INCREASING THE RESILIENCE OF FOREST ECOSYSTEMS AGAINST CLIMATE CHANGE IN THE SOUTHERN CAUCASUS THROUGH FOREST TRANSFORMATION

EC THEMATIC PROGRAMME ON ENVIRONMENT AND SUSTAINABLE MANAGEMENT OF NATURAL RESOURCES

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Technical Assessment Report on Results of Transformation Measures in Georgia

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Technical Assessment Report on results of transformation measures in Georgia

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1. Assessment of results of project preparatory stage in Georgia

1.1 Evaluation of sites

During the entire period of project implementation forest transformation measures have been conducted in selected pilot sites Khashuri (site #1) and Tsavkisi (site #2) with total area of 154 ha. Submitted report aims to provide results of these activities based on relevant field inspections made by national coordinator in the autumn of 2012, spring 2013 and autumn 2013.

1.2 Land tenure

Pilot Forest Site N1 – "*KHASHURI*" in Khashuri Municipality is located on the state forest lands of the former Khashuri State Forestry, Forest Unit N.3, Forest Sub-Units NN.5-7 and NN.9-30 - currently under the management of Shida Kartli Service of the National Forest Agency of the Ministry of Environment Protection and Natural Resources of Georgia. Total area of site is 80 ha. Site is presented by artificial monoculture pine stands established 45-50 years ago.

Pilot Forest Site N2 – "*TSAVKISI*" with area of 74 ha in Tbilisi Municipality is located on the former state forest lands of Kojori Forest Unit of the former Tbilisi State Forestry office - currently under the management of the Municipality of Tbilisi.

The site maps (scale 1:6000) in this report show the boundaries of the pilot sites in Khashuri and Tsavkisi and give an impression of the forest cover and open areas. In the site surveys in tabular form the current natural features of the Georgian sites and in particular the forest vegetation is described.

Figure 1. Planned pilot site map Khashuri

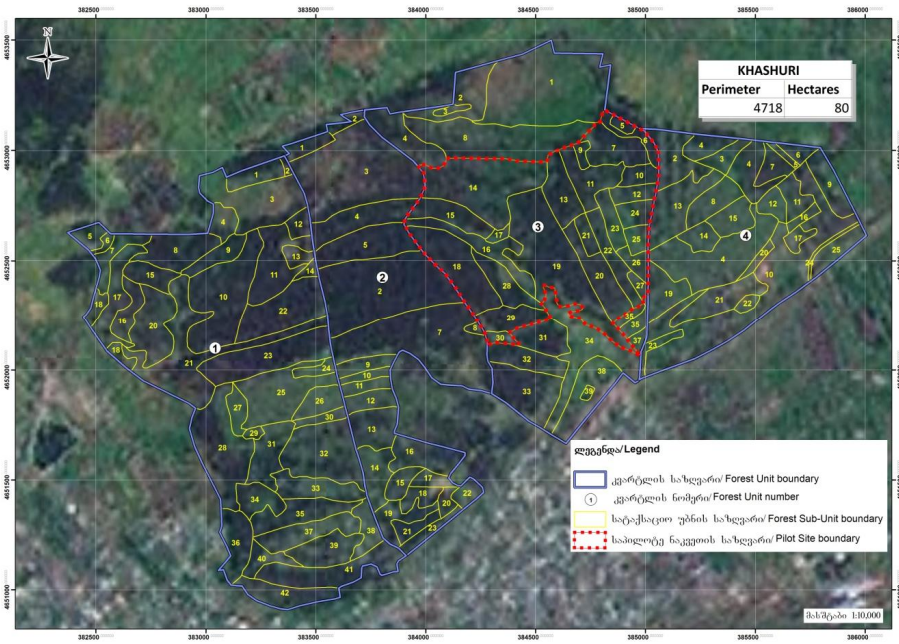
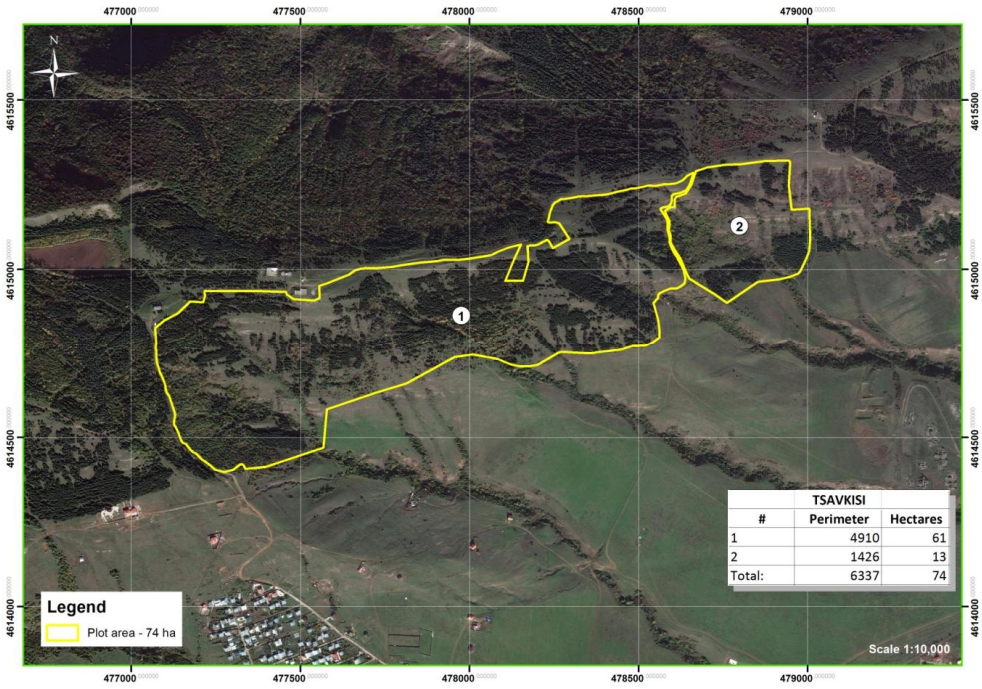


Figure 2. Planned pilot site map Tsavkisi



1.3 Site selection criteria and site surveys

The overall objective of the Project is to increase the resilience of forest ecosystems in the Southern Caucasus, namely in Georgia, against climate change impacts and to improve biodiversity and livelihoods of local populations. The overall objective addresses the overarching threat of climate change to biodiversity and to forest ecosystem services which support the livelihoods of rural communities. Those services include protection of soils and water supply and quality, and timber and non-timber forest products. Objectively Verifiable Indicator (OVI) for the overall objective is that: by 2015 (two years after the completion of the Project), the national government will have adopted and started to implement policies that will make forests and the services they provide highly resilient to climate change.

The specific objective of the Project contributes to the overall objective by establishing the necessary conditions for the forest administrations in Georgia to develop and implement strategies for transforming monoculture forest stands into highly resilient, “close to nature” forest stands. It is proposed to do this through awareness rising about climate change impacts on forests, demonstrating practical measures to make forests more resilient, and providing forest administration staff and local community members who use forests with the necessary knowledge and skills to transfer the development and implementation of transformation measures to other forest stands.

The pilot forest sites have been selected based on above mentioned requirements by the Project team in cooperation with the forest authorities during the inception phase of implementation according to preliminary agreed selection criteria (see Box 1):

Box 1. Site selection criteria

1) Nature conservation criteria

a) Biodiversity indicators occurrence of endemic and/or endangered species
b) Importance to connect fragmentized habitats (eco-corridor)

2) Silvicultural/Ecological criteria

a) Canopy cover
b) Dimension of the forest stand (average height and diameter)
c) Soil and nutrient situation
d) Hydrological situation
e) Capacity of natural regeneration
f) Availability of site adapted planting material
g) Protective function of forest stand
i) Flood water protection
ii) Water protection zone
iii) Erosion Protection
h) Risk factors
(i)Grazing
ii) Fire

3) Legal criteria

a) Land tenure
b) Status of forest land
c) Legal restrictions for forest transformation measures

4) Social-economic criteria

a) Support and interest of local population and government
b) Possibilities of involvement of local population in work process
c) Distance to villages
d) Importance for recreation and environmental education

5) Others

a) Sustainability of the action
i) Commitment of land owner
ii)Capacity of land owner
iii)Possibility of follow-up financing
b) Visibility

Selected pilot sites represent forest stands with artificially propagated monoculture pine plantations and therefore most vulnerable to climate change impacts.

Detailed location and boundaries of the selected sites already agreed with stakeholders, as well as relevant agreements with the stakeholders are available at the following web-pages:

For the Pilot Site N1 : http://awsassets.panda.org/downloads/mou_geo_site_khashuri.pdf

For the Pilot Site N2 : http://awsassets.panda.org/downloads/mou_geo_site_01_tsavkisi.pdf

Tables 1 and 2 below provide detailed description of selected sites:

Table 1. Site survey Khashuri

Project Site	**Khashuri**
Coordination of transformation measures	WWF Caucasus Programme Office
Country **Location** **Grid references**	**Georgia** Georgia, Khashuri **W**-383851, 4652727; **N**-384789, 4653250; **E**-385119, 4652463; **S**-384880, 4652122
Total area	**80 ha**
Ownership	**Forest Fund, National Forest Agency of the Ministry of Environment Protection and Natural Resources of Georgia**
Climatic conditions	
Mean annual temperature	9.6 ^{0}C
Mean temperature vegetation period (April-October)	^{0}C
Min / Max temperatures	-29 ^{0}C / 37^{0}C
Annual precipitation	700 mm
Precipitation in vegetation period (April-October)	500 mm
Site conditions	
Altitude	720 - 830 m a.s.l
Soil type	Brown leached soils, with brown-grey color, with grainy-granular structure, medium to low depth

Natural nutrient situation	Low humus content
Hydrological situation (ground water level, flooding, wind)	No rivers, dry trenches (water only as a result of snow melting or rain), temporary slope water
Exposition	S, S-W, S-E, N-E, N-W
Vegetation	
Potential Natural Vegetation	Middle mountain zone – Oak forest 1. *Quercus iberica* 2. *Carpinus caucasica* 3. *Carpinus orientalis* 4. *Acer campestre* 5. *Acer laetum* 6. *Fraxinus excelsior* 7. *Pyrus caucasica* 8. *Malus orientalis* 9. *Tilia caucasica* 10. *Ulmus carpinifolia* 11. *Cornus mas* 12. *Corylus avellana* 13. *Svida australis* 14. *Rhamnus catartica* 15. *Crataegus* 16. *Ligustrum vulgare* 17. *Euonymus verrucosa* 18. *Rosa canina* 19. *Mespilus germanica*
Actual vegetation/ land use type	Over 90% of Khashuri site is represented by areas covered with forest. Out of it, about 80% of areas are represented by artificial forests of black pine (Pinus nigra) of the age up to 45 years; in small quantities, in

	groups and singly, Caucasian pine (Pinus hamata) is mixed therein. Relatively small areas are occupied by coppice Georgian oak stands with hawthorn and other shrubs. Almost half of pine stands have low and medium density. Natural regeneration with pine (black and caucasian), Georgian oak, field maple, ash-tree and other wood species (trees and shrubs) actively proceeds there. High voltage power transmission line goes through the territory in the south of the site for the distance of 180 r It is remarkable that the pilot site is located near the resort Surami.
History of the area	
	Wood use and land use wasn't performed on the pilot site for the last 10 years. It shall be mentioned that excessive grazing occurs on the territory, negatively affecting the development of sprouts and young growth of deciduous species. Natural regeneration proceeds satisfactorily, fencing of the territory is required for its maintenance.

Table 2. Site survey Tsavkisi

Project Site	**Tsavkisi**
Coordination of transformation measures	WWF Caucasus Programme Office
Country **Location** **Grid references**	**Georgia** Georgia, Tbilisi City **W**-477071, 4614826; **N**-478254, 4615198; **E**-479005, 4615179; **S**-478173, 4614711
Total area	**74 ha**
Ownership	**Tbilisi Mayor's Office**
Climatic conditions	
Mean annual temperature	12.7 ^{0}C
Mean temperature vegetation period (April-October)	?^{0}C
Min / Max temperatures	-23 ^{0}C / 40 ^{0}C
Annual precipitation	560 mm
Precipitation in vegetation period (April-October)	? mm
Site conditions	
Altitude	900 - 1125 m a.s.l
Soil type	Brown soils, medium to low depth
Natural nutrient situation	Low humus content

Hydrological situation (ground water level, flooding, wind)	No rivers, dry trenches (water only as a result of snow melting or rain), temporary slope water
Exposition	S, SE, SW
Vegetation	
Potential Natural Vegetation	Middle mountain zone – Oak forest *20. Quercus iberica* *21. Carpinus caucasica* *22. Carpinus orientalis* *23. Acer campestre* *24. Fraxinus excelsior* *25. Euonymus verrucosa* *26. Rosa canina* *27. Mespilus germanica*
Actual vegetation/ land use type	Almost half of Tsavkisi site is covered with forest. About 70% is of artificial origin (black pine, wild apricot, almond, soap tree, golden-chain). Natural stands are represented by prevalence of Georgian oak, with mixture of hornbeam, oriental hornbeam, ash-tree, maple, wild pear, wild apple, wild cherry, elm, at the same time – lime-tree, nettle tree. Natural regeneration of black pine doesn't occur at all. It allows to conclude that black pine has less prospects for this specific region and it shall be replaced by native species in relatively short time.
History of the area	
	Wood use and land use wasn't performed on the pilot site for the last 10 years. It shall be mentioned that excessive grazing occurs on the territory, negatively

	affecting the development of sprouts and young growth of deciduous species. Natural regeneration proceeds satisfactorily, fencing of the territory is required for its maintenance.

1.4 Forest transformation plan

Forest transformation plan (FTP) was developed in accordance with the Terms of Reference of Agreement #02/30-30-2012/WWF Caucasus 01/01-SRV-GEO-2012/ENRTR-BI-5.2.1 concluded on March 30, 2012 between WWF Caucasus Program Office and Design Planning Organization "Tkeinventproekti" Ltd for the purpose of implementation of EU-funded Project ("Raising of Forest Ecosystem Sustainability in South Caucasian Countries in the Context of Climate Change /NO DCI-ENV/2010/221391/").

Special group, consisting of various specialists (forest planning specialists, botanist, forester-pathologist, soil scientist, GIS specialist) was formed for implementation of activities by "Tkeinventproekti". The client provided the group with the required cartographic, aerial photo, public register and legal materials.

Scope of work defined by Terms of Reference of Agreement was as follows:

1. Elaborate a soil analyses for the selected sites and provide with recommendation for native species to plant/seed based on soil. The forest planning organization will elaborate a map illustrating the soils of the site. For each soil type recommendation for planting/seeding native species will be given. Other parameters as potential natural vegetation, relief, exposition and climate will be considered in this recommendation.

2. Elaborate a detailed plan (verbal description and visual illustration on maps) for fencing, tending, planting or seeding measures on the selected sites. For each selected site the plan illustrates at least following contents:

- Identification of seeding and planting areas
- Description and Visualization of transformation activities
    - Fence line
    - Areas of planting
    - Areas of seeding
    - Areas of tending
    - Areas for natural regeneration assisting measures
    - Areas for clearing of sod creating grasses and other competing vegetation from around the seeded and planted trees
- Design of planting method (groups, rows, spacing, etc)
- Technological scheme for forest transformation activities
- Measures for post-planting maintenance and care of pilot sites (5-year technological scheme of measures for post-planting care of pilot sites)
- Quantification of fence material, planting and seeding material

- Cost calculation of material

3. Elaborate a detailed work/time schedule plan for the implementing works.

Based on these requirements FTP has been elaborated and served as a baseline document for the practical works conducted. In detail Forest Transformation Plan is linked with web page: http://awsassets.panda.org/downloads/forest_transformation_plan___ge_1.pdf

According to FTP each site were carefully studied to identify special silvicultural activities.

Figure 3. Division of Khashuri pilot site according to silvicultural measures

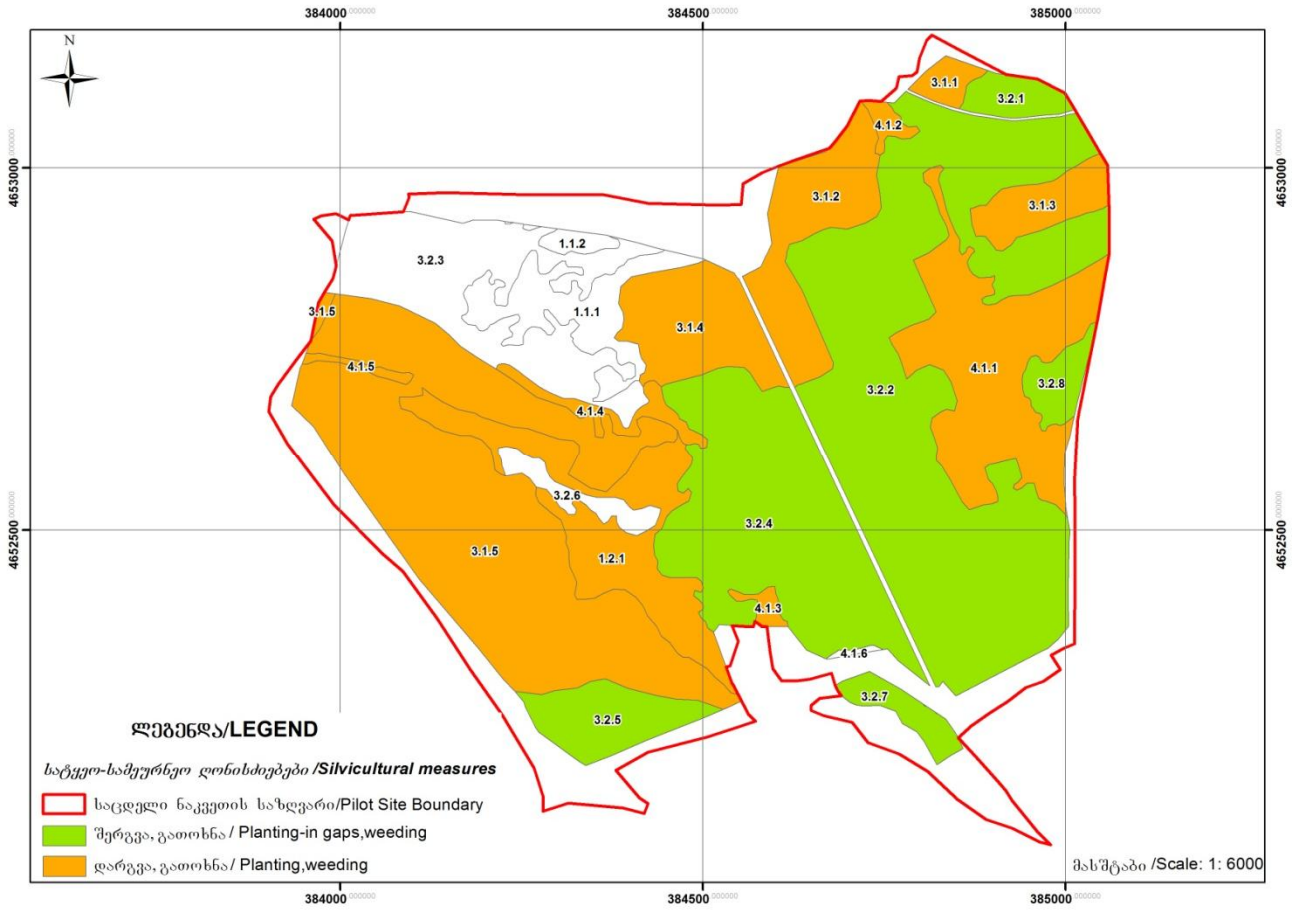


Table 3. Description of Khashuri pilot site by silvicultural measures

# on the map	Area, ha	Brief Characteristics of the site	Proposed measures	Proposed Q-ty of required seedlings	
				Per 1 ha	Total
1.1.1 1.1.2 **Sum**	2,2 0,4 **2,6**	High density deciduous stands of natural origin	Protection from cattle, prohibition of all kinds of cutting	-	-
1.2.1	4,0	Low and medium density	Planting of oaks in canopy	1000	4000

		deciduous stands of natural origin	openings, weeding around seedlings three times		
3.1.1 3.1.2 3.1.3 3.1.4 3.1.5 **Sum**	1.8 3.9 1.3 2.8 15.7 **25.5**	High-density pine stands of artificial origin	Planting of oaks and other deciduous trees in canopy openings, weeding around seedlings three times	300	7700
3.2.1 3.2.2 3.2.4 3.2.5 3.2.7 3.2.8 **Sum**	1.5 17.9 8.2 1.8 1.1 0.8 **31,3**	Low and medium-density pine stands of artificial origin	Planting in gaps of oaks and other deciduous trees in canopy openings, weeding around seedlings three times	1000	31300
3.2.3 3.2.6 **Sum**	6.8 0.7 **7,5**	Low and medium-density pine stands of artificial origin with dense oak young growth	Protection from cattle (fencing)	-	-
4.1.1 4.1.2 4.1.3 4.1.4 4.1.5 **Sum**	6.2 0.3 0.2 0.6 0.3 **7,6**	Woodless territories	Planting of oaks and other deciduous trees (ash-trees, maples, wild pear, wild apple), weeding around seedlings three times	3000	22800
4.1.6	0,5	Territory under high voltage power transmission line		-	-
Total	**79.0**				**65800**

Figure 4. Division of Tsavkisi pilot site according to silvicultural measures

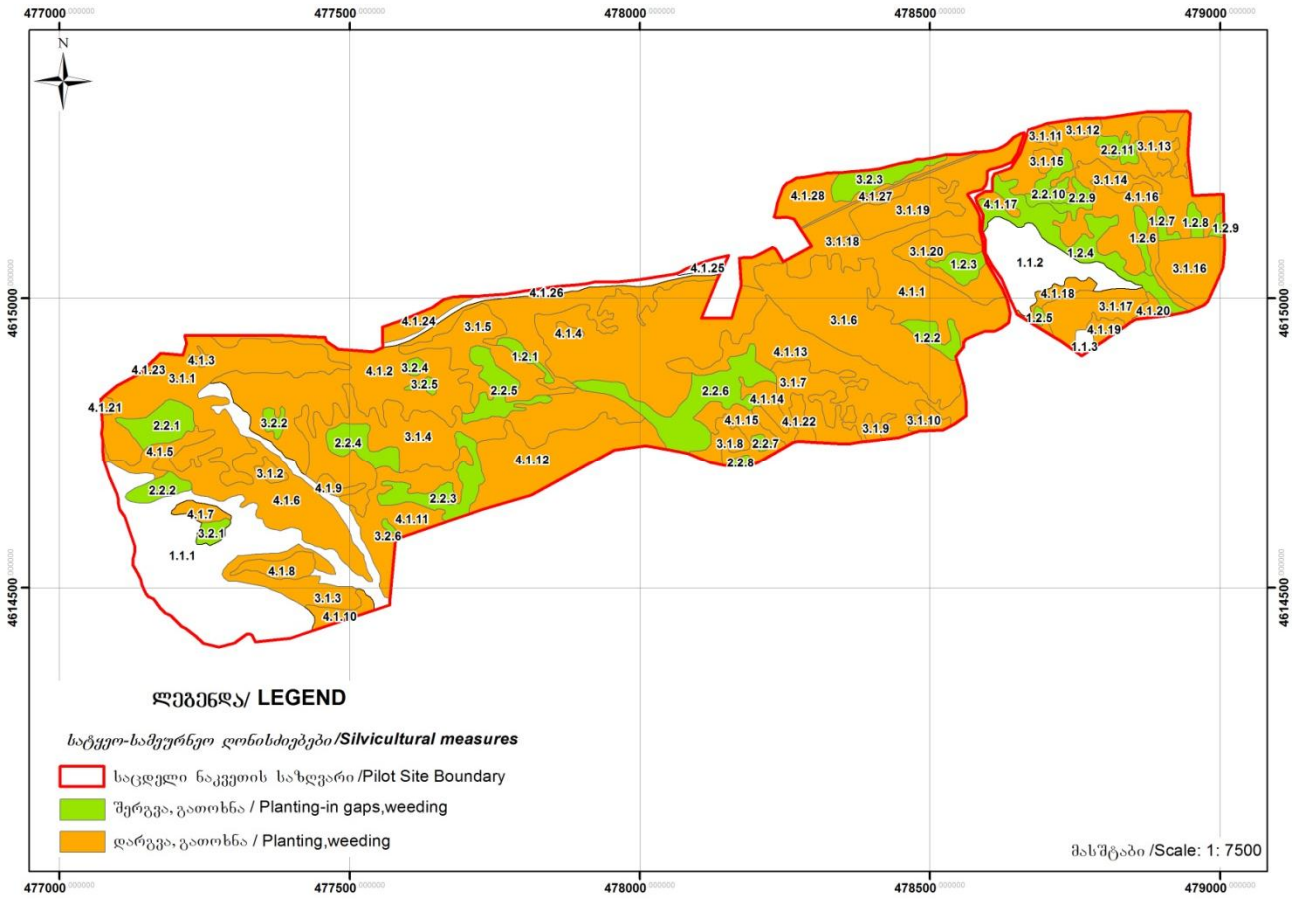


Table 4. Description of Tsavkisi pilot site by silvicultural measures

# on the map	Area, ha	Brief Characteristics of the site	Proposed measures	Proposed Q-ty of required seedlings	
				Per 1 ha	Total
1.1.1 1.1.2 1.1.3 **Sum**	6.6 1.8 0.1 **8,5**	High density deciduous stands of natural origin	Protection from cattle, prohibition of all kinds of cutting	-	-
1.2.1 1.2.2 1.2.3 1.2.4 1.2.5	0.2 0.3 0.3 1.4 0.1	Low-density natural degraded deciduous stands	Planting of deciduous trees in canopy openings (oak, ash-tree, maple, wild pear, wild apple, smoke-tree, nettle tree, sumac), on rocky slopes – planting of		

1.2.6 1.2.7 1.2.8 1.2.9 **Sum**	0.2 0.1 0.1 0.1 **2,8**		oriental hornbeam, smoke-tree, sumac. Weeding around seedlings two times	**1000**	**2800**
2.2.1 2.2.2 2.2.3 2.2.4 2.2.5 2.2.6 2.2.7 2.2.8 2.2.9 2.2.10 2.2.11 **Sum**	0.6 0.3 0.8 0.5 0.7 1.7 0.1 0.1 0.5 0.1 0.2 **5.6**	Low-density degraded artificial deciduous stands	Cutting of over-dry trees in canopy openings and their removal, planting of deciduous trees (oak, ash-tree, maple, wild pear, wild apple, smoke-tree, nettle tree, sumac), on rocky slopes – planting of oriental hornbeam, smoke-tree, sumac. Weeding around seedlings two times	**1000**	**5600**
3.1.1 3.1.2 3.1.3 3.1.4 3.1.5 3.1.6 3.1.7 3.1.8 3.1.9 3.1.10 3.1.11 3.1.12 3.1.13 3.1.14 3.1.15 3.1.16 3.1.17 3.1.18 3.1.19 3.1.20 **Sum**	3.9 0.1 1.0 3.9 1.5 8.5 1.4 0.4 0.2 0.3 0.1 0.2 0.6 0.4 0.1 1.1 1.0 0.1 1.0 1.0 **26,8**	High-density artificial black pine stands	Planting of oaks and other deciduous trees in canopy openings, weeding around seedlings two times	**300**	**8000**
3.2.1 3.2.2 3.2.3 3.2.4 3.2.5 3.2.6 **Sum**	0.2 0.1 0.6 0.1 0.1 0.1 **1,2**	Medium and low-density black pine stands (at the same time, Caucasian pine) with mixture of ash-trees and maples	Planting of oaks and other deciduous trees in canopy openings, weeding around seedlings two times	**1000**	**1200**
4.1.1 4.1.2 4.1.3	4.4 5.5 0.1	Woodless territories; exposition – south, S-E, S-W, on 5-350 angle slopes	Planting of seedlings (oak, ash-tree, maple, wild pear, wild apple, nettle tree, smoke-tree,		

4.1.4 4.1.5 4.1.6 4.1.7 4.1.8 4.1.9 4.1.10 4.1.11 4.1.12 4.1.13 4.1.14 4.1.15 4.1.16 4.1.17 4.1.18 4.1.19 4.1.20 4.1.21 4.1.22 4.1.23 4.1.24 4.1.27 4.1.28 **Sum**	0.1 0.4 2.5 0.2 0.4 0.2 0.3 1.7 2.5 3.0 0.3 0.7 3.9 0.1 0.3 0.2 0.1 0.1 0.2 0.1 0.4 0.1 0.9 **28,7**		sumac), planting of oriental hornbeam, smoke-tree, sumac, nettle tree on rocky sections. Smoke-tree, sumac, nettle tree shall be seeded in terraces on rocky and washed sections	**3000**	**86100**
4.1.25 4.1.26 **Sum**	0.1 0.5 **0,6**	No planting due to existing underground communication		-	-
Total	**74,2**				**103700**

1.5 Protection of the pilot sites

According to FTP Fencing is considered as the measure for facilitation of natural regeneration on the pilot sites; it will prevent pasturing of cattle on this site, which will facilitate self-regeneration of natural young growth of wood species (trees and shrubs). Also provide protection from massive human intervention in particular at Khashuri site due to the pilot site is highly visited place for recreation purposes by local population as well as tourists because of close location of very popular in Georgia Surami resort.

Therefore both sites are completely fenced. Total fence length in Khasuri is 4611 m and Tsavkisi 6336 m.

1.6 Transformation techniques

FTP identified basic approach to undertake practical works which includes: soil preparation, planting/or seeding.

Planting should be performed in the late fall or early spring in pits. Pits should be located along the slope in rows. The distance between the rows should be 2 m, between seedlings in rows – 1,5 m. The seedling shall be placed in the pit up to the root neck and soil shall be compacted. A depression shall be formed around the seedling so that moisture remains in the pits after precipitation (the regions are characterized by low

precipitation level, hot summer, the possibility of artificial watering is limited and efficient use of natural precipitations is necessary).

The technology and scheme of planting of forest crops on woodless territories (planting), in the canopy openings of high density stands (planting) and low and medium density stands (planting in gaps) is the same. The only difference is in quantity of planting material.

Seeding is only considered for Tsavkisi site. Seeding of drought-resistant shrubs on local areas (rocky slides exposed soil, fragments of steep slopes with thin soils with small rocks) for the purpose of soil strengthening, retention of surface run-off and maintenance of humidity is considered as additional measures.

Seeding shall be carried out by spreading. For the purpose of convenience and more or less even distribution on the territory, seeds shall be mixed with sand of 10-fold volume and this mixture shall be spread manually.

1.7 Maintenance activities

Weeding around seedlings is a basic activity recommended by FTP to provide maintenance of newly established plantations.

1.8 Cost efficiency and cost models

FTP provide information on costs related to for all silvicultural measures which are divided on two periods: first for years 2012-2013, and second for 2014-2018, which are given in tables below.

Table 5. Summary for transformation and post transformation works and cost calculation for 2012-2013

Description of works	Unit of measurement	Volume of works	Daily norm of works	Number of required man/ days	Cost of works. GEL		Note
					man/ days	Total	
1	2	3	4	5	6	7	8
Khashuri pilot site 2012 – 2013							
1.Planting of seedlings	Unit	65 800	80	822			
2.Seeding	M^2	_	_	_	_	_	
3.Maintenance (weeding)	Unit	197 400	500	395	_	_	Shall be implemented 3 times
4.Maintaining cuts	_	_	_	_	_	_	

Total				1217			
Tsavkisi pilot site 2012 – 2013							
1.Planting of seedlings (replenishment)	Unit	103 700	80	1296			10% of total q-ty
2.Seeding	M^2	30 000	1500	20	_	_	
3.Maintenance (weeding)	Unit	311 000	500	622			Shall be implemented 3 times
4. Maintenance cuts	cub.m	_	_	_	_	_	
Total				1 938			
Total on both sites							
1.Planting of seedlings (replenishment)	Unit	169500	80	2118			
2.Seeding	Mm^2	30000	1500	20			
3.Maintenance (weeding)	Unit	508400	500	1017			
4. Maintenance cuts	cub.m	_	_	_			
Sum				3155			

Table 6. Summary of post transformation works and cost calculation for 2014-2018

Description of measures	Unit of measurement	Volume of works	Daily norm of works	Number of required man/ days	Cost of works, GEL		Note
					Man/ days	Total	
1	2	3	4	5	6	7	8
Khashuri pilot site 2014-2018							
1.Planting of seedlings (replenishment)	Unit	6 600	80	83			10% of total q-ty

2.Seeding	–	–	–	–	–	–	
3.Maintenance (weeding)	Unit	526 400	500	1 053			Shall be implemented 8 times
4.Maintaining cuts	cub.m	350	3	117			
Total				1253			
Tsavkisi pilot site 2014-2018							
1.Planting of seedlings (replenishment)	Unit	10 400	80	130			10% of total q-ty
2.Seeding	–	–	–	–	–	–	
3.Maintenance (weeding)	Unit	829 600	500	1 659			Shall be implemented 8 times
4. Maintenance cuts	cub.m	100	3	33			
Total				1822			
Total on both sites							
1.Planting of seedlings (replenishment)	Unit	17 000	80	213			
2.Seeding	–						
3.Maintenance (weeding)	Unit	1356000	500	2712			
4.Maintenance cuts	cub.m	450	3	150			
Sum				3075			

2. Lessons learned in Georgia

This chapter provides assessment of results of works conducted and main lessons learned derived in the course of practical implementation.

2.1 Land tenure

Sites allocated for the project implementation are under management of state authorities. Khashuri site is under management of National Forest Agency of the Ministry of Environment Protection and Natural Resources and Tsavkisi site management responsibilities belongs to Tbilisi Municipality. According to Georgia Government Decree #241 of August 2010 "On rules of forest restoration and maintenance" fencing is considered as one of the most efficient approach to protect forest plots identified for restoration. Therefore, decision on practical application of fencing on both sites is within of existing legal norms. From other hand it is unusual for local villagers around pilot sites as well as for whole Georgia rural population to see that territories which they consider as part of their cattle grazing ground or the area which they visit often for different purposes (recreation, collecting of wild berries, mushrooms and pine cones for heating) are restricted for entrance at all. This may cause some conflict situation due to reduce of grazing areas and limitation of their livelihood opportunities. To predict possible negative affect from surrounding population and rise project "ownership" filling to them project actively did involve local labor in all silvicultural measures and proposes to continue over whole maintenance period. At the same time further explanation of project ideas, in particular importance of forest restoration for their future as well as overall objectives of sustainable forest management for Georgia's ecological stability and economic development seems also very efficient mechanism for final success of the project.

2.2 Site selection criteria and site surveys

Project team did agree quite a wide-ranging site selection criteria used for the selection pilot sites. Both sites are in line with agreed criteria presenting vulnerable to negative impact of climate change monoculture forest stands with high risk to fire and other anthropogenic impact. For example Khashuri site is in line with nature conservation criteria b) importance to connect fragmentized habitats (eco-corridor) since it provides such service to fauna occurred at nearby located two small water ponds (see photo). Both sites are important due to there are high risk factors as grazing and fire, also importance of sites with their protective function against erosion. From the point of social-economic indicator close location to villages(c) and importance for recreation and environmental education (d) is also very essential indicator. Commitment of land owners to transformation measures but with no capacity (financial, intellectual) also is considered as a deciding criteria, and last but not least is "Visibility" – both sites are very popular places (tsavkisi is an important from the point of view that many citizens are occupying surrounding areas for establishment of their summer houses, and Khashuri is an important resort area for many Georgians).

Implementation of Forest Transformation Plans were conducted by specialized company "Georgian Seedlings" based on contract with WWF Caucasus Program Office. Due to financial constraints implementation plan in contract were adjusted to financial possibilities of the Project. In this regard planting activities were reduced at Tsavkisi pilot site by reason of already existing signs of forest transformation with

deciduous species (bushes and trees) and some increase in Khashuri since forest stands there are represented by pure monoculture coniferous species.

Transformation works were conducted in close cooperation of contractor and WWF Caucasus Programme Office at every stage of its implementation. Each planting season was accompanied with field inspection by National Coordinator and results of inspection were provided in relevant reports which summarized in Table 7.

Table 7. Distribution of planted species by pilot sites

#	Species	Planted, Khashuri				Planted, tsavkisi				Total by species
		2012, Autumn	2013, Spring	2013, Autumn	Total	2012, Autumn	2013, Spring	2013, Autumn	Total	
1	*Quecus iberica*	8500	21500	17000	47000	3000	4200	1950	9150	56150
2	*Fraxinus excelsior*	-	2000	400	2400	-	1000	730	1730	4130
3	*Fraxinus oxycarpa*	1800	2160	4460	8420	1000	-	-	1000	9420
4	*Acer campestre*	1780	5800	-	7580	1000	750	170	1920	9500
5	*Acer velitinum*	600	1000	4000	5600	-	-	-	-	5600
6	*Tilia caucasica*	600	1000	2000	3600	-	-	-	-	3600
7	*Pirus caucasica*	-	-	-	-	-	250	-	250	250
8	*Malus orientalis*	-	-	-	-	-	350	-	350	350
9	*Cotinus cotigria*	-	-	-	-	-	200	-	200	200
10	*Celtis caucasica*	-	-	400	400	-	-	400	400	800
10	**Total planted**				**75000**				**15000**	**90000**

Two maps below show all planting activities undertaken by each planting season at each pilot site.

Figure 5. Khashuri map of silviculture measures

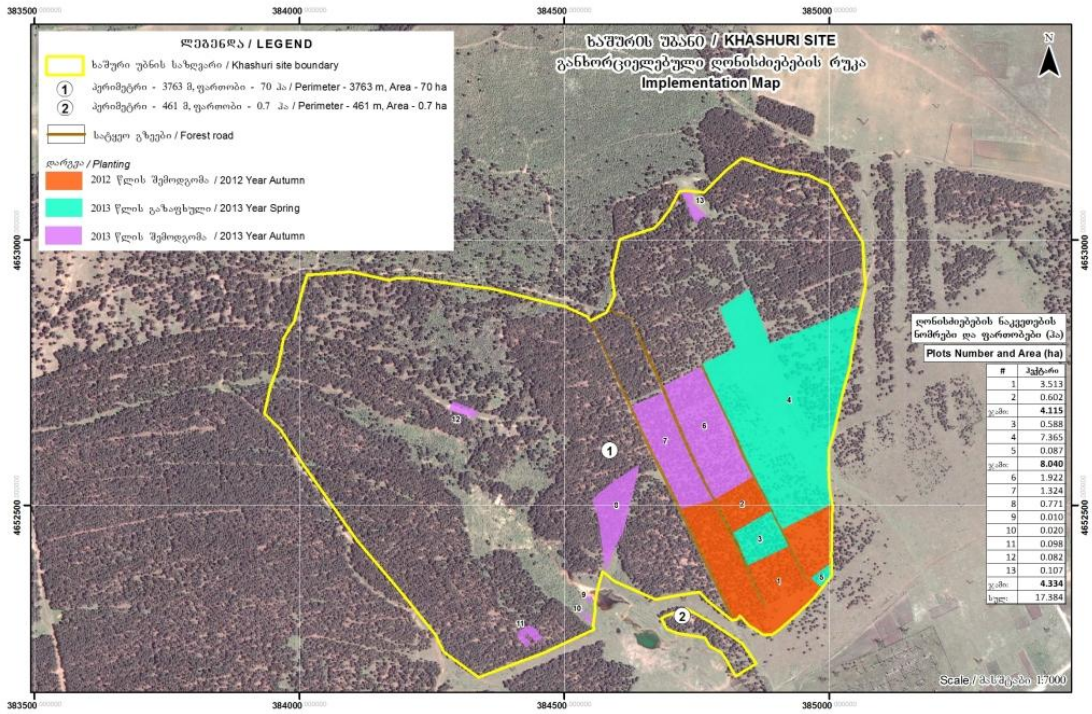
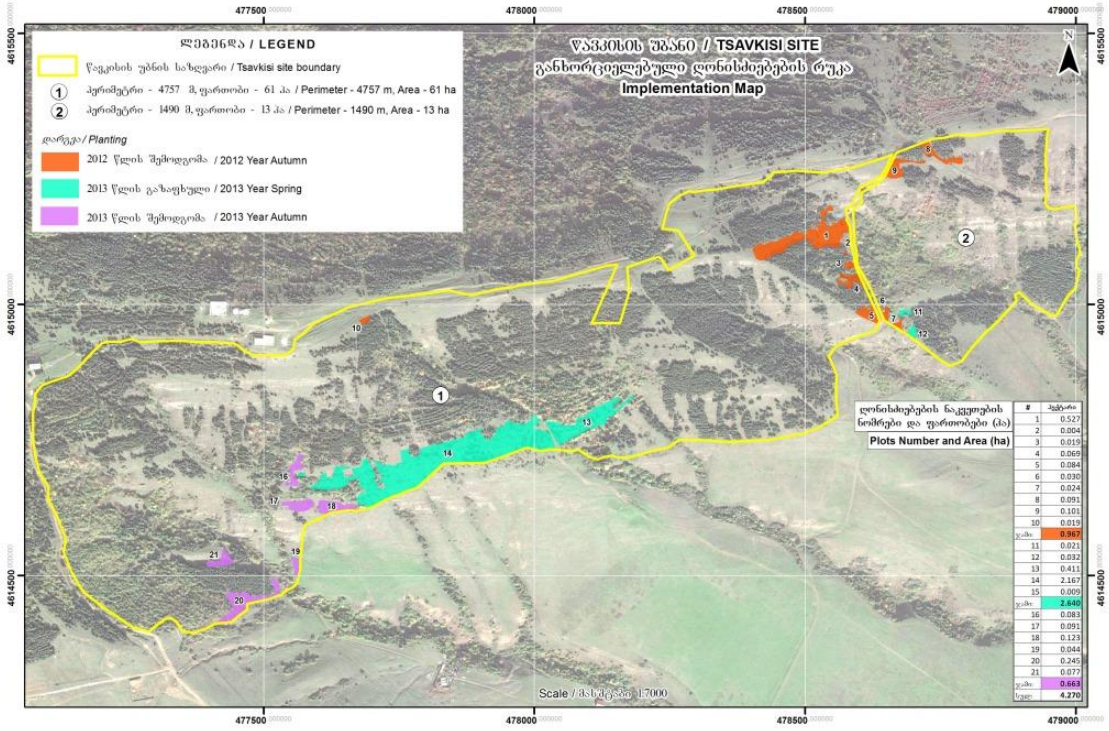


Figure 6. Tsavkisi map of silviculture measures



According to final figures at Khashuri site 17,384 ha were planted, at Tsavkisi 4270 ha. Total number of seedling used is 90000. Additionally about 0,5 ha at Tsavkisi site were seeded by 10 kg seeds of different species (5 kg- *Celtis caucasica*; 2 kg- *Carpinus orientalis*; 1 kg-*Cotinus coggygria*; 1kg-*Pistacia mutica*; 1kg-*Rhus coriaria*). Generally, further growing potential for new plants seems to be promising, except of the open area in Khashuri site where is an obvious trend of soil trenching which cause a problems for young seedlings (see photo in annex). There should be a special attention for this area during a maintenance period.

2.3 Site preparation, protection

According to FTP site preparation for both pilot areas aimed to arrange pits prior planting. Pits are located along the slope in rows. The distance between the rows are 2 m, between seedlings in rows – 1,5 m. Schematic diagram of dislocation of rows and species at each site are provided in Forest Restoration Plan. Pits were arranged manually using special forest spade or with drilling machine provided by WWF Caucasus PO. Whole area of pilot sites are well fenced, though it was noted at both sites that population is still have an attempt to move inside for grazing or other purposes (see photos in annex).

2.4 Seedlings procurement and quality, planting/seeding technique and maintenance requirements

Seedling for selected wood species were provided by Contractor from its private nursery. Size of 1-2 year seedlings were around 10-50 sm over ground and 10-25 sm underground (root length). According to wood species, the following proportion is maintained: 60% - oak, 40% - other deciduous species. Such proportion conditions formation of mixed deciduous stands with oak prevalence. It's also important because oak needs accompanying, so called "nurse" species; besides, forests composed of several species are more resilient to all kinds of natural disasters.

As the soil conditions on the planned territory are not homogenous (soil depth, slope angle, humidity level, proximity of parent material, etc.) and for the purpose of achieving higher probability of successful growth of seedlings, planting was done in staggered rows. The scheme of the order of seedlings between rows and in rows is as follows:

After each 20-30 seedlings in the row the wood species shall change; other wood species shall be planted in neighboring row at this distance. Besides, the above mentioned proportion of wood species is maintained – 60% oak, 40% - other deciduous species.
Maintenance requirement for new plantations are identified mainly as weeding around seedlings two-three times.

General financial results (fencing and planting costs, purchase of seedlings and other materials) under the project activities are summarized in annex 1.

3. Summary and outlook for Georgia

It is obvious that significant work is done towards achievement a main objective of the project – increasing resilience of forest ecosystems against climate change through practical implementation on selected pilot sites in Khashuri and Tsavkisi within the period of project duration. These results are reflected as a visible indicator (a well-protected area, new plantations established) and also on such factors as an involvement of all stakeholders like Central and local government, private companies designing and implementing Forest Transformation Plan and most important – intensive involvement local population in the works and with this making them "closer" to project and providing some alternative revenue opportunities.

Therefore, first step is done successfully. Detailed analysis of more reliable outcomes tested by time could only be made after several years and maybe decades since silviculture is a long term activity and consequently needs long term observation for final conclusion about success (or not success) of particular measure. Nevertheless, already at this very early stage we may conclude that basis for future success is done through honest and hard work.

In order, that the work done will not be wasted, further maintenance and protection of pilot sites to be continued. Site protection measures could include maintenance of fences and hiring of field monitor/ranger from the local population. Young seedlings planted also to be maintained through weeding to ensure better condition for their growth as it is recommended by FTP.

A monitoring programme (system) is to be established for the pilot sites. The monitoring programme (system) will be based on the manual of monitoring methodology developed by the project consultant.

A team of local scientists that will include but not limited to the botanists, zoologists, forest specialists, soil specialists is to be established to conduct monitoring field visits and research at least once in a year and prepare monitoring reports. The issue of sustainability and the necessity to maintain monitoring data of the area beyond the project lifetime needs to be considered in the establishment of a monitoring group. To ensure capacity development of decision makers, scientists, relevant faculty students, technicians and workers in monitoring ecological processes and ecosystem restoration techniques as well as in basics of best European standards in sustainable forestry the training materials and modules to be developed which may play an important role for further development of a training system in the forest sector.

To raise awareness in local population and main stakeholders planning and implementation of particular activities could be arranged. These activities are to be organized through particularly targeted meeting or posters for locals, meetings with school children and university students and other stakeholders.

Annexes

Annex 1- Financial summary of the project activities

GEORGIA	Contractual Cost in EUR	Contractual Unit Name	Contractual No. Units	Contractual Unit Cost in EUR		Unit Name	No. de-facto Units	Unit cost in EUR per de-facto hectare
Supply of Fencing Materials	47,425.50	km	13.00	3,648.12		ha	144.07	329.18
Installation of Fence	19,500.00	km	10.471	1,862.29		ha	144.07	135.35
SUB-TOTAL FOR FENCING	**66,925.50**					**ha**	144.07	**464.53**
Supply of Seeds								
Supply of Seedlings	89,800.00	seedling	90,000	0.998		ha	144.07	623.31
SUB-TOTAL FOR PLANTING MATERIAL	**89,800.00**					**ha**	144.07	**623.31**
Preparation of Sites	10,800.00					ha	144.07	74.96
Planting	43,200.00					ha	144.07	299.85
Maintenance (weeding)	10,800.00					ha	144.07	74.96
Other Measures	7,200.00					ha	144.07	49.98
SUB-TOTAL FOR PLANTING, SEEDING, WEEDING and OTHER MEASURES	**72,000.00**					**ha**	144.07	**499.76**
SUB-TOTAL FOR TOOLS & INSTRUMENTS	**30,967.30**					**ha**	144.07	**214.95**
TOTAL without TOOLS & INSTRUMENTS	**228,725.50**					**ha**	144.07	**1,587.60**
GRAND TOTAL	**259,692.80**					**ha**	144.07	**1,802.55**

Annex 2-Photos

1. Khashuri site- water pond near the site

2. Khashuri site –Frog moving through pilot site to its habitat

3. Khashuri site- fence is cut

4. Khashuri site – trend to soil trenching is serious problem to seedlings

5. Tsavkisi site- barb wire cut

6. Tsavkisi site – new plantations in open area