



EuropeAid Project Reference no: **CCGS/124**

CFCU/TR2013/0327.05.01-02/124 – EuropeAid/138406/ID/ACT/TR

This Programme is co-funded by the European Union and Republic of Turkey

## Project: Development of a common protocol to assess the impact of forest management practices on climate change

# Field Sampling

## Deliverable 2.1



May 2018





EuropeAid Project Reference no: **CCGS/124**

CFCU/TR2013/0327.05.01-02/124 – EuropeAid/138406/ID/ACT/TR

This Programme is co-funded by the European Union and Republic of Turkey

---

## Contents

1. Scope.....	3
2. The results of sample plots .....	9
3. The results of sample trees .....	11



EuropeAid Project Reference no: **CCGS/124**

CFCU/TR2013/0327.05.01-02/124 – EuropeAid/138406/ID/ACT/TR

This Programme is co-funded by the European Union and Republic of Turkey

## 1. Scope

The aim of the Action is to report result and data field sampling needed monitor inter-annual fluctuation of net carbon storage, focusing on CO<sub>2</sub> (no other GHG) in forests. The Action involves all data and analysis results used the development of common guidelines (Protocol) for the assessment of carbon storage in planted forests through afforestation/reforestation projects. This common protocol will also assess and validate forest management practices and applied measures in these types of areas, aiming to improve the CO<sub>2</sub> removal/sequestration balance through management treatments.

The Action incorporates sample plots and sample trees data. The results of sample plots include stand type, stand diameter (two type: mean diameter and quadratic mean diameter), stand height, basal area, number of trees, herbaceous biomass, shrub biomass, litter biomass, lying dead wood biomass, herbaceous carbon amount, shrub carbon amount, litter carbon amount and lying dead wood carbon amount. The Sample trees results include diameter at breast height, tree height, stem biomass, branch biomass, foliage biomass, stem carbon amount, branch carbon amount and foliage carbon amount.

The project site (Vakfikebir forest) has approximately 200 ha of scattered planted areas of beech (*Fagus orientalis*), up to 34 years old (Image 1). Past management was based on previous management plans (1973, 1984, 2006 & 2016), with different priorities.

Field measurements were applied to estimate the aboveground live tree volume, using allometric equations developed in this project. Field measurements were also applied to estimate the aboveground live tree biomass in branches and foliage, as well as the shrub/herbaceous volume. Other measurements provided data for standing dead wood, lying dead wood and litter. The parameters to be measured/assessed were included in the Inventory sheet.

The beech plantations were stratified into 10-year age classes (4 age classes overall) and 3 types of site quality in the forest (good, medium, poor). In order to efficiently estimate the carbon stock, random stratified sampling will be applied. Stratification minimizes the variation within each stratum therefore providing a more precise estimate, with less effort and cost. Effort has been made to equally allocate at least three sample plots to each age classes. For each age class, effort was also made to include the full range of site conditions (from poorest to best). Sampling will therefore be carried out in 3 plots for each age class – site quality combination (stratum) which sums up to 32 plots overall (Table 1).

The selection of the size and shape of the plots was based on capturing the variation of the stand at each sampling. The plot size will vary between 100 to 600 m<sup>2</sup> depending on the age class and site quality (smaller area for trees of smaller dimensions). Each plot will include at least 30 trees, which exceeds the 10–20 trees



EuropeAid Project Reference no: **CCGS/124**

CFCU/TR2013/0327.05.01-02/124 – EuropeAid/138406/ID/ACT/TR

This Programme is co-funded by the European Union and Republic of Turkey

---

set as a rule of thumb in order to obtain a representative sample (ForestWorks ISC, 2014). The distribution of site quality and age classes the sample plots is shown in Table 1.

**Table 1. Distribution of site quality and age classes of sample plots**

Site Quality	Age class (no of sample plots)			
	I	II	III	IV
	0 - 10	10 - 20	20 - 30	30 - 40
Good (A)	9	11	5	2
	10	20	19	17
	16	21	26	25
Medium (B)	8	4	22	6
	12	7	27	28
	14	18	32	29
Poor (C)	13	23	3	1
	15	31	30	24



EuropeAid Project Reference no  
CFCU/TR2013/0327.05.01-02/124 – Europe  
his Programme is co-funded by the European Uni

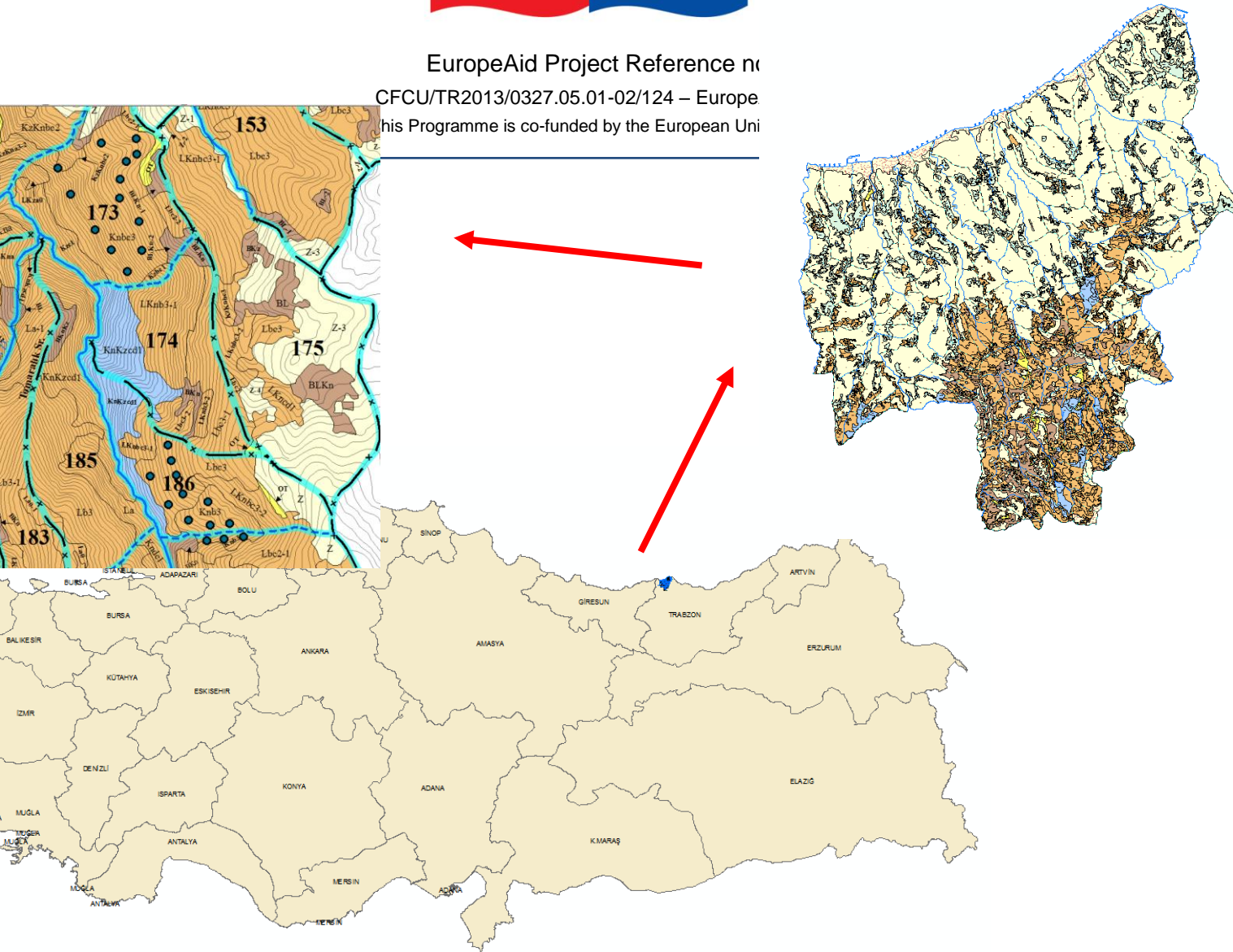


Figure 1. Overview of the project areas



The sampling plots will be allocated between planning units of the Vakfıkebir State Forest (Figure 2 and Figure 3) as follows:

Vakfıkebir planning unit: 19 sampling plots

Tonya planning unit: 13 sampling plots

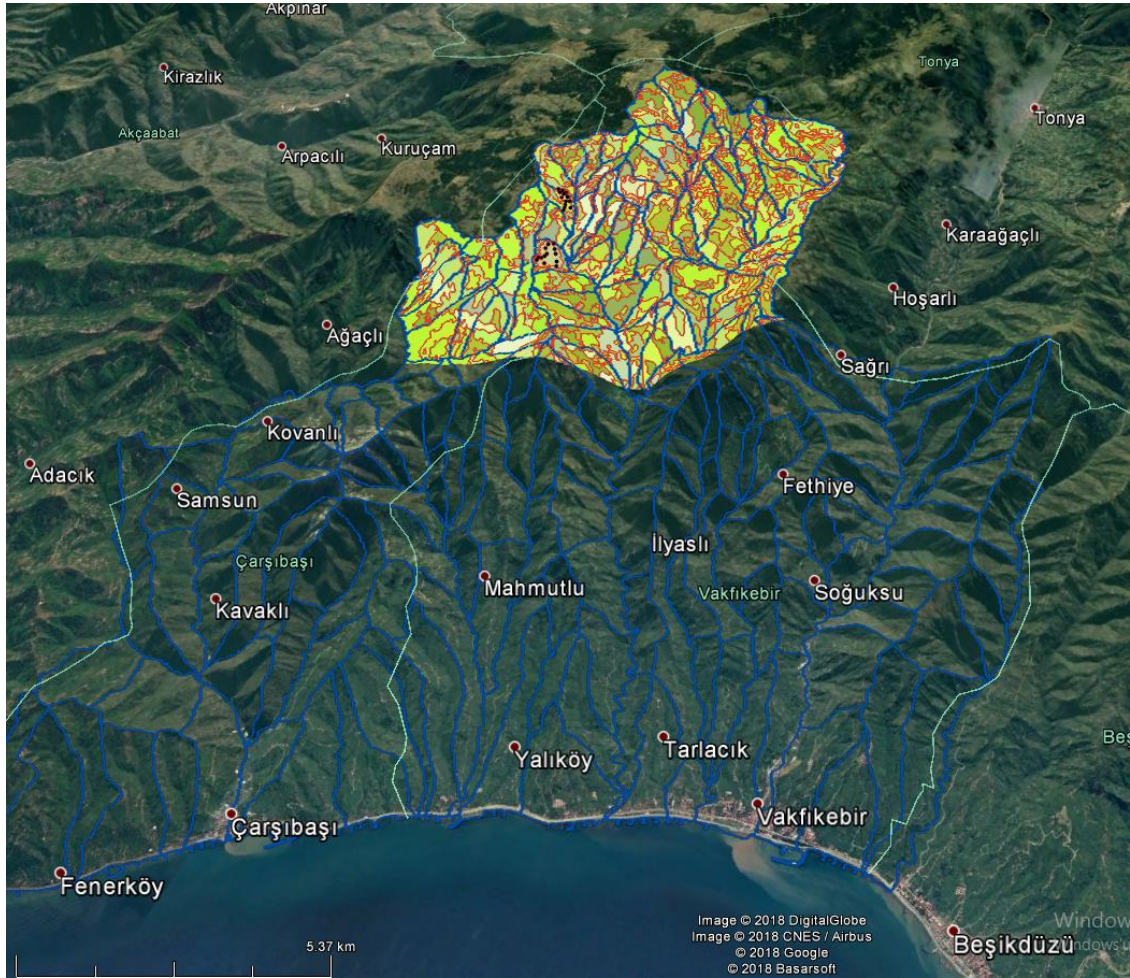
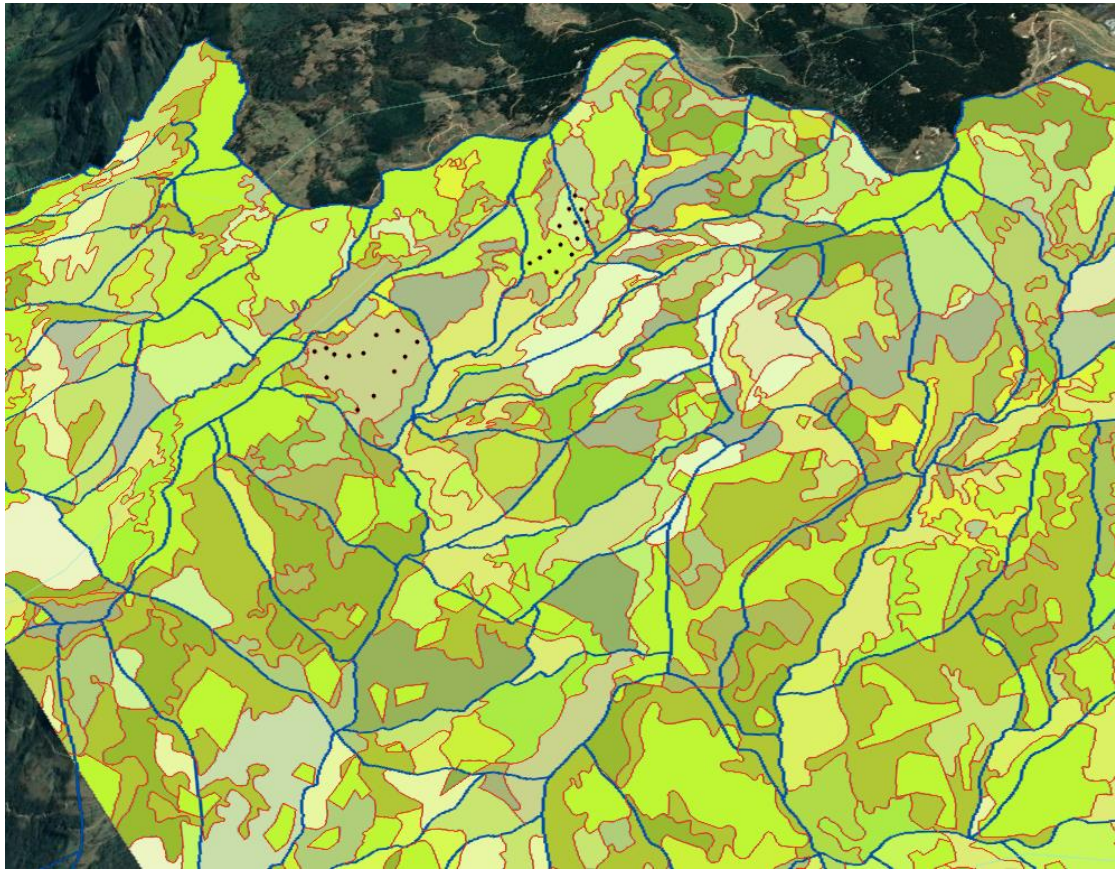


Figure 2. Project area



**Figure 3. Sampling Plots**

A design of nested quadrats of different sizes will be implemented in order to measure vegetation of different sizes and strata, and for collecting litter to estimate carbon stock (Figure 4). The 1m X 1m quadrat will be used for small shrubs biomass (< 2cm DBH), herbaceous species and litter.

The 10m X 10m and 20 m x 20 m quadrats will be used for sampling above-ground live trees with 2-10 cm *dbh* and dead wood. The second quadrat will be used for trees with *dbh* between 11 – 29 cm. Trees with *dbh*  $\geq$  30 cm should be counted in the entire sample plots. The size of the sampling plots depended on the stratum (age class and site quality).



## 2. The results of Sample Plots

The results obtained from measurements made of sample plots were presented in Table 1 and Table 2.

Table 1. Some characteristics of the sample plots

Sample Plot No	Mean diameter (cm)	Age class	Site class	Basal area m <sup>2</sup> /ha	Number of trees
1	17.0	IV	Poor	19.4	800
2	10.8	IV	Good	44.7	4000
3	13.2	III	Poor	36.1	2000
4	9.3	II	Medium	37.2	4100
5	12.8	III	Good	53.0	3400
6	14.3	IV	Medium	29.9	1550
7	9.7	II	Medium	33.1	3700
8	5.5	I	Medium	25.5	9600
9	5.7	I	Good	29.9	6700
10	6.8	I	Good	36.1	8000
11	7.8	II	Good	20.7	3400
12	0.8	I	Medium	0.1	867
13	1.3	I	Poor	0.4	2500
14	1.1	I	Medium	0.7	5200
15	0.9	I	Poor	0.2	3067
16	6.7	I	Good	17.4	3800
17	13.3	IV	Good	37.1	2200
18	11.5	II	Medium	39.1	2867
19	12.6	III	Good	26.8	1645
20	11.4	II	Good	52.2	4300
21	10.8	II	Good	43.1	4000
22	13.5	III	Medium	49.0	2900
23	11.6	II	Poor	32.9	2534
24	22.7	IV	Poor	40.9	925
25	15.9	IV	Good	33.0	1500
26	14.7	III	Good	26.6	1425
27	15.0	III	Medium	24.0	1200
28	16.9	IV	Medium	27.1	1050
29	15.8	IV	Medium	38.1	1700
30	13.1	III	Poor	20.2	1325
31	12.4	II	Poor	19.6	1475
32	13.7	III	medium	19.2	1225





Table 2. Biomass of the sample plots

Sample Plot	Biomass (kg)			
	Herbaceous	Shrub	Litter	Lying dead wood
1	0	1830	7200	0
2	0	4950	12000	3375
3	38	750	3200	1080
4	0	4980	26400	2370
5	129	3870	14200	3270
6	76	3020	19580	2280
7	23	57.5	10800	200
8	125	750	23000	6030
9	30	0	30200	480
10	58	345	8200	2490
11	75	150	8600	2030
12	975	163	5867	303
13	2610	6525	2000	5925
14	260	0	2600	0
15	1280	80	8600	345
16	700	4200	14000	3480
17	0	1245	10600	6990
18	0	1890	10200	1960
19	23	1125	11600	2175
20	40	2370	17200	1140
21	21	735	13600	1698
22	26	1820	8800	1540
23	52	3090	10400	1710
24	0	500	6000	500
25	10	1000	10000	1701
26	20	1200	8000	3252
27	15	950	9008	4000
28	0	1200	7040	3270
29	0	750	3040	1050
30	0	57	10560	201
31	0	0	2720	0
32	0	0	3200	1080



### 3. The results of Sample Trees

The results obtained from measurements made of sample trees were presented in Table 3.

Table 3. Biomass and some characteristics of sample trees

Sample tree no	<i>Dbh</i> (cm)	Tree Height (m)	Stem biomass (kg)	Branch biomass (kg)	Foliage Biomass (kg)
1	11.70	11.55	37	2.25	0.01
2	8.80	10.80	16	0.24	0.01
3	7.00	11.90	16	0.47	0
4	5.30	7.15	4	0.21	0.05
5	15.50	12.20	43	4.83	0
6	6.20	8.60	4	4.62	0
7	15.50	13.10	58	20.10	0.68
8	12.80	15.20	50	5.49	0.76
9	14.20	13.10	49	14.10	0.54
10	8.00	7.90	10	2.13	0.08
11	7.50	10.25	17	3.19	0.37
12	10.50	11.90	21	4.03	0.34
13	16.40	14.80	79	20.52	1.71
14	6.90	10.65	14	2.60	0.26
15	0.30	1.60	0	0.02	0.02
16	1.40	1.25	0	0.04	0.01
17	1.20	1.45	0	0.03	0.02
18	1.20	1.33	0	0.03	0.03
19	8.20	11.60	19	1.30	0.13
20	4.90	10.70	6	0.70	0.08
21	24.8	18.40	165	124.40	10.9