Cover (%)	
ES	01	01	ES_01_01	12.6567874	49.005085	10	120	70	60	50	
FR	03	02	FR_03_02	12.6567874	49.005085	11	90	90	80	70	
SW	35	03	SW_35_03	12.6567874	49.005085	2	200	90	90	90	
GE	15	04	GE_15_04	12.6567874	49.005085	10	70				
SE	18	05	SE_18_05	12.6567874	49.005085						
DA	07	03	DA_07_03	12.6567874	49.005085						

Essential

Optional

Plot | Species | 1_1_Overstory-Individual | 2_Saplings | 3_Seedlings | 4_Non tree understory species | 5_Microhabitat | 6_Lying_Deadwood

Table 4.1.2 Overstory & Sapling variables

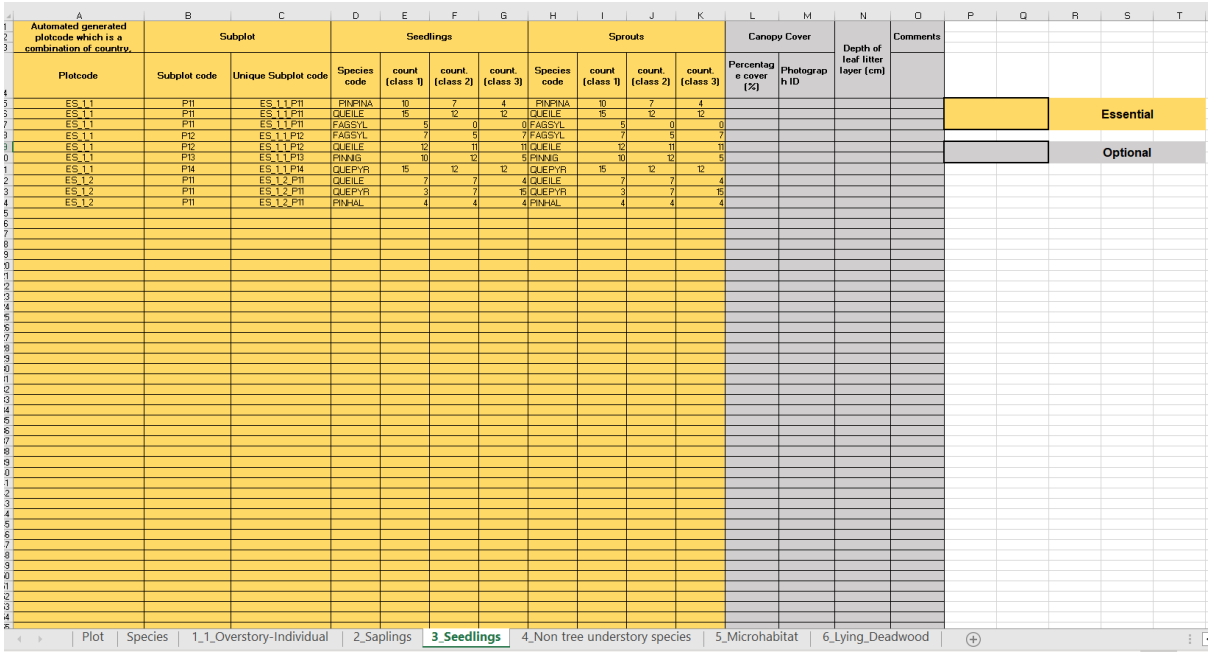


Automated generated plotcode which is	Unique tree code		Harmonized species code following sheet 1	To be measured in the field		0 - Living; 1 - Dead	If dead:	If dead:		Comments
Plotcode	Tree number in the plot	Treecode = Plotcode and treenumber	species code	dbh (cm)	height (m) 3 individuals by	Dead tree	Decay class (1 - Sound; 2 - Intermediate, 3 - Rotten)	Hardwood / Softwood	surveydate (yyyymmdd)	
ES_1_1	001	ES_1_1_T001	PICABI	10	1.44	0				
ES_1_1	002	ES_1_1_T002	PICABI	50	1.24	0				
ES_1_1	003	ES_1_1_T003	PINSYL	15.7	1.91	0				
ES_1_1	004	ES_1_1_T004	PINSYL	100	2.53	1	1			
ES_1_1	005	ES_1_1_T005	PICABI	7.8	1.46	1	2			
ES_1_1	006	ES_1_1_T006	PINSYL	120.5	2.49	1	3			
ES_1_1	007	ES_1_1_T007	PINSYL	22.5	-	0				

Essential

Plot | Species | 1_1_Overstory-Individual | 2_Saplings | 3_Seedlings | 4_Non tree understory species | 5_Microhabitat | 6_Lying_Deadwood

Table 4.1.3 Seedlings variables



Automated generated plotcode which is a combination of country,	Subplot		Seedlings				Sprouts				Canopy Cover		Depth of leaf litter layer (cm)	Comments						
Plotcode	Subplot code	Unique Subplot code	Species code	count (class 1)	count. (class 2)	count. (class 3)	Species code	count (class 1)	count. (class 2)	count. (class 3)	Percentage cover (%)	Photograph ID								
ES_1_1	P11	ES_1_1_P11	PINPINA	10	7	4	PINPINA	10	7	4										
ES_1_1	P11	ES_1_1_P11	QUEILE	15	12	12	QUEILE	15	12	12										
ES_1_1	P11	ES_1_1_P11	FAGSYL	5	0	0	FAGSYL	5	0	0										
ES_1_1	P12	ES_1_1_P12	FAGSYL	7	5	7	FAGSYL	7	5	7										
ES_1_1	P12	ES_1_1_P12	QUEILE	12	11	11	QUEILE	12	11	11										
ES_1_1	P13	ES_1_1_P13	PINNIG	10	12	5	PINNIG	10	12	5										
ES_1_1	P14	ES_1_1_P14	QUEPYR	15	12	12	QUEPYR	15	12	12										
ES_1_2	P11	ES_1_2_P11	QUEILE	7	7	4	QUEILE	7	7	4										
ES_1_2	P11	ES_1_2_P11	QUEPYR	3	7	15	QUEPYR	3	7	15										
ES_1_2	P11	ES_1_2_P11	PINHAL	4	4	4	PINHAL	4	4	4										

Essential

Optional

Plot | Species | 1_1_Overstory-Individual | 2_Saplings | 3_Seedlings | 4_Non tree understory species | 5_Microhabitat | 6_Lying_Deadwood