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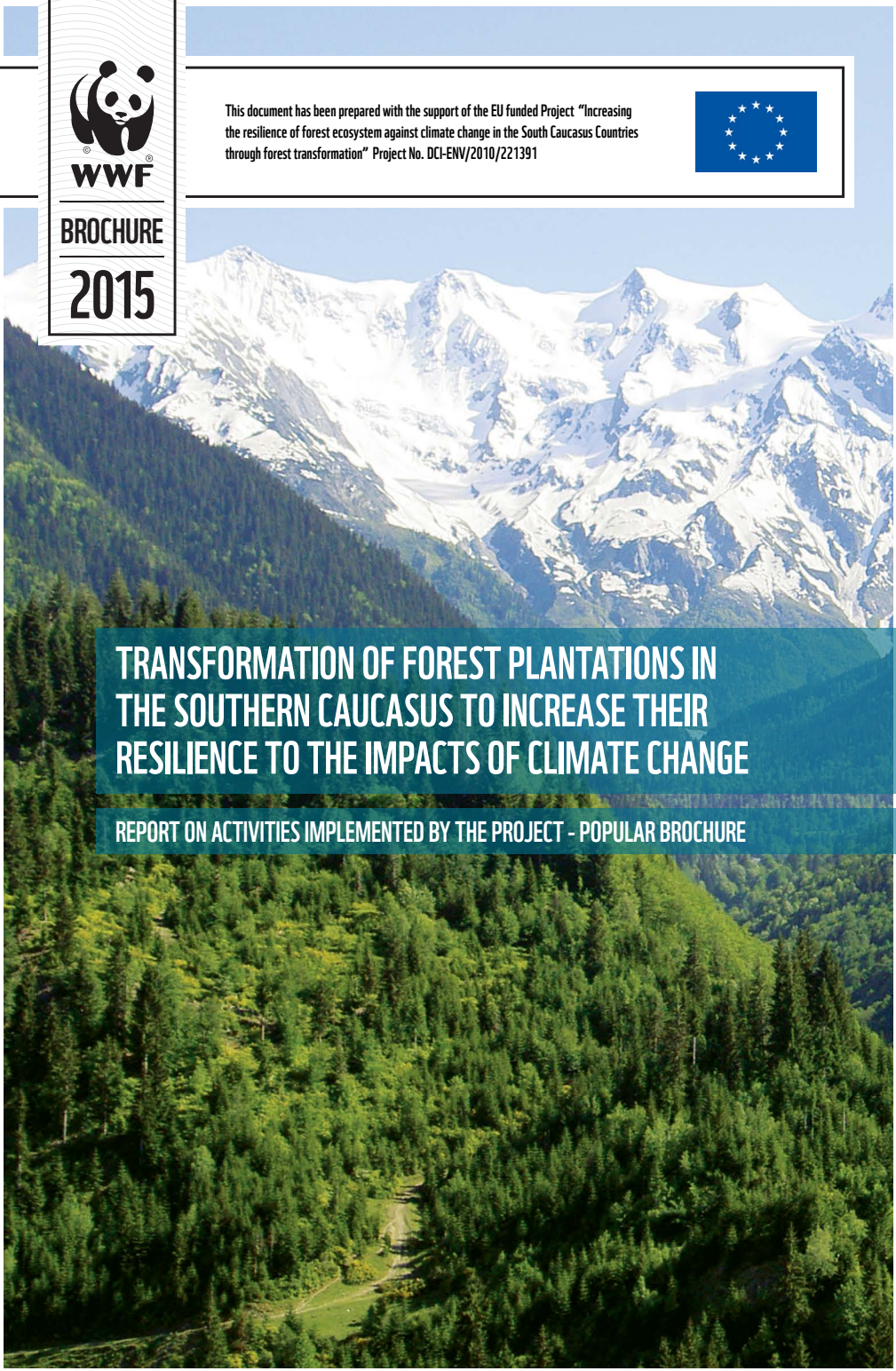

TRANSFORMATION OF FOREST PLANTATIONS IN THE SOUTHERN CAUCASUS TO INCREASE THEIR RESILIENCE TO THE IMPACTS OF CLIMATE CHANGE

REPORT ON ACTIVITIES IMPLEMENTED BY THE PROJECT - POPULAR BROCHURE

ABOUT THIS REPORT

This popular brochure was prepared by WWF Caucasus Programme Office (WWF-Caucasus) and WWF-Germany to provide an account of the activities which they implemented in the framework of the project "Transformation of forest plantations in the southern Caucasus to increase their resilience to the impacts of climate change". The project was implemented during 2011-2014 with funding from the EU in the framework of the Environment and Sustainable Management of Natural Resources including Energy Thematic Programme

All possible mistakes and deficiencies of the study remain in the full responsibility of the author.

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LIST OF ABBREVIATIONS

BMU	Bundesministerium für Umwelt, Naturschutz und eaktorsicherheit
CO2	carbon dioxide
ENP	European Neighbourhood Policy
ENPI	European Neighbourhood and Partnership Instrument
ENRTP	Environment and Natural Resources Management including Energy Thematic Programme (of the EU)
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FTSC project	The project "Increasing the resilience of forest ecosystems against climate change in the southern Caucasus through forest transfor mation"
GHG	greenhouse gas
ha	hectare
km	kilometre
WWF	Worldwide Fund for Nature

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EXECUTIVE SUMMARY

There are about 4 million hectares of forests in the southern Caucasus countries of Armenia, Azerbaijan and Georgia, the vast majority of them natural or semi-natural and the most important biome for biodiversity in the region. Anthropogenic emissions of "greenhouse gases" are causing changes in the region's climate. The results of climate modelling indicate that the region will become generally hotter and drier. Changes in the climate will affect forests: the forest formations that exist in the region have adapted to climatic conditions that were stable for thousands of years; the changes that we can expect will cause climatic zones to move and the forest formations adapted to the zones will be stressed; the speed of the change will make it difficult for forest formations to adapt naturally; the ecosystem services that forests provide will be threatened by the changes.

There are measures that can be taken to make forests more resilient and thereby mitigate the impacts of climate change. Between 2011 and 2014 WWF, with financing from the EU, implemented a project to demonstrate measures in the southern Caucasus countries together with complementary actions to raise awareness of the problem and build capacity to act. The project elected to demonstrate transformation measures in plantations: although plantations comprise a small part of the total forest area they are typically under greater stress than natural and semi-natural forests and less resilient to climate change. Two sites in each country – about 450 hectares in total – were selected as demonstration sites. The measures included planting, seeding and measures to promote natural regeneration, and measures to protect and facilitate the growth of the young trees. The complementary actions were a regional conference, study tour and workshops for staff of the three countries forest administrations and workshops with communities neighbouring the demonstration sites.

The measures implemented by the project were aimed at establishing a new storey of trees native to the region and well-adapted to the predicted future climate that eventually would develop into a more resilient, "close to nature" forest formation. Transformation plans were prepared by country planning teams in accordance with a standard template and guidelines elaborated by the project. The physical parameters of the sites and existing stands were assessed as a precursor to preparing the transformation plans. The planning teams were encouraged to choose species or provenances for planting or seeding that would be better adapted to conditions projected for the pilot sites. The planning teams found it difficult to do this because of the uncertainty surrounding the predictions. Also there was only a limited range of species and provenances available for purchase during the implementation period.

From March 1, 2011 to March 1, 2014 the total costs (costs for fencing material and fencing works, seeds and seedlings, preparation of sites, planting and maintenance/weeding works) per pilot hectare of forest on which transformation measures were carried out ranged from €1,500.55 per pilot ha for the Armenian sites to €1,587.60 for the Georgian and €1,968.19 for the Azerbaijan sites. Fencing against livestock was a substantial proportion of the total cost – 28% in Armenia, 29% in Georgia and 44% in Azerbaijan. In Azerbaijan expensive steel poles set had to be used in concrete bases because Azerbaijan fencing regulations restrict the use of wood.

The impacts of the measures demonstrated by the project will depend

on how well the young trees are protected from grazing and maintained against competition from grasses and shrubs and drought. The impacts will not be measurable for many years after the end of the project.

Much will depend on the attitude of the neighbouring communities towards the demonstration sites. Although the perceptions of the communities towards the project were fairly positive, some people were concerned about their customary use of the sites being curtailed, and some people were frustrated enough that they cut the fences at some of the pilot sites.

The measures demonstrated by the project can be extended to other plantations and to degraded natural and semi-natural forests. Considering the moderately high costs of the measures and the expense of subsequence maintenance, this should be done only after carefully weighing the likely benefits and the risks that measures might fail due to neglect.

There are other measures that might be more cost-effective, and more appropriate for the natural and semi-natural forests that comprise by far the largest part of the region's forest fund: where conditions are favourable, promoting natural regeneration by felling trees to create gaps in the canopy; encouraging communities act more responsibility towards their local forests and empowering them to be responsible for them.

Because of the long time between silvicultural measures being implemented and the impacts being assessable, projects such as this can only demonstrate the measures, not the impacts. Long term research projects needed to be implemented in which the impacts of different

measures in different forest formations can be monitored and evaluated over decade,

1 INTRODUCTION

During 2011-2014 WWF implemented a project "Increasing the resilience of forest ecosystems against climate change in the southern Caucasus through forest transformation" (FTSC project) with funding from the EU in the framework of the Environment and Sustainable Management of Natural Resources including Energy Thematic Programme (ENRTP).

WWF proposed the project to the EU because forests will come under increasing pressure from climate change, which will bring increases in temperature, lower rainfall and increased damage from floods and storms. The geographical ranges in which the region's tree species can thrive will move, and in parts of the region where they can no longer thrive the forests which they form will lose their vitally. As a result they will no longer be able to provide the eco-system services on which the people of the region depend, or they will provide those services in lower amounts.

To mitigate the impacts of climate change forest managers need to help forests adapt. EU countries have already started to implement measures to help forests become more resilient to the impacts of climate change, for example by gradually replacing species that are poorly adapted to predicted future climates with species that are better adapted, and by increasing the number of species to make forests more diverse. The aim of the FTSC project was to get decision makers in the forestry administrations of the three southern Caucasus countries of Armenia, Azerbaijan and Georgia to factor the impact of climate change on forests into forest management and to demonstrate adaptive measures at a number of pilot sites.

1.1 WHY FORESTS ARE IMPORTANT

Forests cover 4 million hectares of the southern Caucasus countries, which constitutes 22% of the countries' combined land and inland water surfaces: Armenia 332 thousand hectares (11.17%), Azerbaijan 990 thousand hectares (11.4%), Georgia 2,793 thousand hectares (40.7%) (FAO, 2010a). The region's wide variety of climatic zones in combination with variation in soils and relief has provided conditions for the development of a wide variety of forest formations.

In addition to the region's natural forest formations there are about 198 thousand hectares of artificially propagated plantations which were established in the early 1990s for various purposes including mitigating the risk of soil erosion, creating a supply of fuel wood for neighbouring communities. In Armenia about 55,000 thousand hectares of plantations were established, in Azerbaijan about 59,000 hectares, and in Georgia about 84 thousand hectares.The region's forests are important for a number of reasons:

BIODIVERSITY

The southern Caucasus is part of the Caucasus ecoregion - one of WWF's 35 "priority places" and one of 34 "biodiversity hotspots" identified by Conservation International as being the richest and at the same time most threatened reservoirs of plant and animal life on Earth. Forests are the region's most important biome for biodiversity, harbouring many endemic and relic species of plants and providing habitats for globally rare and endangered animals.

CARBON STORAGE

In 2010 the forests of the southern Caucasus countries held about 225 million tonnes of carbon in above ground biomass (FAO 2010b), equivalent to about 2.5% of global emissions of carbon dioxide in 2013 (Oliver et al 2013). Preservation of the region's forests therefore makes an important contribution to mitigating climate change.

SOIL AND WATER PROTECTION

Forests play an essential role in the protection of soils and water resources. Loss of forest often leads to erosion, increased risk of flooding and water shortage. The services provided by forests become even more important with climate change, which is likely to result in more irregular rainfall patterns and extended drought periods.

FOREST PRODUCTS

The region's forests are an important source of fuel. According to one study, in 2010 in Armenia 61% of all households still used wood as fuel (Junger and Fripp 2011). Rural households harvest nuts, berries and mushrooms from forests for domestic consumption and for sale. Georgia's forests support a relatively small but locally important wood processing industry.

CULTURE AND HEALTH

The region's forests provide opportunities for recreation, education and other social activities. Forests may have important historical connections or may have special cultural, including sacred, values.

1.2 IMPACTS OF CLIMATE CHANGE ON THE REGION'S FORESTS

Armenia, Azerbaijan and Georgia all show statistically increasing trends in mean annual temperature, mean daily minimum temperature and mean daily maximum temperature over the last century. There is an overwhelming scientific consensus that these changes are caused by anthropogenic emissions of carbon dioxide (CO2) and other so-called greenhouse gases (GHG). The climate will continue to change in response to additional GHGs that have already been emitted into the atmosphere and to future emissions. Climate models make it possible to project, with varying degrees of certainty, changes in the climate as a result of these GHGs.

PROJECTED FUTURE CLIMATE

In their 2nd national communications to the UNFCC, all three southern Caucasus countries presented projections for changes in precipitation and temperature based on the results of modelling. All the projections indicated that mean annual temperatures will increase significantly by the end of the present century. Projections based on the A2 emission scenario1 were: 1.8 °C-5.2 °C and 3.5 °C-4.9 °C, in western and eastern Georgia, respectively; 4 °C - 5.1 °C in Armenia; and 3 °C-6 °C in Azerbaijan. While the projections for temperature appear clear cut, there were discrepancies in the projections for precipitation. One model projected increases in mean annual precipitation in western Georgia and Azerbaijan, while other models for Georgia project declines.

A subsequent study (UNDP 2011) using projections from four General Circulation Models[2] (GCM) which simulate historical climate reasonably well projected declines in precipitation for all three countries: 20-31% in Armenia, 5-23% in Azerbaijan, and 0-24% in Georgia by the end of the century under the A2 emissions scenario. Across the four selected GCMs and using the A2 emissions scenario the projected changes in mean annual temperature by 2050 are: Armenia 1.1 °C – 1.9 °C, Azerbaijan 1.0 °C – 1.6 °C, Georgia 0.9 °C – 1.9 °C. By 2100, the projected increase is more dramatic: Armenia 4.4 °C - 5.5 °C, Azerbaijan 3.6 °C - 4.1 °C, and Georgia 4.1 °C - 5.5 °C.

- Increased concentrations of CO2 will have a positive effect on tree growth. This is because current concentrations of CO2 in the atmosphere are below the levels that are optimum for plant growth. However, any increases in productivity resulting from higher levels of CO2 in the atmosphere will be offset, and in many situations completely cancelled, by changes in the climate resulting from the higher levels of CO2 and other GHGs:

- Changes in temperature, rainfall, wind and humidity will affect photosynthesis and respiration (and therefore growth), reproduction, pollination, seed dispersal, phenology, pest and disease resistance and competitive ability.

- More frequent strong winds will damage forests by uprooting and breaking the stems of trees, and more frequent heavy rain will increase the risk of soil erosion and landslides. The

1. GHG emissions scenarios are alternative images or "storylines" of how the future might unfold and are used to analyse how driving forces may influence future emission outcomes and to assess the associated uncertainties. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which results in a continuously increasing global population. Economic development is primarily regionally oriented and per capita economic growth and technological change are more fragmented and slower than in other storylines. (IPCC 2000)

2.General Circulation Models (GCMs) are spatially-explicit, dynamic models that simulate the three-dimensional climate system using as first principles the laws of thermodynam¬ics, momentum, conservation of energy and the ideal gas law. (UNDP 2011)

disturbances caused by such events reduce productivity in the short term and can make forests more vulnerable to pests and diseases.

- Prolonged dry and hot weather will increase the risk of forest fires. Severe fires destroy organic matter and nutrients are lost by volatilization. Frequent fires can also increase soil erosion, reduce regeneration and in dry areas may accelerate desertification.

- Warmer climate conditions increase the risk of insect epidemics. The drought stress of trees will make forests more vulnerable to infestation by insect herbivores and fungal diseases).

- Climate change may increase niche availability for invasive species. Dominant endemic species may no longer be adapted to the changed environmental conditions of their habitat, affording the opportunity for introduced species to invade, and to alter successional patterns, ecosystem function and resource distribution.

IMPACTS OF CLIMATE CHANGE ON FORESTS IN THE SOUTHERN CAUCASUS

The climate of the southern Caucasus is likely to become generally less suitable for most of the forest types that occur in the region at present. While some forest formations may benefit overall from climate change, most formations will become stressed and lose vigour. Under ecologically more favourable GHG emissions scenarios conditions will become more suitable over a larger part of the region for dry woodlands, Buxus, Castanea, Parrotia and Zelkova. Under ecologically less favourable scenarios conditions will become more suitable over a larger part of the region only for dry woodlands and Zelkova.

Forests and their biological components respond autonomously to long term climate change. The distribution of forests and of different forest types in the southern Caucasus 5,000 years ago, before human activity started to cause the deforestation of large areas, was very different from what it was immediately after the end of the last ice age. However, the rate at which tree species migrate is critical: after the last glacial period, tree species migrated a few kilometres per decade or less, whereas climate zones are likely to shift by 50 kilometres per decades; therefore the migration and adaptation rates of many tree species may not be able to keep pace with projected global warming.

If no action is taken to mitigate the impact of climate change on forests the changes in forest health, vitality and productivity caused by changes in climatic variables will have significant consequences for people living in the region. Those consequences will include:

- an overall reduction in the quantity of timber and non-wood forest products such as mushrooms, berries and nuts from the forest types present in the region today, though production may increase in the Kolkhic bio-climatic region;
- an overall reduction in the value of environmental services provided by the region's forests, including regulation of water quality and water flow, prevention of erosion, landslides and avalanches;
- changes in biodiversity and the special values of the region's protected areas;
- changes in the visual landscape.


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2 PROJECT DESIGN

2.1 OBJECTIVES AND EXPECTED RESULTS

The logframe of the project is presented in Annex 1[3]. The project was designed to contribute to the overall objective of increasing the resilience of forest ecosystems in the southern Caucasus 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. The objectively verifiable indicator (OVI) for the overall objective is that two years after completion of the project the national governments 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, i.e. the objective which was to be achieved by the end of the project, contributes to the overall objective by establishing the necessary conditions for the forest administrations in southern Caucasus countries to develop and implement strategies for transforming monoculture forest stands into highly resilient, "close to nature" forest stands. The following OVIs were to be achieved by the end of the Project:

- the structure of forest stands on pilot sites has been transformed in such a way that the stands will be highly resilient to climate change;
- the potential of forest stands on the pilot sites to enhance the livelihoods of neighbouring communities will have increased; and
- the chief executives and heads of the policy and planning departments of forest administrations and heads of relevant departments in the forest administrations show a demonstrable increase in their awareness of climate change impacts on forests and motivation to develop strategies for making forests more resilient.

The expected results of the project were:

1. Selected forest stands vulnerable to climate change have been transformed into highly resilient "close to nature" forest stands;
2. Silvicultural guidelines for the transformation of monoculture stands into more resilient stands are elaborated, published in national and English languages and made available for relevant officials and experts;
3. The capacities of forest administration experts to develop silvicultural strategies to transform monoculture stands into stable, site-adapted forests are increased;
4. The awareness of local communities about the importance of forest rehabilitation with regard to mitigating negative biotic and abiotic impacts of climate change is improved.

The silvicultural focus of the project and of these guidelines was the transformation of monoculture forest stands in the region into highly resilient, "close to nature" forest stands. Thus there are two conditions that the transformation measures had to meet: the transformed stands must be highly resilient to climate change; and they must be "close to nature".

Resilient in the context of the project means the ability of an ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation, and the capacity to adapt to stress and change. According to this definition a forest can undergo changes in some of its characteristics, for example genetic

3. The logframe at Annex 1 is the revised version that was prepared during the first year of project implementation. The revision was made to incorporate changes that became necessary after six months experience of implementing the project.

composition of a species, species composition of a stand, and still meet the definition of resilient provided that the system is still recognisably a forest in terms of its physical structure and the variety of goods and services that it provides. Within the meaning of resilient such scope for change in the genetic character of the forest is probably going to be essential: no change or only a small change is almost certainly unrealistic given the increases in temperature and decreases in precipitation that are expected in the region.

"Close to nature" means a system of forest management which provides continuous regeneration, development and treatment of stands that are similar in species composition, structure and dynamic to forests occurring naturally in the specific site conditions (see Box 1).

Thus we can summarise the project's transformation aims in the following way:

Resilient to climate change. The stand will continue as a forest formation (i.e it will not transform into another state such as grassland). The stand will continue to provide the range of goods and services that we currently associate with forests but the volumes/ quantities of individual goods and services and their volumes/quantities relative to each other may change (e.g. the forest will continue to produce harvestable timber but may do so in smaller amounts than now, and it will continue to provide soil and water regulation services).

Close to nature forest stand. The tree species which form the stand are native to the South Caucasus. The tree species are mixed in proportion to each other and arranged spatially in a way that resembles the structure of the forest that we would expect to develop naturally on the site. The questions of how far predicted future climate change should be taken into account and the composition of the forest that would develop naturally on the site under those predicted future conditions are important when deciding transformation measures for specific stands.

2.2 PLANNED ACTIVITIES

The planned activities were structured into four work packages as follows:

1. Research and demonstration package – the development and piloting of silvicultural measures for transforming forest stands that are vulnerable to climate change into resilient forest stands and provision of practical experience in the target countries which could be used as a basis for training materials and as demonstration sites;

2. Dissemination package for the forest administrations in the target countries, including information and materials on forest transformation measures that could be applied to all forest stands vulnerable to climate change in the target countries. The envisaged materials were silvicultural guidelines, a popular report describing activities implemented by the project (this report), results and lessons learned from the Project, and training modules;

3. Capacity-building package, designed to train staff of the forest administrations to develop and implement strategies for transforming forest stands more widely in the target countries after the action hadbeen completed, and to create the supportive policy environment for the forest administrations to be able to develop and implement strategies for making forests more resilient to the impacts of climate change;

4. Awareness raising package, aimed at building the awareness in the communities adjacent to the pilot sites and local NGOs and CBOs active in the locality of the pilot sites about the impacts of climate change on forests and forest services and at involving them in the implementation of the action at the pilot sites.

Box 1 – Close to Nature Forestry (adapted from Slovenia Forest Service, 2008)

The following description of "close to nature forestry" is taken from a publication by the Slovenia Forest Service which is a long standing follower and promoter of the approach:

"Close to nature forestry uses forest management methods that promote conservation of nature and forests, as its most complex creation, while deriving tangible and intangible benefits from a forest in a way to preserve it as a natural ecosystem of all its diverse life forms and relations formed therein. Close to nature forestry is based on forest management plans adapted to individual site and stand conditions as well as forest functions, and considering natural processes and structures specific to natural forest ecosystems. Natural processes are altered as little as possible, while still maintaining the financial profitability and social sustainability of forest management. Similarly to natural processes, close to nature forestry also contains inbuilt mechanisms for continual internal checks (controls) providing timely response to modify measures adapted in accordance with developmental characteristics of single forest stands and a forest as a whole.

Characteristics of close-to-nature forest management are:

- Preservation of the natural environment and the ecological balance of the landscape;
- Sustainability of all forest functions;
- Integrated approach to a forest ecosystem;
- Imitation of natural processes and forms;
- Tree species suited to site conditions;
- Based on [the adaptive] approach – constant monitoring and learning;
- Based on long-term economic efficiency;
- Plans designed at a broader and more detailed level.

Close-to-nature forest management is, therefore, a forest management practice where the goals of sustainable and multifunctional forest management are achieved through preservation of natural forest and silvicultural approach mimicking natural disturbances and processes. In this sense, close-to-nature forest management combines the principles of sustainable forest management and the ecosystem approach."

3 ACTIVITIES IMPLEMENTED BY THE PROJECT

3.1 RESEARCH AND DEMONSTRATION

3.1.1 RESEARCH INTO THE RESILIENCE OF FOREST STANDS AND ELABORATION OF RECOMMENDATIONS ON TRANSFORMATION MEASURES

The project design included desk-based research to provide a basis for planning transformation measures at the pilot sites. The project contracted an international forestry expert to carry out the research and to prepare a report in cooperation with the project staff. The report was adapted for dissemination and published in July 2012. The published report contains, in addition to an introduction, contains six chapters as follows:

- overview of the forests of Armenia, Azerbaijan and Georgia, their importance, and the pressures and threats that they face.
- nformation about changes in the climate in the region up to the present day and predicted future changes from modelling studies.
- description of the impacts of changes in the climate on forests generally and the impacts that we should expect on forests in the South Caucasus.
- description of strategies for mitigating the impacts of climate change on forests including adaptation of forests to climate change.
- discussion of resilience and close to nature forest management and recommended process for elaborating transformation plans for the pilot sites.
- outlook for the pilot sites in the face of the uncertainty surrounding the predictions about the future climate.

A copy of the full report can be downloaded in Adobe Acrobat© format using the following link: http://d2ouvy59p0dg6k.cloudfront.net/downloads/adaptation_of_forests_to_climate_change.pdf

3.1.2 REGIONAL CONFERENCE

The project held a regional conference in Tbilisi in February 2013 to exchange information and share experience among senior forest engineers, forest ecologists and other stakeholders in the region on climate change impacts on forests and best practice in forest transformation. The conference targeted policy makers in forestry administrations of the three countries. 35 people participated including experts from forest administrations and academic institutions, international organizations, and two experts from EU member states.

The conference provided a forum to discuss potential project impacts, challenges, risks and risk mitigation strategies, and came up with a number of conclusions and recommendations as outlined below:

1. Climate change will have significant impacts on forests in the region and the negative impacts of climate change will almost certainly outweigh any positive impacts.

2. In the framework of the Project measures are being taken at a number of pilot sites to transform monoculture stands that are particularly susceptible to climate change into structurally diverse stands of mixed species.

3. Transformation measures – fencing, and planting, sowing, natural regeneration and ancillary operations – are already well established at the Project's pilot sites.

4. The selection of the species and provenances which will be planted or sown in the process of forest transformation is very important. Future climate conditions need to be taken into account when deciding which species and provenances to use.

5. As a general rule, natural regeneration of native species should be favored because natural regeneration is a good indicator of the site's suitability for the species in question. Further, natural regeneration is the most cost-effective silvicultural measure for forest transformation.

6. Grazing pressure needs to be managed to allow natural regeneration and to prevent damage to young trees. Forest managers need to engage with the people who depend on their livestock for their livelihoods and who have become accustomed to using forest stands for grazing.

7. In order to sustain the impacts of forest transformation measures, the seedlings need to be tended. Projects such as the current action need to obtain reasonable guarantees from the owners of the forests in question regarding subsequent maintenance of the implemented measures.

8. The subsequent development of stands in which transformation measures have been carried out needs to be monitored so that one can learn lessons and adapt approaches to transformation accordingly.

9. In order to go beyond small scale pilot projects such as the present action the Governments of Armenia, Azerbaijan and Georgia need to elaborate and implement national strategies for mitigating and adapting to the impacts of climate change on forests.

The report of the conference forms Annex 1 of the project's second interim narrative report, a copy of which can be downloaded in Adobe Acrobat© format using the following link: http://d2ouvy59p0dg6k.cloudfront.net/downloads/eu_enrtp_regional_conference_2013.pdf

3.1.3 DEMONSTRATION OF TRANSFORMATION MEASURES

Site selection

Two sites in each of the project's target countries were selected for demonstrating transformation measures. The main precondition for site selection was to identify monoculture forest stands. The sites were selected based on the criteria elaborated in collaboration with the forest authorities of the target countries before starting to search for sites (Box 2). The six sites were selected by the project partners together with the forest administrations responsible for assigning the pilot sites to the action (in Armenia the "Hyantar", in Georgia the Municipality of City of Tbilisi and the Natural Resources Agency of the newly established Ministry of Energy and Natural Resources, in Azerbaijan the Forestry Department of the Ministry of Ecology and Natural Resources) using the criteria developed in activity 1.2.1. Local government and community administrations were involved in site selection where relevant (one of the pilot sites in Georgia was selected on municipality managed forest land). Descriptions of the selected sites are presented in Table 1 together with the objectives for each of the sites that were agreed with the forest authorities. The total area of the selected sites is 443.47 hectares, of which 151.80 ha are located in Armenia, 148.00 in Azerbaijan and 144.07 in Georgia.

Box 2 - 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

Table 1 - Description of the pilot sites and their management objectives

Project sites	Description of sites	Management objectives
Spitak, Armenia	Monoculture pine stands, 4-11 years old, rather dense, never thinned, with some open areas, erosion (sometimes rather severe) present in some places, limited presence of other species.	1. Connect fragmentized habitats (eco-corridor) 2. Mitigate the risk of soil erosion 3. Generate employment opportunities for the local population
Noyemberian, Armenia	Severely degraded pine stands, more than 30 years old, degradation continuing due to wind and snow; presence of bush vegetation, in some places old planted broadleaf species (apple, maple) and natural regeneration with poor growth due to grazing.	1. Mitigate the risk of soil erosion 2. Generate employment opportunities for the local population 3. Increase the aesthetic and recreational value of the forest
Agsu, Azerbaijan	Artificially established monoculture pine strands 40-50 years old; mainly single storey; a second storey with young oak and ash and some shrubs occurs in low density areas; in some areas there are wind fallen trees.	1. Mitigate the risk of soil erosion 2. Generate employment opportunities for the local population
Yevlakh, Azerbaijan	Artificially established monoculture pine stands 50-60 years old. Entirely one storey with tamarisk bushes in the under storey. No natural regeneration.	1. Generate employment opportunities for local population
Khashuri, Georgia	Artificial forests of black pine (Pinus nigra) up to 45 years old; Caucasian pine (Pinus hamata) is mixed therein in small quantities, in groups and singly,. Relatively small areas are occupied by Georgian oak stands of coppice origin with hawthorn and other shrubs. Almost half of the pine stands have low and medium density.	1. Connect fragmented habitats (eco-corridor) 2. Mitigate the risk of soil erosion 3. Generate employment opportunities for local population 4. Increase the aesthetic and recreational value of the forest
Tsavkisi, Georgia	High and medium density monoculture pine (Pinus nigra) stands scattered throughout natural stands represented by a prevalence of Georgian oak, a with mixture of hornbeam, oriental hornbeam, ash and other species.	1. Connect fragmentized habitats (eco-corridor) 2. Mitigate the risk of soil erosion 3. Generate employment Increase the aesthetic and recreational value of the forest

Site survey

After selection the sites were surveyed so that the project team could select the specific stands in which transformation measures would be carried out and to provide information needed for the preparation of the transformation plans. The outputs from the surveys were maps of the sites and the boundaries of the specific pilot stands, significant natural features of the sites, and a description of the stands including the growing stock. The activity was led by the project partners and the work was organised and carried out by the project's country coordinators with the participation of local forestry administration staff and local community members close to the sites. The country coordinators were led and advised by the project's International Project Advisor and supported by the project's Regional GIS expert.

Elaboration of forest transformation plans

The FTSC project contracted out the elaboration of transformation plans for the demonstration sites to the organisations shown in Table 2. The terms of reference of the contracts required the organisations to elaborate transformation plans in accordance with a standard template. The template is at Annex 2.

Table 2 - Name of organisations responsible for elaboration FPTs

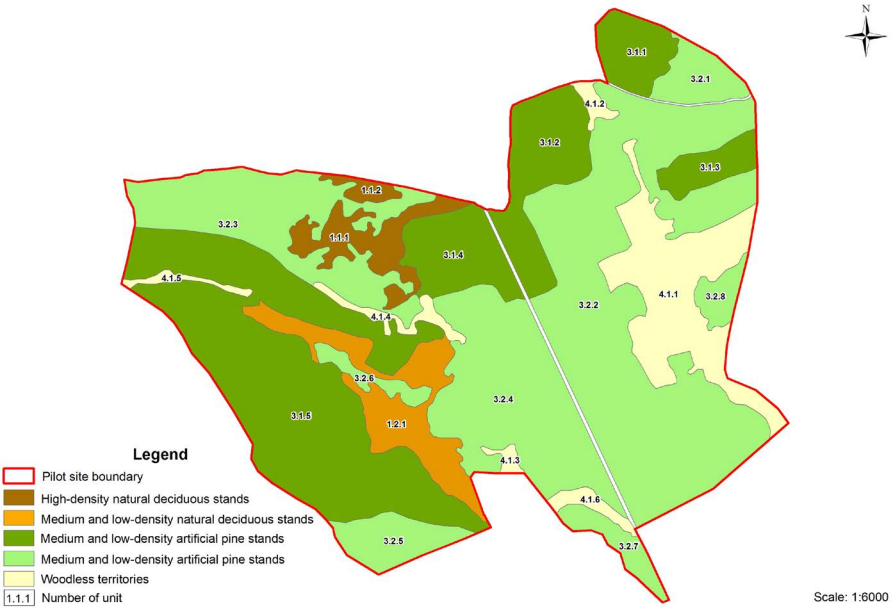
Country	Pilot Site	Name of organization
Armenia	Spitak Noyemberian	"Kanach Desine" LLC
Azerbaijan	Agsu Yevlakh	Forestry Development Department of the Ministry of Ecology and Natural Resources
Georgia	Khashuri Tsavkisi	"Tkeinventproekti" LLC

Each planning organization formed a special group, consisting of various specialists (forest planning specialists, botanist, forester-pathologist, soil scientist, GIS specialist), to prepare the transformation plans. WWF provided the group with the required cartographic, aerial photo, public register and legal materials.

Site assessment

The first step towards elaborating the transformation plans was to assess important site parameters, including forest type, soils, climate, interactions with neighbouring communities, pressures on the site (for example from grazing), and protection needs. Forest types were distinguished by reference to species composition, origin (natural or artificial) and canopy density(see Figure 1 for an example of a map of forest types). Different typologies were developed for each of the pilot sites, according to each sites characteristics. For example, in the Khashuri site in Georgia, six types were distinguished:

Figure 1 – Map of forest types. Khashuri pilot site, Georgia



- high density deciduous stands of natural origin;
- low and medium density deciduous stands of natural origin;
- high-density pine stands of artificial origin;
- low and medium-density pine stands of artificial origin;
- low and medium-density pine stands of artificial origin with dense oak young growth;
- treeless territories;

whereas in the Spitak site in Armenia the following types were distinguished:

- Forest cultures
- Forest cultures with non-closed canopy
- Open area

Choice of species for the transformed stands

The planning teams decided what would be the best mix of tree species for each of the demonstration sites based on the available knowledge about the forest communities that are best adapted to the sites' soils and climatic conditions and other relevant site parameters. Guidance given to the planning teams emphasised the importance of choosing species native to the southern Caucasus, in keeping with the principle of creating "close to nature" stands, which are likely to be more resilient to the impacts of climate change than stands composed of non-native species.

Since projected changes in the region's climate are large enough to raise concerns about the suitability of species that are adapted to present day conditions, the planning teams were encouraged to take climate predictions into account, for example by choosing

species that are better adapted to conditions similar to those projected for the pilot sites, or by selecting provenances that show the greatest tolerance of high temperatures. In practice the planning teams found it difficult to factor predicted changes in climate into their species choices because the predictions that are available are surrounded by high levels of uncertainty. Furthermore, only a limited range of species and provenances were

Box 3 – Example of the approach to determining the preferred species at the pilot sites (Khashuri pilot site, Georgia)

"According to the Scheme of Division of Caucasian Forest Vegetation in Districts and Vertical Zones, developed by Academician Vasil Gulisashvili, the planned territory is included in the district of the humid part of east Georgia (Zemo and Shua Kartli district). According to vertical zoning, four zones are included in this district: I – oak zone in the range of 600-1000 m above sea level; II – maple zone in the range of 1000- 1500 m above sea zone; III - spruce and fir zone in the range of 1500 – 2000 m above sea level; IV – subalpine thin zone in the range of 2000- 2300 m above sea level.

The planned territory is completely in the oak zone. The basic wood species, creating the forests of this zone, is Georgian oak (Quercus iberica); the forest also consists of: hornbeam (Carpinus caucasica), light maple (Acer laetum), field maple (Acer campestre), ash (Fraxinus excelsior), oriental hornbeam (Carpinus orientalis), wild pear (Pyrus caucasica), wild apple (Malus orientalis), lime-tree (Tilia caucasica), elm (Ulmus carpinifolia). Undergrowth species are diverse – cornel (Cornus mas), hazelnut (Corylus avellana), red dogwood (Swida australis), spindle tree (Euonymus verrucosus), dog-rose (Rosa canina), medlar (Mespilus germanica), buckthorn (Rhamus catartica), hawthorn (Crataegus spp.), privet (Ligustrum vulgare)."

available for the project team to purchase during the implementation period.

An example of the approach taken by the planning teams is given in Box 3.

Planning of transformation measures

After carrying out the site assessments and deciding which species would be most suitable the planning teams elaborated transformation strategies for the sites and specified the

Table 3 – Transformation strategies selected for the Khashuri demonstration site, Georgia

Stand type	Transformation strategy
High density deciduous stands of natural origin	Protection from cattle and prohibition of all kinds of cutting. In the longer term, implementation of maintenance cuts, facilitation of natural regeneration, formation of full-value high density seed- originated oak stand.
Low and medium density deciduous stands of natural origin	Planting oak in canopy openings. In the longer term implementation of maintenance cuts, facilitation of natural regeneration for the purpose of formation of mixed stands..
High-density pine stands of artificial origin	Planting oak and other deciduous trees in canopy openings, cutting of dying and slowly-growing trees, implementation of cuts in the course of natural regeneration and successful development of planted saplings to provide seedlings with sufficient light and to ensure the successful formation of mixed stands.

Stand type	Transformation strategy
High density deciduous stands of natural origin	Protection from cattle and prohibition of all kinds of cutting. In the longer term, implementation of maintenance cuts, facilitation of natural regeneration, formation of full-value high density seed- originated oak stand.
Low and medium density deciduous stands of natural origin	Planting oak in canopy openings. In the longer term implementation of maintenance cuts, facilitation of natural regeneration for the purpose of formation of mixed stands..
High-density pine stands of artificial origin	Planting oak and other deciduous trees in canopy openings, cutting of dying and slowly-growing trees, implementation of cuts in the course of natural regeneration and successful development of planted saplings to provide seedlings with sufficient light and to ensure the successful formation of mixed stands.
Low and medium-density pine stands of artificial origin	Planting oak and other deciduous trees in gaps in canopy openings. In the longer term cutting of drying and slowly-growing trees, facilitation of natural regeneration, implementation of cuts in the course of natural regeneration and successful development of planted saplings to provide seedlings with sufficient light and to ensure successful formation of mixed deciduous stands in the future.
Low and medium-density pine stands of artificial origin with dense oak young growth	Protection from cattle. In the longer term removal of pine trees in the course of development of young growth to improve light conditions for oak and formation of full-value stand. Cuts of pine trees shall be performed while oak young growth is elastic and can easily go straight after leaning down as a result of cutting of trees (and not break or root out as a result of being hit by trees, but lean over).
Treeless territories	Planting, facilitation of natural regeneration, of oaks and other deciduous trees (ash-trees, maples, wild pear, wild apple), facilitation of natural regeneration, maintenance of young growth and sprouts for the purpose of forming mixed deciduous stands with oak prevalence. Measures are not be taken where there are power transmission lines.

transformation measures to be implemented by the project and maintenance measures to be implemented after the project ended. An example of the transformation strategies elaborated for one of the pilot sites is presented in Table 3.

Protection

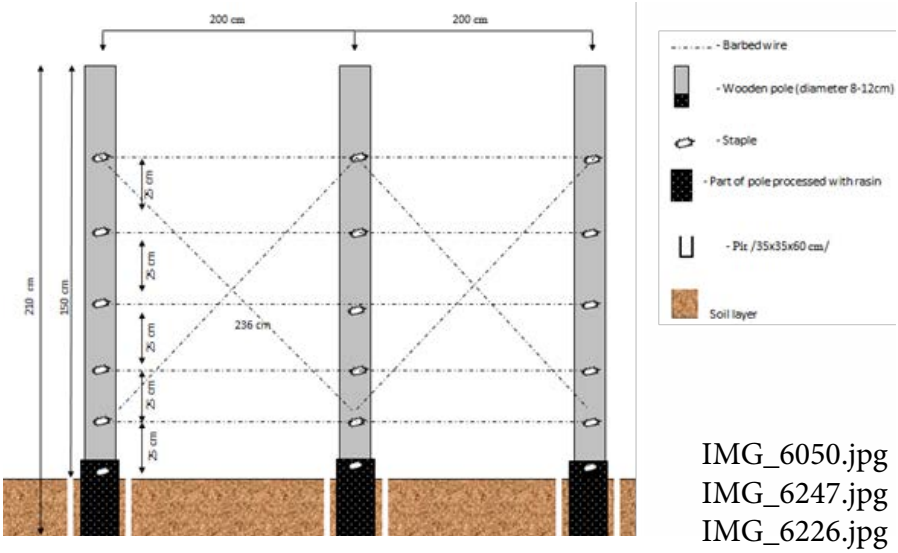
The transformation strategies identified a need to protect stands that are being regenerated, whether naturally or artificially, from grazing animals, in particular domestic livestock. One

Table 4 – Planned fencing in three countries at the six demonstration sites

Site	Planned Fence length (m)	Area of site (ha)	Metres of planned fence per hectare
Armenia			
Spitak, Noyemberian	15,000	151.80	98.81
Azerbaijan			
Agsu, Yevlakh	12,000	148.00	81.08
Georgia			
Khashuri, Tsavkisi	13,000	144.07	90.23

option would have been to fence the individual plots in which transformation measures were to be implemented, but in the case of all of the pilot sites it was more cost-effective

Figure 3 – Design for the fencing used in Armenia and Georgia



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IMG_6226.jpg

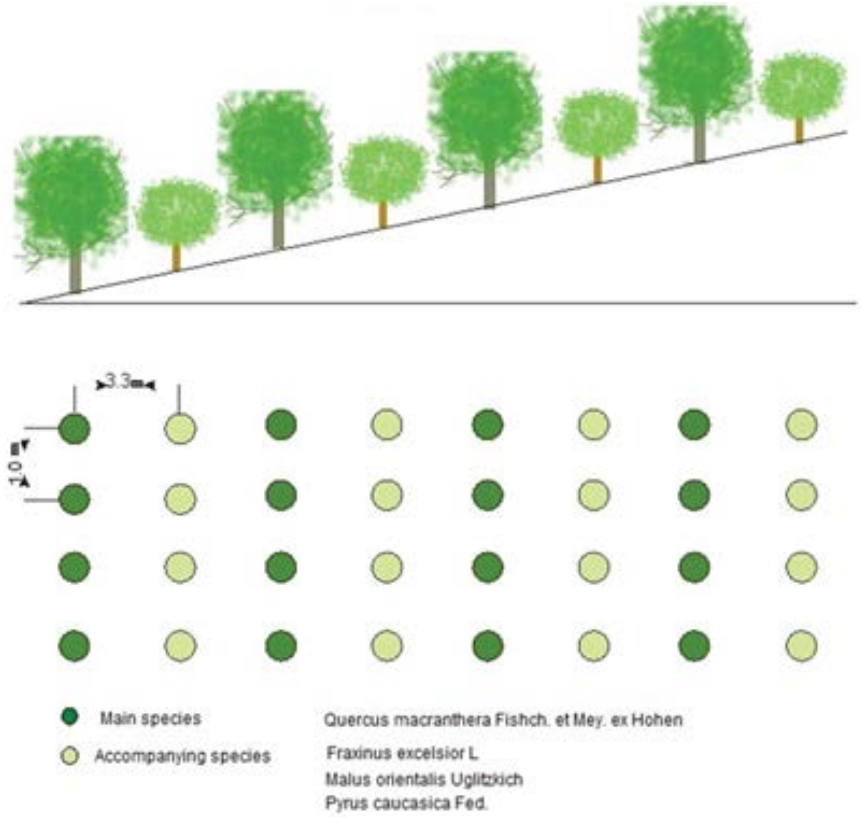
to fence the entire site. To protect the sites from grazing, the project erected 34.2 km of fence. The planned length of fence and length of fence per hectare for each country are given in Table 4.

In Armenia and Georgia wooden poles with regular non-galvanized barbed wire were used for fencing (see the design in Figure 3). In Azerbaijan, due to legal restrictions concerning of forest use, the fences were constructed using metal was fixed in concrete with galvanized barbed wire.

Planting method / site preparation

The planning teams had to consider, for each stand, whether to assist natural regeneration (for example by scarifying the soil or by removing competing shrubs), reinforce natural

Figure 2 – Design for the fencing used in Armenia and Georgia



regeneration of preferred species by planting seedlings or sowing seed, or, where there was no natural regeneration, to regenerate the stand by sowing or planting. Regeneration measures (seeding, planting, removing competing shrubs) were focused on existing gaps in preference to creating gaps by felling healthy trees, which the project team considered would cause controversy among stakeholders; anyway the budget for transformation measures was absorbed by implementing measures in existing gaps.

Planting design

Planting and sowing schemes were elaborated for the different site conditions and for different combinations of species (see the example in Figure 2).

Planned regeneration measures

Direct regeneration measures (planting and seeding) were planned on approximately 150 hectares out of the demonstration sites' total area of about 450 hectares.

Measures for post-planting maintenance

The planning teams had to specify measures for ensuring that the planted seedlings and seedlings from the sown seed would become properly established. Measures were specified for the year in which planting and sowing were done and for five years thereafter. Specified measures included rodent control, removal of competing vegetation by cutting, and replacement of seedlings that had died.

Costs of transformation measures

Table 5 – Costs of measures for the South Caucasus region and each country

SOUTH CAUCASUS	Cost (EUR)	Unit Name	No. Units	Unit Cost (EUR)	Total Area (ha)	Cost per hectare (EUR)
Supply of Fencing Materials	170,275.50	km	40.00	4,256.89	443.87	383.62
Installation of Fence	89,450.00	km	34.200	2,615.50	443.87	201.52
SUB-TOTAL FOR FENCING	**259,725.50**				443.87	**585.14**
Supply of Seeds	2,861.00	kg	3,876.70	0.738	443.87	6.45
Supply of Seedlings	230,040.00	seedling	445,790	0.516	443.87	518.26
SUB-TOTAL FOR PLANTING MATERIAL	**232,901.00**				443.87	**524.71**
Preparation of Sites	38,276.25				443.87	86.23
Seeding and Planting	153,105.00				443.87	344.93
Maintenance (weeding)	38,276.25				443.87	86.23
Other Measures	25,517.50				443.87	57.49
SUB-TOTAL FOR PLANTING, SEEDING, WEEDING and OTHER MEASURES	**255,175.00**				443.87	**574.89**
TOTAL FOR THE SOUTH CAUCASUS	**747,801.50**				443.87	**1,684.73**

The project spent €747,801 on transformation measures. Table 5 provides a breakdown of the costs by the region and by item/activity. Costs are shown for gross area (the area of the demonstration sites). Costs varied between countries, substantially for some items. Fencing costs were much higher in Azerbaijan than in Armenia and Georgia (about three times more per metre) because more expensive steel poles were used (Azerbaijan law does not allow wood to be cut in Azerbaijan's forests for such purposes). The cost of seedlings in Georgia was more than three times the cost in Armenia and twice the cost in Azerbaijan because there are few suppliers and therefore little competition.

3.2 DISSEMINATION

The project's activities in Work Package 2 were the elaboration and dissemination of this report, dissemination of the training module elaborated under work package 3 (see section 3.3 below), and elaboration and dissemination of guidelines on forest transformation .

The aim of the guidelines is to extend the results of the project and to support the planned adaption of forests in the southern Caucasus countries of Armenia, Azerbaijan and Georgia to climate change. They describe - based on the research carried out, and the practical experience gained by the project - how to plan and implement measures that will make forests more resilient to the impacts of climate change. The guidelines begin with a short overview on the forest landscapes in the region. This is followed by an account of how the region's climate has been changing and of what the climate might be in the future based on projections from climate models. Then the guidelines describe the impacts of climate change on forests and the effects of projected changes in the climate of the southern Caucasus on the region's forests. Thereafter, the guidelines describe and explain the process of planning forest transformation measures taking into account projected changes in the climate and the suitability of different tree species to future climatic conditions.

3.3 CAPACITY BUILDING

4."Forest Transformation Guidelines: Transformation of forest plantations in the southern Caucasus to increase their resilience to the impacts of climate change". Published by WWF Germany and WWF Caucasus Programme Office. 2015.

3.3.1 NATIONAL WORKSHOPS

The project held one national workshop in each of the target countries during June - July, 2011 to introduce the topic of climate change impacts on forests and the objectives, expected results, and activities of the action to senior staff of the countries' environment ministries and forest administrations. The workshops targeted around 50 people in total in the target countries. The workshops were used as a forum for discussing the draft criteria for selecting the pilot sites. The participants' knowledge of climate change impacts on forests and of strategies for increasing forest resilience was assessed at the start of the workshops by questionnaire. The workshops were arranged and facilitated by the project partners.

The workshops strengthened participant's knowledge about climate change impacts on forests and of transformation strategies. Through participating in this action, they were able to obtain skills to develop in future policies that would increase the resilience of forests and to lobby for support of those policies from ministers and the parliaments. The selection criteria for selecting the sites at which transformation measures were supposed to be piloted were discussed, adopted to national conditions and agreed. Consensus on possible location of two pilot sites in each country were reached by reviewing the potential areas using the selection criteria developed under the project. The workshops were followed up by analyses of forestry and socio-economic information and GIS mapping for site selection in joint working groups of specialists.

3.3.2 STUDY TOUR TO GERMANY

The project arranged a study tour for staff from the target countries' relevant governmental agencies and forestry administrations. The study tour took place in Germany in April 2013 and was organised and led by Hessen-Forst, the German State of Hessen's forestry service.

The objective of the study tour was for forestry policy holders and practitioners from the region to learn how climate change has been addressed in the forestry policy and strategy of an EU member state and to see at first hand the silvicultural techniques which forest managers in that member state are using to make forests more resilient to the projected impacts of climate change.

The project chose Germany as the destination country for the study tour because many of Germany's federal states had been implementing policies of converting poorly adapted monocultures to more diverse and more resilient stands for a number of years, and forest managers in Germany - in the state and private sectors - have a lot of practical experience in forest transformation.

15 persons participated in the study tour: two senior staff from each of the countries' relevant governmental agencies; two staff from each of the countries' relevant local forestry administrations; and one member of the WWF project team from each of the target countries. In addition the regional project coordinator from WWF Caucasus participated along with the international project manager from WWF-Germany.

A copy of the full report of the study tour can be downloaded in Adobe Acrobat© format using the following link: http://d2ouvy59p0dg6k.cloudfront.net/downloads/study_tour_report_1.pdf

3.3.3 TRAINING MODULE AND TRAINING EVENTS

The project prepared a one day training module on forest transformation for forestry professionals and administrating bodies and applied the module in training events in the region in February 2014. The training module gives a first insight of the topic to trainees by addressing a theoretical background on climate change, examples of transformation strategies and measures adaption in other countries with case studies, and a final debating part developing commonly local-specific next steps for the region.

The module illustrates the environmental and social risks consequent on climate change and enables trainees to analyse their situation and develop mechanisms to adapt to future challenges due to climate change for the forest sector. The module provides tools for adaptive forest management planning and forest transformation on the one hand and decisional assistance on the other hand.

The training module contains five main topics:

a) Introduction

b) Global Situation

c) European Response

d) Current Caucasian Situation

e) Implementation options in Caucasus

These topics are divided into four key parts:

1. Sensitising questions. Each training event begins with sensitising questions reflecting the opinion of the audience towards climate change. This is followed by a brief description of the scope of climate change worldwide, in Europe – and finally specifically in the Caucasus region and especially its impact on forestry.
2. Training exercises. This is the core part of each training event. Participants are taught to identify potential environmental and socio-economical dangers due to the ongoing climate change in their local region.

3. Presentation of a European case study. The module provides trainees with an insider view to how other countries such as Germany have already developed policies and standard procedures to combat this risk-category, presented with examples of good practice and conducting of case studies.
4. Outlook and closing debate. At this closing stage of the trainees are invited to brainstorm what they consider to be needed in future.

The complete training module can be downloaded in Adobe Acrobat© format using the following link: http://d2ouvy59p0dg6k.cloudfront.net/downloads/forestry_training_module.pdf

3.4 AWARENESS-RAISING

The project implemented four types of awareness-raising activities:

- Initial awareness-raising events for local communities and NGOs, CBOs and local government.
- Participation by community members in forest transformation and maintenance measures.
- Mid-term workshops for local communities and NGOs, CBOs and local government.
- Closing workshops for local communities and NGOs, CBOs and local government.

The example of Armenia provides more detail. There the members of the communities adjacent to the pilot sites were intensively involved in implementation of field transformation activities through casual labour contracts.

Information meetings with engaged (and generally interested) community members were conducted with the aim of providing information about the project, discuss the ongoing and planned activities and the benefits of the communities' involvement in the works. Community members had a chance to express their expectations, concerns and interest in the project.

The aim of the events was to raise the awareness of local communities, local self-governing bodies and local organizations about the importance of forests and transformation measures, climate change and ecosystem services.

In particular, awareness on climate change and its impact on forests was assessed. It could be observed that people generally value intact forest high and mainly expect long-term benefits of the project such as erosion control, clean and stable water supply and the recreation potential of forests.

Separate meetings were held with heads and community council members of three engaged communities – Lernantsq, Saramej and Koghb communities in Lori and Tavush regions. More formal indoor workshops for the communities in both pilot sites were organized during March-April 2013 (details see below item 4.3).

In addition, mid-term workshops for local communities and NGOs, CBOs and local government were organized in three adjacent communities to the project pilot sites, namely Saramej and Lernantsq communities (28-29 March 2013) in Lori Region (Gugarq forest enterprise of "Hayantar" SNCO) and Koghb community (12 April 2013) in Tavush Region (Noyemberyan forest enterprise).

4 COMMUNICATION AND VISIBILITY

Communication and visibility activities are an important, indeed a required, element of all EU-finance projects.

As a first step, shortly after the start of the project the regional team created project template documents – templates for project deliverables, reports, presentations etc. Two versions of templates were created for all four organizations in English and bilingual (English-Russian as intermediate language tool for the South Caucasus). English-Russian versions later on were adapted into bilingual English- National-Language versions for the three southern Caucasus countries, – thus ensuring better understanding of the project title and its funding source.

All presentations and hand-outs had the European Union logo and a textual statement about financial support from the European Union. All presentations made during project implementation specified that the Action had received EU funding.

Project Web-page

In the second half of July 2011 the web-page for the Project was launched. The project's regional team stationed in WWF-Caucasus created and maintained the web page, which was installed on www.panda.org/caucasus (in English). The project was also covered in WWF-Armenia's web-pages. The main purpose of the project web-page was to accumulate all project related information from different sources and make it available for a wide range of stakeholders. The project web-page contains following folders/links: project overview, news and publications, tenders and announcements, contacts.

Links were installed to the EU Thematic Programme on Environment and Sustainable Management of Natural Resources including Energy (ENRTP), European Neighbourhood and Partnership Instrument (ENPI), European Neighbourhood Policy (ENP) and useful working tools for the project implementation (e.g, Practical Guide to contract procedures for EU external actions /PRAG/, Communication and Visibility Manual for EU ExternalActionsetc).

The web page was updated for news and publications on a regular basis, covering, inter alia, successful stories of the project activities and achievements.

Project Leaflets

The project printed leaflets in English, Azerbaijani and Georgian Languages to be handed out, and to explain the objectives and expected results of the project, to the project's target groups. The leaflets were designed in accordance with Europe Aid Communication and Visibility Manual.

Other communication and visibility activities

The project team also arranged briefings and events with high-level officials of the governments of the target countries and multilateral organisations such as UNDP. Opportunities were taken to present project activities to the media and several reports about the project were made including on national television in all countries.

5 RESULTS AND LESSONS LEARNED

The project was designed to promote the adoption and implementation of policies that will make forests and the services they provide highly resilient to climate change. Activities to achieve that objective were arranged in four work packages: (i) demonstration of the transformation of vulnerable stands into resilient stands; (ii) increasing the capacities of forest administrations to develop and implement climate-adaptive strategies; (iii) increasing the awareness of local communities of that have a potential to enhance the livelihoods of neighbouring communities and (ii) increasing the awareness of local communities about the impacts of climate change; (iv) a dissemination package which includes the preparation and distribution of this report and guidelines on forest transformation.

5.1 DEMONSTRATION OF TRANSFORMATION MEASURES

The project demonstrated transformation measures in artificial plantations. According to FAO estimates there were 90,000 hectares of plantations in the southern Caucasus countries in 2005. In contrast there are nearly 4 million hectares of natural and semi-natural forests in the region that are more valuable in terms of natural heritage than plantations. The project focused on plantations because they are under greater stress and are inherently less resilient than natural or semi-natural forests, which stand a greater chance of adapting to a changing climate through natural processes.

The project aimed at transforming the demonstration stands into close to nature stands; an important principle was to select regionally native species suited to future climatic conditions at the pilot sites. In practice the project team found it difficult to adhere to that principle due to the uncertainties surrounding predictions of what the climate will be like and the limited availability of suitable plant. In some cases, due to inadequate control, species that are not native to the region were planted.

The transformation measures implemented by the project focused on establishing a new storey of native trees by planting seedlings, sowing seeds and facilitating natural regeneration in naturally occurring gaps. The project team chose not to facilitate natural regeneration by felling trees to create new gaps or enlarging existing gaps because of the controversy that felling might have caused. Felling existing trees potentially is a cost-effective transformation measure for sites where natural regeneration is expected, provided that competing vegetation is controlled and grazing animals are excluded.

The costs of the transformation measures per hectare (the gross area of the demonstration sites) are high, ranged from €1,500.55 per pilot ha for the Armenian sites to €1,587.60 for the Georgian and €1,968.19 for the Azerbaijan sites (these amounts do not include the cost of tools and instruments purchased by the project because they can be used again). A substantial proportion of the total cost is represented by fencing: 29% in Georgia and 44% in Azerbaijan (the higher proportion in Azerbaijan is due largely to more expensive steel poles being used). The costs are still high enough that the benefits of carrying the types of transformation measures implemented by the project need to be weighed carefully, and taking into account the costs of follow-on maintenance and tending measures.

For the transformation measures implemented by the project to have beneficial impacts on the demonstration stands continued protection of the young trees against damage by grazing animals will need to be ensured and competing vegetation will need to be removed. Thus the long term impact of the measures carried out at the demonstration sites will depend on the continued commitment of the organisations responsible for the sites and the attitude of the neighbouring communities.

5.2 CAPACITY BUILDING OF FOREST ADMINISTRATIONS

In number of formal training events the project trained staff of the three countries' forest administrations in forest transformation strategies and techniques. Ten staff of the forest administrations participated in the study tour to learn about forest transformation in Germany and number of staff participated in the national and regional workshops organised by the project. It is too early to say if the knowledge passed on by these activities will result in action by the countries' administrations to mitigate the negative impacts of climate change on forests. There are some positive signs: the impact of climate change on forests features in the forest policy document adopted by the Parliament of Georgia in December 2013, though it would not be fair to attribute this to the project. Also in Georgia a project financed by the Austrian Life Ministry is supporting the elaboration of new management plan for one forest district specifically to provide for climate-adaptive management. However there have also been some negative signs in Georgia: there have been several changes in the senior management team of the Ministry of Environment and Natural Resources Protection and National Forestry Agency that may result in the administration losing some of the knowledge and motivation imparted by the project.

5.3 AWARENESS RAISING OF LOCAL COMMUNITIES

The awareness-raising activities implemented by the project were aimed at getting the neighbouring communities to think and act positively towards the demonstration sites, especially considering the negative impacts if the unsustainable resource use practices of the past were to continue. It became evident during project implementation that the

neighbouring communities saw the benefit of the project more in the potential of the transformation measures to enhance ecosystem services such as erosion control, clean and stable water supply and the potential of a diverse forest for recreation; the project's connection between climate change and forests often appeared somewhat distant to community members.

It is not clear if community members thought that climate change was, or was going to be, an important factor in terms of the way they used natural resources. Like most rural communities in the region, those neighbouring the demonstration sites are poor and many of their inhabitants are living at a subsistence level or close to it. In such circumstance people generally discount the future heavily because they have to put most or all of their emotional and physical energy into surviving for the present. Against such a background it should not be surprising that villagers around the pilot sites found it unusual to see access restricted to 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). To mitigate the risk of conflicts the project actively involved community members in implementing the transformation measures (this in addition to communicating the purpose of the project, in particular the importance of forest restoration for their future and of sustainable forest management for ecological stability and economic development of respected countries). However, the monetary benefits from being paid to work at the demonstration sites will be short-lived and will not prevent conflicts arising in the future; indeed, even before the project ended the fences around some of the pilot sites were cut in some places.

6 CONCLUSIONS

Climate change in the southern Caucasus threatens the health of the region's forests and the ecosystem services that they provide. The threat can be mitigated by implementing measures that will make forests more resilient to climate change. The FTSC project demonstrated a limited set of measures to enhance the resilience of monoculture plantations by planting and supporting natural regeneration to increase species diversity and carrying out supporting measures such as fencing and weeding. The measures are directly transferable to other plantations and to degraded natural and semi-natural forests; however, the measures are expensive. The high cost of materials (fencing in Azerbaijan, seedlings in Georgia) were contributing factors; so too were the small sizes of the areas on which measures were actually implemented in relation to the total areas of the demonstration sites and the resulting lengths and therefore cost of the perimeter fences. Forestry administrations should therefore be cautious about implementing the same measures in other forests and should consider alternatives to the measures demonstrated by the FTSC project.

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Annex 1 – Logical Framework of the Project

LOGICAL FRAMEWORK FOR THE PROJECT				
	Intervention Logic	**Objectively verifiable indicators of achievement**	**Sources and means of verification**	**Assumptions**
Overall objectives	To increase the resilience of forest ecosystems in the Southern Caucasus against impacts of climate change, and to improve biodiversity and livelihoods of local populations.	By 2015, the governments of Armenia, Azerbaijan and Georgia have adopted and started to implement policies that will make forests and the services they provide highly resilient to climate change.	Published policy documents. Field based assessments of implemented measures.	Assumptions: - Environment ministries and forestry administrations are motivated to extend the results of the action. - Forest administrations have the financial resources to develop and implement forest strategies.
Specific objective	To transform monoculture stands on selected model sites in Armenia, Azerbaijan and Georgia highly vulnerable to climate change and to improve related forest management.	By the end of the action the structure of forest stands on 6 pilot sites has been transformed in such a way that they will be highly resilient to climate change. By the end of the action the potential of the forests stands on 6 pilot sites to enhance the livelihoods of neighbouring communities will have been increased.	Ex-post assessment of the resilience of the model forest stands and the quality of management. Ex-post assessment of the economic value of goods and services that will be provided to neighbouring communities compared with the situation ex- ante.	Assumptions: - No changes in tenure of the pilot sites during the project. - The target countries' environment ministries and forestry administrations are motivated to participate in the action. - The structure and personnel of the institutions whose co-operation is required is not subsequent to frequent change. - Local communities, NGOs, CBOs and local self-
		By the end of the action, the chief executives and heads of the policy and planning departments of forest administrations and heads of relevant departments in the forest administrations show a demonstrable increase in their awareness of the climate impacts on forests and motivation to develop strategies for making forests more resilient.	Reports of workshops held with target groups. Assessments of awareness and motivation carried out at the workshops held with the target groups .	Governance bodies which participate in the action are motivated to engage in follow- up activities.
Expected results	1. Selected forest stands vulnerable to climate change have been transformed into highly resilient "close to nature" forest stands.	By the final month of the action transformation measures have been carried out in 6 forest stands with a total area of at least 450 ha.	Documented results of field assessments carried out during and at the end of the action.	External conditions: - No changes in the tenure of the pilot sites before transformation measures have been completed.
	2. Practitioner-friendly silvicultural guidelines for ecologically sound and sustainable techniques (incl. transformation of monoculture stands into more resilient stands) are elaborated, published in three languages and distributed to relevant forest practitioners in each country.	By the final month of the action practitioner-friendly guidelines have been published in the national languages of the three countries and distributed to the 30 most relevant forest practitioners in each country.	Existence of guidelines in the appropriate language on the "bookshelves" of relevant forest administration experts.	External conditions: - None.

	Intervention Logic	Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
	3. The capacities of forest administration experts to develop silvicultural strategies to transform monoculture stands into stable site adapted forests are increased, leading to further forest transformation after the action has been completed.	By the final month of the action 60 forest administration engineers from the three countries have received training in forest transformation strategies and techniques. By the final month of the action, 15 senior officials in the environment ministries and forestry administrations of the target countries show a demonstrable increase in their knowledge of and interest to act on climate impacts on forests.	Reports of training events. Structured "appropriateness and effectiveness of training" assessments completed by trainees. Structured self- assessments completed by the participants before the first awareness-raising event and after the end of the final event.	External conditions: - Appropriate staff nominated to participate in trainings. - Staff trained by the action remain in post long enough to have an impact.
	4. The awareness of local communities about the importance of forest rehabilitation with regard to mitigating negative biotic and abiotic impacts of climate change is improved.	By the final month of the action at least 50% of the members of each of the local communities targeted by the action show a demonstrable increase in their awareness of climate impacts on forests and forest services.	Reports of training and awareness-raising activities.	External conditions: - Members of local communities are motivated to participate in awareness-raising events.
Activities	Activities contributing to Result 1			
	1.1.1. Conduct research into resilience of forest stands and prepare recommendations on transformation measures.	Means: - Project international advisor, - Local office space and contribution to local office costs - Subcontracted international forestry engineer	Sources of information on progress: - Progress report from activity coordinator. - Document findings of research.	Conditions: - None.
	1.1.2. Conduct regional conference on forest resilience and transformation.	Means: - Project international advisor, - Country coordinators - Georgia communications manager - Local office space - Conference organiser (external service provider) - International flights and local transport for participants - Accommodation for participants - Venue for the conference - Translation services - Interpretation services	Sources of information on progress: - Workshop report by activity coordinator. - Documented programme, participation list, input materials.	Conditions: - None
	1.2.1. Develop criteria for selection of pilot sites.	Means: - Project international advisor, - Project country coordinators, - local office space and contribution to local office costs, - vehicles (running costs only)	Sources of information on progress: - Regular progress reports by activity coordinators during preparation. - documented criteria.	Conditions: - None.

	Intervention Logic	Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
	1.2.2. Select and agree sites with forest administrations.	Means: - Project international advisor, - Project country coordinators - local office space and contribution to local office costs, - vehicles (running costs only)	Sources of information on progress: - documented agreement of the forest administrations to the pilot sites.	Conditions: - None.
	1.2.3. Design and carry out site surveys.	Means: - Project international advisor, - Project country coordinators, - GIS experts, - Local office space and contribution to local office costs, - Vehicles	Sources of information on progress: - Site survey reports.	Conditions: - The forestry administrations agree to the sites selected by the project team.
	1.2.4. Prepare transformation plans for the selected stands.	Means: - International advisor - Country coordinators - GIS expert - Forest planning expertise (external service providers) - Local office space and contribution to local office costs, - Vehicles	Sources of information on progress: - Documented transformation plans	Conditions: - None.
	1.2.5. Implement the transformation plans in the selected stands.	Means: - Country coordinators - Local office space and contribution to local office costs, - Service provider to implement the transformation measures - Labour to carry out the work - Equipment and tools - Fencing materials - Seeds and plants - Vehiclesw	Sources of information on progress: - Regular progress reports by activity coordinators. - Documented “provisional/ final acceptance certificates” approved by the country coordinators and where appropriate by international advisor.	Conditions: - Sufficient seeds and seedlings of appropriate quality available.
	Activities contributing to Result 2			
	2.1. Prepare and print silvicultural guidelines on forest transformation strategies and techniques in English and the languages of the target countries.	Means: - Project international advisor - International forestry expert - Local office space and contribution to local office costs - Country coordinators - Translation services - Design and printing services	Sources of information on progress: - Progress report by activity coordinator during preparation. - English text ready for translation. - National language texts ready for printing. - Printed texts ready for dissemination.	Conditions: - None.

	Intervention Logic	Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
	2.2. Disseminate the guidelines on forest transformation strategies and techniques to the relevant governmental agencies together with the training modules developed in activity 3.2.1. and the "popular report" prepared in activity 3.3.3.	Means: - Country coordinators, - Local transport	Sources of information on progress: - Confirmation of distribution by activity coordinators.	Conditions: - None.
	Activities contributing to Result 3			
	3.1.1. Training for local staff of forest administrations responsible for the pilot sites.	Means: - Country coordinators - Fencing materials - Seeds and seedlings - Vehicles	Sources of information on progress: - Progress reports by activity coordinators. - Documented "self assessments" by trainees.	Conditions: - Staff are motivated to participate.
	3.2.1. Prepare training modules in the national languages of the target countries for wider training of forest administration staff.	Means: - Project international advisor, - Project country coordinators, - Local office space - Translation services - Printing services in local offices	Sources of information on progress: - Progress report by activity coordinator. - Documented training modules and training materials.	Conditions: - None.
	3.2.2. Carry out wider trainings of forest administration staff.	Means: - Trainers (country coordinators) - Training materials - Training venues - Accommodation for trainers and trainees - Vehicles (running costs only) - Training materials	Sources of information on progress: - Reports of training events.	Conditions: - Forestry administrations nominate appropriate staff.
	3.3.1. Conduct workshops with senior ministry of environment and forest administration staff.	Means: - Project country coordinators, - Project international advisor, - Local transport - Venues (room in ministry or forest administration building)	Sources of information on progress - Reports of workshops.	Conditions: - Ministries of environment and forestry administrations nominate appropriate staff..
	3.3.2. Study tour for senior ministry of environment and forest administration staff.	Means: - External service provider to arrange the tour in the host country - International flights for study tour participants - Accommodation for study tour participants - Appropriate demonstration areas and meeting venues - Interpretation services	Sources of information on progress: - Report of study tour.	Conditions: - Ministries and forestry administrations nominate appropriate staff.

	Intervention Logic	Objectively verifiable indicators of achievement	Sources and means of verification	Assumptions
	3.3.3. Prepare and print "popular report" of project activities, results and lessons learned in English and the languages of the target countries.	Means: - Project international advisor - Subcontracted international forest engineer - Country coordinators - Local office space - Translation services - Design and printing services	Sources of information on progress: - Progress report by activity coordinator during preparation. - Document available for translation into national languages. - Document in national languages available for printing. - Printed document available for dissemination. - Confirmation of dissemination by country coordinators.	Conditions: - None.
	3.3.4. End of project workshops with senior ministry of environment and forest administration staff.	Means: - Project country coordinators - Local transport - Venues (room in ministry or forest administration building)	Sources of information on progress: - Reports of workshops	Conditions: - Ministries of environment and forestry administrations nominate appropriate staff.
	Activities contributing to Result 4			
	4.1. Initial awareness-raising events for local communities and NGOs, CBOs and local government.	Means: - project country coordinators - local site coordinators - vehicles for transport to venues - simple leaflet - venues (village halls or similar)	Sources of information on progress: - Regular progress reports by activity coordinators during preparation. - Reports of events.	Conditions: - Local communities and NGOs, CBOs and local government motivated to participate.
	4.2. Participation by community members in forest transformation and maintenance measures.	Means: - project country coordinators - local site coordinators - vehicles for transport to sites - tools and equipment - safety clothing	Sources of information on progress: - Regular progress reports by activity coordinators.	Conditions: - Local communities members motivated to participate.
	4.3. Mid-term workshops for local communities and NGOs, CBOs and local government.	Means: - project country coordinators - vehicles for transport to venues - venues (village halls or similar)	Sources of information on progress: - Reports of workshops	Conditions: - Local communities and NGOs, CBOs and local government motivated to participate.
	4.4. Closing workshops for local communities and NGOs, CBOs and local government.	Means: - project country coordinators - vehicles for transport to venues - venues (village halls or similar)	Sources of information on progress: - Reports of workshops.	Conditions: - Local communities and NGOs, CBOs and local government motivated to participate.

Annex 2 – Template for transformation plans prepared for the pilot sites in Armenia, Azerbaijan and Georgia

Technical Statement for Planning Work Design (Client Organization; Planned Area, Planning Organization, Number of Experts Involved etc, Duration of Assignment, linkage with other institutions etc)

Authors and Contributors

Abbreviations

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100%
RECYCLED

+5000

WWF has
over 5000 staff worldwide

+100

WWF is active in over 100
countries, on 5 continents

+5M

WWF has over 5 million
supporters

1961

WWF was founded
in 1961