

NATIONAL  
DEVELOPMENT  
PLAN 2020



**EUROPEAN UNION**  
European Regional  
Development Fund

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I N V E S T I N G   I N   Y O U R   F U T U R E

**Climate change mitigation potential of trees in shelter belts of  
drainage ditches in cropland and grassland  
Nr. 1.1.1.1/21/A/030**

Implementation period 3/01/2022 – 30/11/2023

Latvian State Forest Research Institute SILAVA  
&  
Ltd "Latvian Rural Consultation and Education Centre"

**Deliverable 1.2  
REPORT**

**Site types in buffer zones around drainage ditches and  
GIS data for identification of  
growth conditions and other  
characteristics of the  
shelter belts**

**Salaspils, 2023**

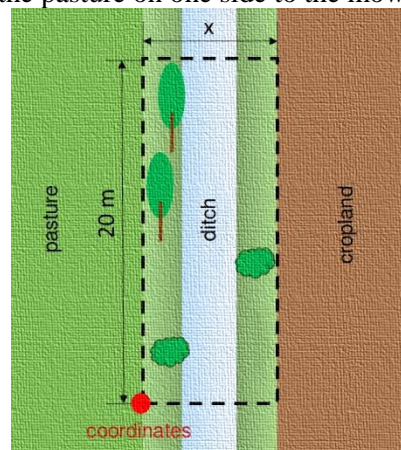
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# Field measurements

## Survey methodology

1. On one site should be placed 3 plots, which are located 250 m from each other.
2. In the South-Western directional corner of the first plot, according to the Latvian coordinate system, coordinates are determined using a handheld GPS device, which will serve as a starting point for the creation of the plot and, later, to recognize the plot in orthophoto images.
3. To each plot a number is assigned depending on the location near the object (for example, at object 18, 18-2, 18-3 plots are located).
4. When measuring plots, the performer(s) of the work and the date on which the survey was carried out must be noted.
5. Each plot consists of a 20 m long strip, but the width is different and depends on the total width of the two slopes of the ditch on the object surveyed (Figure 1), forming a rectangular shape:
  - 5.1. From the arable layer on one side to the arable layer on the other side of the ditch so that all woody vegetation is included in the plot;
  - 5.2. From the mowed part of the pasture on one side to the mowed part of the pasture on the other.



**Figure 1. Plot diagram.**

6. Within the plot all standing trees and shrubs (alive and dry-standing) are measured, if the average height of trees or shrubs at a height of 1.3 m above the root neck (hereinafter - 1.3 m in height) is 2.1 cm and more. Parameters, which are determined in the field protocol are shown in Table 1:
  - 6.1. species of trees and shrubs;
  - 6.2. an average diameter at 1.3 m using a calliper (accuracy of 0.1 cm);
  - 6.3. height using a height measuring device such as Vertex (accuracy of 0.1 m):
    - 6.3.1. The height of a tree shall be measured from the place from which the top of the tree is precisely visible.
    - 6.3.2. In the case of a tree growing obliquely, a calculation shall be made to determine the height, mentioning that the tree tilted on/from or parallel to the centre of the ditch using the formula (1):

$$h_i = \sqrt{h_v^2 + l_h^2} \quad (1)$$

where

$h_i$  – tree height, m

$h_v$  - measured vertical height, m

$l_h$  - distance of projection of the top (apex) of the tree to the base of the tree, m

- 6.3.2.1. the height is measured from the place against which the slope of the tree is directed;

- 6.3.2.2. for height measurements, the distance is determined from a place perpendicular to the top on the ground or "below the top";

7. All trees and shrubs thinner than 2.1 cm in height of 1.3 m should be recorded in the survey, including the number by species and the average height of the visually selected average specimen of undergrowth trees (Table 2). All shoots that have grown out of the ground or stump and are at least 10 cm high are counted during the inventory.

1. table

**Fieldwork protocol**

Date	Measured by	PL no.	PL width, m (x)	Species	D, cm	H, m	Notes
17.06.22.	Eve	18-1	5.2	B	7.2	8.5	
				B	3.9	5	Bevel

2. table

**Undergrowth measurement protocol**

Date	Measured by	PL no.	PL width, m (x)	Species	Number N	D, cm	H, m	Notes
17.06.22.	Eve	18-2	5.4	B	6	1.6	2.7	
				warbler	20	2	4	

## First data

By surveying the drainage ditches of the territory of Latvia and carrying out surveys of the naturally formed vegetation, it was found that the most common willows of various species, *Salix spp.*, then white alders *Alnus incana*, spruces *Picea abies*, ravens *Frangula alnus*, black alders *Alnus glutinosa*, birches *Betula pendula*, *Betula pubescens*, voles *Viburnum opulus* and ash *Fraxinus excelsior*, yews *Padus avium*, oaks *Quercus robur*. When maintaining the ditches, the trees growing on their sides are periodically cut down, so there are always juvenile, fast-growing trees in the buffer strips, the height of the longer-grown strips is 10-20 meters. In the "undergrowth" of the buffer strips, there are younger trees and willows that form bushes and garden fugitive fruit trees. Field measurements data are in file D.1.2. Copy of Field\_protocols data\_ERAF30\_

## Measurements on four plots at multipurpose tree planting in Skrīveri

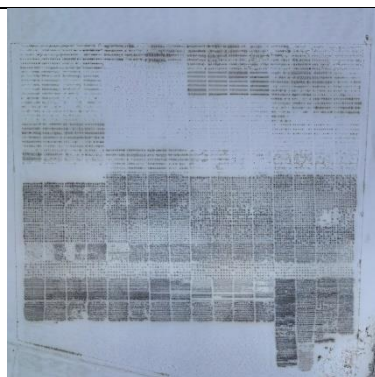
### Phenology measurements

Phenological measurements were conducted based on remote sensing orthophoto maps taken once a month within the research area from a drone, at an altitude of 120 meters, resulting in the creation of high-resolution orthophoto maps throughout the both years.





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2022.02.



2022.03.



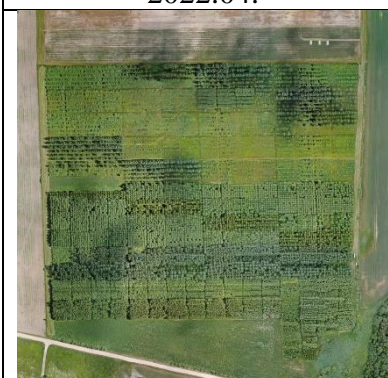
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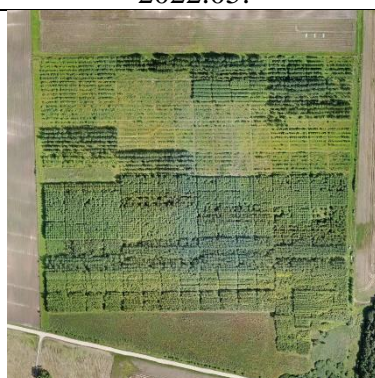
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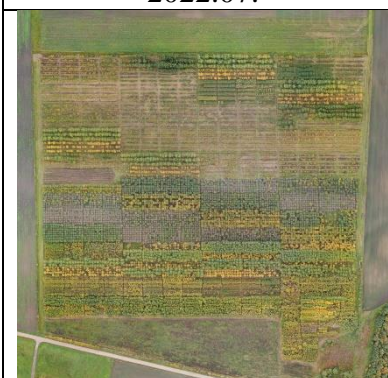
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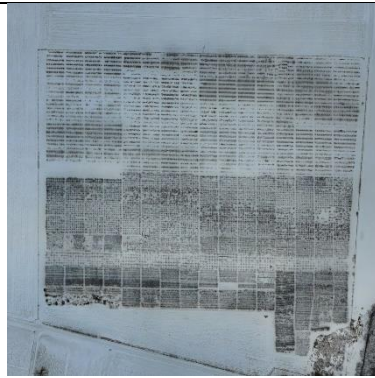


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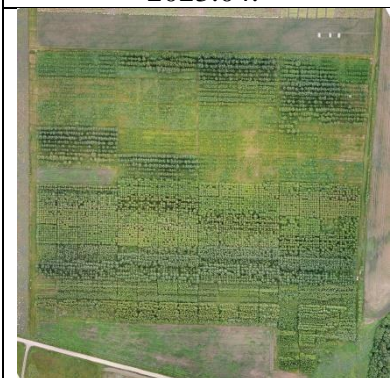
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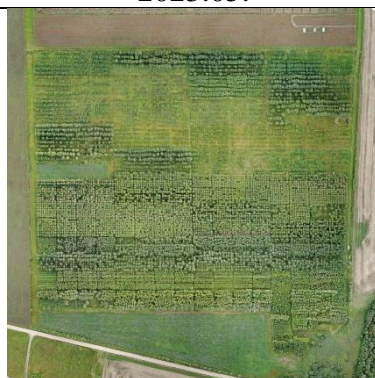
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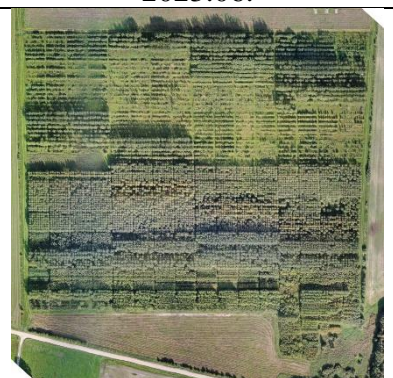
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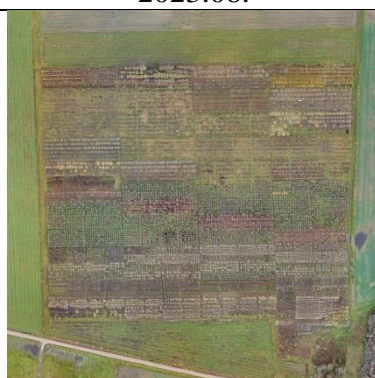
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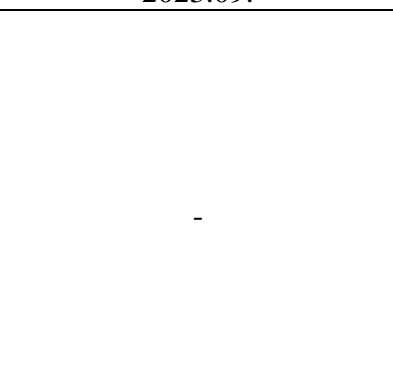
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

















































































































































































































































2023.10.



2023.11.



Phenology table depicts the dynamics of the study area throughout the time period from January 2022 to November 2023, highlighting the significant differences in spring and autumn – showing which tree species leaf out earlier or later, as well as which species shed their leaves sooner or later.

Year	Tree sp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2022	Hybrid Alder												
2023													-
2022	Grey Alder												
2023													-
2022	Black Alder												
2023													-
2022	Birch												
2023													-
2022	Aspen												
2023													-
2022	Sweet Cherry												
2023													-
2022	Linden												
2023													-
2022	Aspen												
2023													-
2022	Hybrid Aspen												
2023													-
2022	Populus												
2023													-
2022	Salix												
2023													-

-  Light snow
-  Deep snow
-  Leafless period
-  Sprouting
-  Foliating
-  Full leaf out
-  Yellowing
-  Partially bare