The European Union's Thematic Programme on Environment and Sustainable Management of Natural Resources including Energy (ENRTP)

Climate Change and Forest Transformation in the Southern Caucasus

Training Manual

One-Day Training Module for Forestry Professionals and Administrating Bodies

**REGIONAL VERSION
FOR THE SOUTH CAUCASUS
COUNTRIES**

**INCREASING THE RESILIENCE OF FOREST ECOSYSTEMS AGAINST CLIMATE CHANGE IN THE SOUTH CAUCASUS COUNTRIES THROUGH FOREST TRANSFORMATION
PROJECT No. DCI-ENV/2010/221391**

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Implementing Partner
WWF

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Project No. DCI-ENV/2010/221391

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CLIMATE CHANGE AND FOREST TRANSFORMATION IN THE SOUTHERN CAUCASUS - TRAINING MANUAL : ONE-DAY TRAINING MODULE FOR FORESTRY PROFESSIONALS AND ADMINISTRATING BODIES – REGIONAL VERSION FOR THE SOUTH CAUCASUS COUNTRIES

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Climate Change and Forest Transformation in the Southern Caucasus

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One-Day Training Module for Forestry Professionals and Administrating Bodies

Regional version prepared

for the South Caucasus Countries

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Abbreviations

AFC – Actual Forest Cover
CBD – Convention on Biological Diversity
GIS – Geographic Information System
GHG – Greenhouse Gas
IPCC – Intergovernmental Panel on Climate Change
MCM – Million Cubic Meters
MLR – Ministry of the Environment, Climate Protection and the Energy Sector Baden-Württemberg
PFC – Potential Forest Cover
UNFCC – United Nations Framework Convention on Climate Change
UNEP – United Nations Environment Programe
WMO – World Meteorological Organization
WWF – Worldwide Fund for Nature

1 Introduction & Objectives

As part of the EU-project Increasing the resilience of forest ecosystems against climate change in the Southern Caucasus through forest transformation a one day training module for forestry professionals and administrating bodies shall be offered . The training shall give a first insight of the topic to the participants by addressing a theoretical background on climate change, transfer to the adaption in other countries with case studies and a final debating part developing commonly local-specific next steps for the region.

Forest Transformation refers here to a change of a non-natural forest cover towards a more potentially natural forest cover (PFC).

The module will illustrate the environmental and social risks as a consequence of climate change as described in the accompanying report of the project for the forest sector in Southern Caucasus region. The participants shall be enabled to analyse their situation and develop mechanism to adapt to future challenges due to climate change for the forest sector.

The objective of the manual itself is to deliver adequate tools for adaptive forest management planning and forest transformation on the one – and decisional assistance on the other hand. The development of strategies and silvicultural guidelines adapting to the climate change will be part of another publication within the frame of this project .

[1] Three one-day-trainings with specific local focus shall be hold in the three participating project countries Armenia, Azerbaijan and Georgia in February 2014.

[2] Garforth, M. 2012. Adaptation of Forests to Climate Change - Report of Desk-Based Research on Resilience of Forests to Climate Change and Transformation Measures. M. Dzneladze (ed.). Report prepared for the EU funded Project DCI-ENV/2010/221391. WWF Caucasus Programme Office, Tbilisi.

[3] Published in the near future by WWF – Author M. Garforth, an international forestry expert.

2 Methods

The training module contains five main topics, such as

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. The training shall be initiated 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 the workshop. Participants are taught to identify potential environmental and socio-economical dangers due to the ongoing climate change in their local region. This should aim at very precise cases in their forest management areas.

3. Presentation of a European case study
   Participants are provided 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 training participants are invited to brainstorm of what they consider to be needed in future. Next steps shall be developed commonly in order introduce or improve forestry risk management systems.

3 Warm up with Audience

To get the training started it is essential to define the baseline. This aims at:

- an understanding of the audiences´ state of knowledge about climate change;
- helps to evaluate progresses in this understanding;
- adapting the training material for other training sessions.

The introducing PowerPoint-Slide – after the formal introduction–shall be an eye-catching provoking question such as:

Do you think climate change exists - or is it just an invention of scientists and environmental organizations hoping for new funds??

After a short discussion about this the trainer asks the audience to fill out a little questionnaire (see Error! Reference source not found. about the knowledge and thoughts about consequences of climate change).

4 Climate Change and Forests

4.1 Weather versus Climate

In order to define 'climate' it is important to distinguish it from 'weather'. The weather that can be experienced on a day-to-day basis is a momentary atmospheric state characterized by temperature, precipitation, wind, etc. It seems to vary in an irregular way, not following any particular pattern. When considering longer time scales weather can be seen to vary in a recurrent way on global, regional or local scale. This is referred as climate. In contrast to the instantaneous conditions described by weather, climate is described with average values (e.g. annual average or mean temperature), but also typical variability (e.g. seasonal maximum/minimum temperatures) and frequency of extremes such as monsoons/hurricanes/cyclones. The timescale upon which climate statistics are calculated is typically thirty years (e.g. 1981-2010).

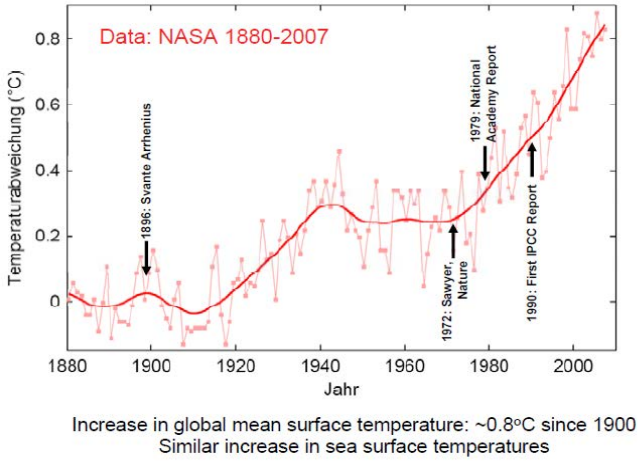


Figure 1 Increase in global mean surface temperature: ≈ 0,8°C (Source: S. Rahmstorf 2008: The 5 most important data sets of climate science)[i]

With increasing industrialization in the last 50 years and related combustion of fossil fuels the amount of so-called greenhouse gases (CO_2, CH_4, N_2O, etc.) has risen extremely. This is called men-made climate change. These greenhouse gases lead to an obvious temperature rise - in its speed significantly different from previous hot and cold periods.

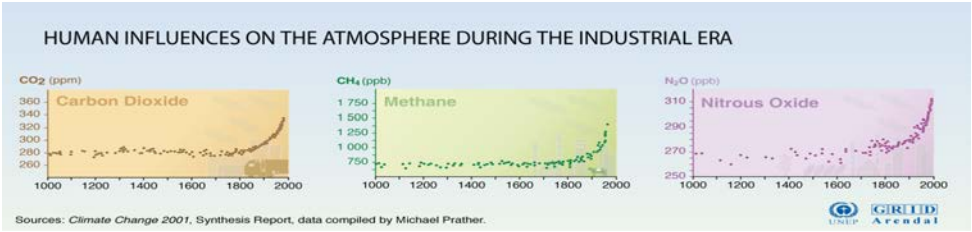


Figure 2 Human influences on the atmosphere during the industrial era (Source: IPCC 2001, compiled by M. Prather)

4.2 Reaction on Climate Change of United Nations

As stated on the IPCC-Website : The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change. It was established by the United Nations Environment Programe (UNEP) and the World Meteorological Organization (WMO) in 1988 to provide the world with a clear scientific view on the current state of knowledge in climate change and its potential environmental and socio-economic impacts. In the same year, the UN General Assembly endorsed the action by WMO and UNEP in jointly establishing the IPCC.
The IPCC is a scientific body under the auspices of the United Nations (UN). It reviews and assesses the most recent scientific, technical and socio-economic information produced worldwide relevant to the understanding of climate change. It does not conduct any research nor does it monitor climate related data or parameters.

Figure 3 Constitution of IPCC in 1988 (PanForestal own illustration)

Thousands of scientists from all over the world contribute to the work of the IPCC on a voluntary basis. Reviewing is an essential part of the IPCC process, to ensure an objective and complete assessment of current information. IPCC aims to reflect a range of views and expertise. The Secretariat coordinates all the IPCC work and liaises with Governments. It is supported by WMO and UNEP and hosted at WMO headquarters in Geneva.

4.1Climate and Forests

The climate change has of course an impact on forests. Climate change has several impacts on forests like e.g. the composition of tree species, loss of biodiversity, more calamities are recorded and in most areas heat-resistant tree species are advantageous. Due to flooding in some areas and erosion increase the ecosystem services of the forests like delivering drinking water, Non-Timber-Products will be less, negative impact on air-cleaning capacity diminish. This all leads to a total decrease of high forests while shrubs increase as well as desertification.

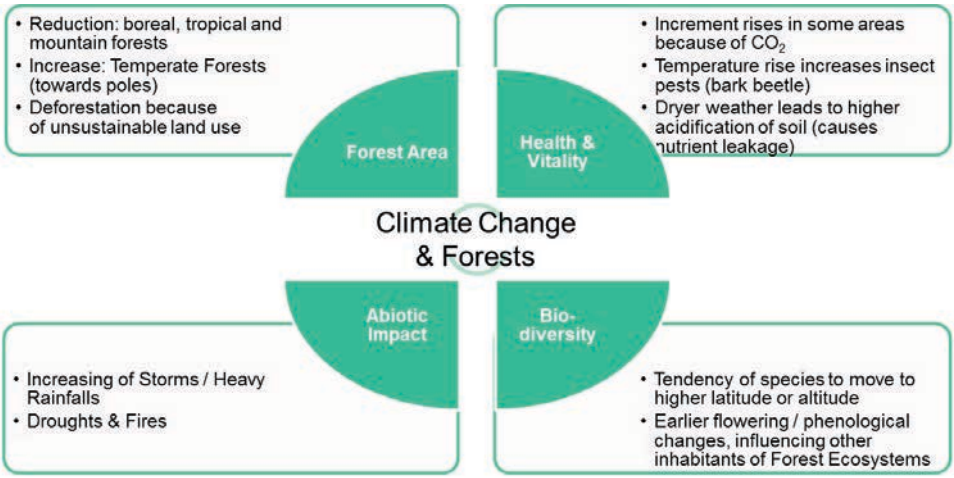
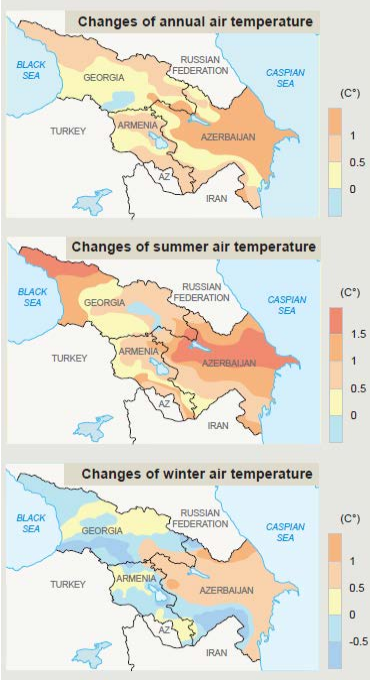


Figure 4 Direct Impacts of Climate Change on Forests (PanForestal 2014, adapted from FAO 2012)

4.2 Climate Change in the Caucasus



The last decades brought already an increase of the air-temperature to the South Caucasus (s. Figure 5 Change of Air-Temperature between 1935-2008 in Armenia, 1936-2005 in Georgia, 1960-2005 in Azerbaijan .

In their 2nd national communications to the UNFCC, all three countries presented projections for changes in precipitation and temperature based on the results of modelling. All the projections indicated that the mean annual temperature will increase significantly by the end of the present century. Projections based on the A2 emission scenario were: 1.8 °C -5.2 °C and 3.5 °C -4.9 °C, in western and eastern Georgia, respectively (see Figure 6 Forecasted Changes of Mean Air Temperature Figure 7 Forecasted Changes of Precipitation (Source: UNDP 2011, in ENVSEC 201);

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 (see Figure 7 Forecasted Changes of Precipitation (Source: UNDP 2011, in ENVSEC 201).

Although there are still uncertainties of how exactly the climate in the Caucasus region is changing – it is evident that there is a change in a so far by mankind inexperienced pace is going on.

Figure 5
Change of Air-Temperature between 1935-2008 in Armenia, 1936-2005 in Georgia, 1960-2005 in Azerbaijan (Source: UNDP 2011 , in ENVSEC 2011)

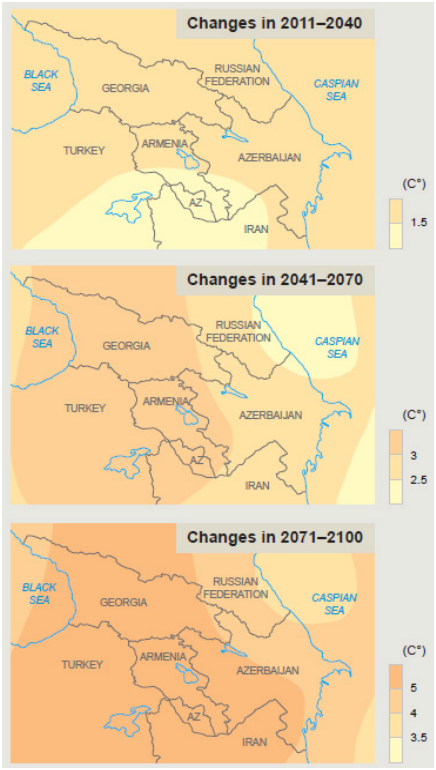


Figure 6 Forecasted Changes of Mean Air Temperature
(Source: UNDP 2011 , in ENVSEC 201)

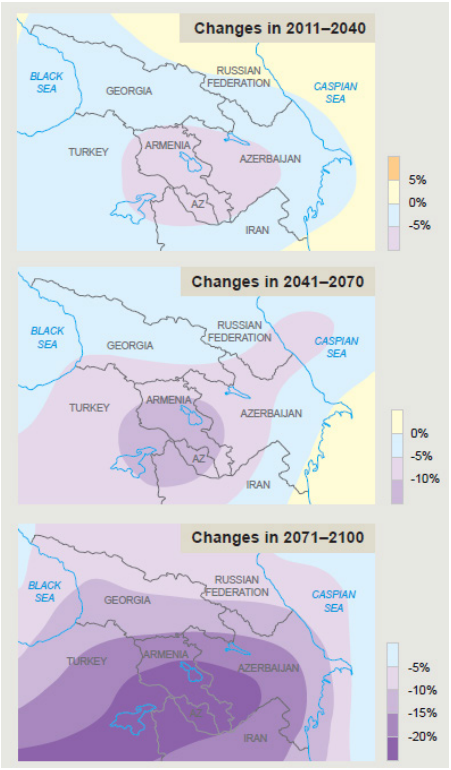


Figure 7 Forecasted Changes of Precipitation
(Source: UNDP 2011 , in ENVSEC 201)

5 European Cases – Adapting to Climate Change

Although each country has its own forestry tradition with its own specifications the ecological and social impact of climate change is global. So even if the living conditions, the values and the history of every country are unique, it might be worth to share experiences from other areas on dealing with the consequences of this phenomenon.

5.1 Case I – Forest Calamities in the German Federal State Baden-Württemberg

The German constitution grants the federal states sovereignty about their forestry legislation – as long as they stay in the frame of the Federal Forest Act. So each federal state has formulated an own Land Forest Act accordingly on which forest owners have to orientate their management and the forest policies are stipulated.

5.1.1 Description of the Case: Forestry Sector Baden-Württemberg 1980-2000

In this case study the focus is laid on the federal state of Baden-Württemberg which has changed its forest policies in the last 25 years quite progressively.
In the 1980´s more and more calamities hit the German forest sector. Subsequently of the Acid Rain (caused by coal firing power plants, intensive animal husbandry and transport) a lot of the mountainous forests all over Germany suffered of the "Waldsterben" (Forest Dieback). Although the air pollution with SO2 was reduced due to filters and catalysers the debate lingered on and produced a hypercritical public opinion against the forestry sector. At the same time the price for timber decreased as the timber-market was more and more internationalised. The years of 1990 started with the strongest storms by the name of "Vivian & Wiebke" that the sector experience so far. The storm years were always followed by insect calamities (mostly Ips typographus) spreading out easily in the damaged monoculture stands. The next figure shows clearly that:

- Although the share of spruce has been "only" 45% - its wind-throw share was significantly higher (63%)
- All the other tree species were damaged less than their share in the forest stands.

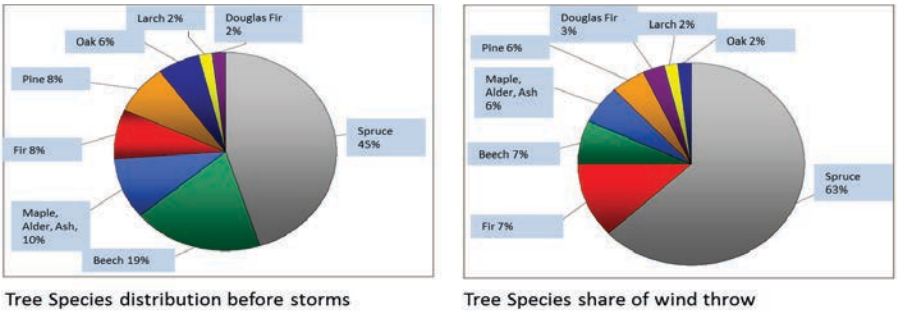


Figure 8 Left Tree Species Distribution before storm - Right Tree Species Share of Wind Throw (Source: MLR 2008, compiled PanForestal 2013)

The following figure shows the share of the so called "Randomly Harvest" (meaning caused by calamities) of the total cut since the early 80´s. The red arrows indicate climatic extreme events like storms and an extraordinary heat-wave in 2003.

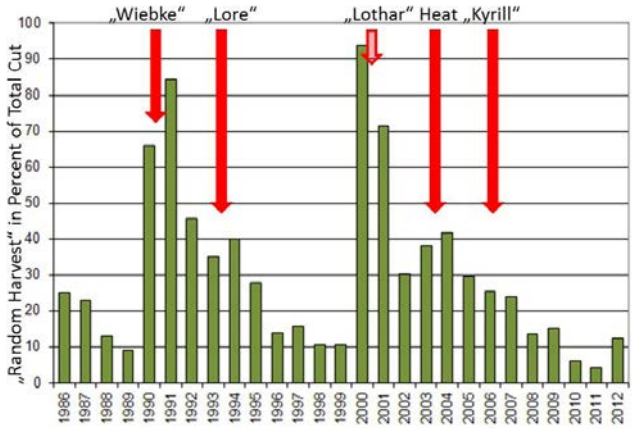


Figure 9 Share of "Randomly Harvest" on total Cut (Source: Delb et. al 2013, modified PanForestal 2014)

Summarizing this case Baden-Württemberg´s forestry sector faced the following factors:

- Environmental Frame:
  - Acid Rain (due to intensive animal husbandry and transport) causing soil acidification and in succession forest dieback
  - Storms Vivien & Wiebke (1990-15 MCM (Million Cubic Meter) - Lothar (1999 - 29 MCM wind throw)
  - With dryer summers and after storms more and more Picea Abies -stands are seriously damaged by bark beetles

- Social-Economical Frame:
  - „Waldsterben" (Forest Dieback)-Debate at early 1980´s creating hypercritical public opinion against Forestry Sector;
  - From 1980´s Wood prices were sinking – labour costs rising – the forestry sector did not work profitable anymore
- Climate
  - Less total precipitation
  - More heavy precipitation
  - More storms
  - Rising temperature

5.1.2 Case Study - Interactive Part: Brainstorm on Solutions

Interactive Part:

In the next 60 minutes the audience shall:

- Form groups á 4-6 persons;
- Discuss the Case of the forestry sector under the following questions (20 min/group):
  - What are the priority fields of action?
  - How shall the forest administration react on the increasing calamities?
- Make a small presentation in their language (10min/group);
- Discuss presentation in their language (5min/Presentation).

5.1.3 Case Study: What did Baden-Württemberg do?

At the beginning of the 90´s the forest administration on ministry level had to admit that its promoting of Spruce as the Cash-Cow of forestry has created the problem in the first place. With scientific aid the natural tree species of Baden-Württemberg was recapitulated and a new guiding principle was developed: The close-to-nature-forestry, meaning:

- Identify the Natural Potential Forest Associations (Today rather the Potential Forest Cover- PFC) vs. Actual Forest Cover (AFC);
- In State Forests develop steps towards PFC;
- More "biological automation"- meaning less planting/thinning more natural regeneration;
- In private forests – set incentives to develop more close to nature systems.

The following development displays the historical and targeted development of tree species distribution by the forestry administration.

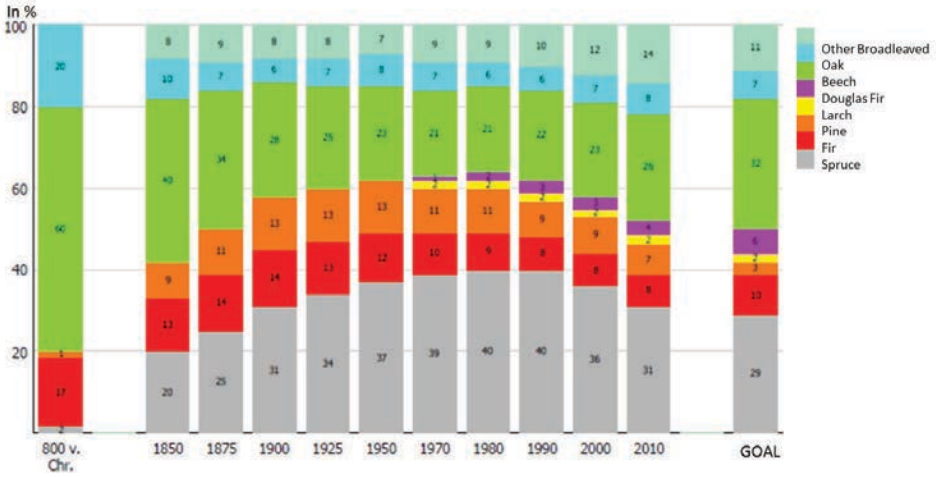


Figure 10 Historical Tree Specie Distribution in Baden-Württemberg (Source: MLR, 2008, customized by PanForestal)

With the beginning of the 90´s Baden-Württemberg concretized its new guiding principles with the development of the 19 so-called WET (Forest-Development-Types). These are aiding the foresters to transform instable monoculture / conifer stands towards more close-to-nature stands. The Forest-Development-Types define status situation and describe the vision/goals for a stand based on tree-species-shares, e.g.:

- Labile Spruce with goal Beech-Mixed Stand Beech 40 – 70% other Deciduous 20 - 40% other Conifers 0 – 30%
- Pine with goal Beech-Conifer-Mixed Stand Beech 30 – 80% other Deciduous 0 – 30% Pine (Conifer) 10 – 40%.

These WET are based on actual stand-factors (e.g. soil-type/-structure, actual/potential forest cover, etc.) which are monitored on a regularly basis of ten years and then finalised in the forest management planning. In sense of real Adaptive Forest Management (AFM) the WET are also under an ongoing revision as forest and climate science adding new facts and the societal demand changes.

During 2006-2010 a new planning instrument was developed – the Mapping of Potential Future Tree Ranges were developed for the major species Spruce, Beech, Oak for each forest district. As the debate on climate change impacts on ecosystems is of great relevance to trees, as these take many years to reach maturity, and given their sessile growth strategy they are especially vulnerable to rapid changes in climatic conditions.

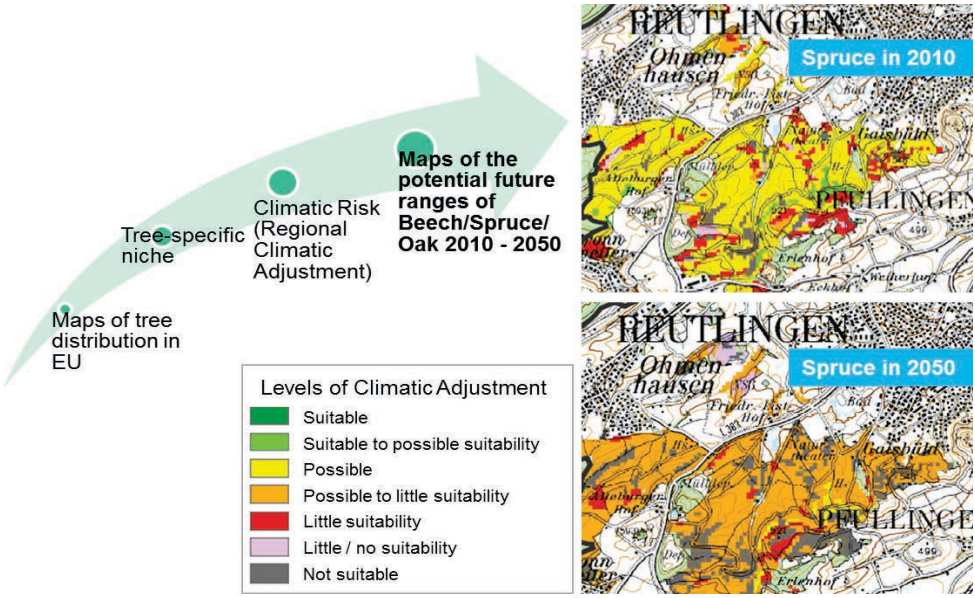


Figure 11 Exemplary Mapping of Potential Future Tree Ranges (Source: Hanewinkel 2010 - Figure by PanForestal 2013)

By official acknowledgement of the Minister of Forestry the forest administrations are committed to take theses maps into account when developing their WET and management-plans.

For next case: Please look up the MANFRED Project - where this kind of mapping is used to make a coherent climate-change-adaptive management for the whole Alpine region.

6 Foresters in the Caucasus Starting Situation – Climatic Impact

Looking at the nowadays forests in the Southern Caucasus area a study of 2011 has shown that only 4 mil ha of the potentially 9 mil ha forest area are left. Absolute and percentage losses vary between bioclimatic region with losses of up to about 90% in the South Uplands and Dry Plains and Ridges regions, between 50% and 75% in the East Caucasus, Southern Lesser Caucasus and the Hyrcan regions, and 42.91% in the Colchic region.

6.1 Expected Impact on Forest Ecosystems

A study conducted by WWF on 2011 made visible at to what extent the forests will be affected by an ongoing climatic change unto the year 2080. The study oriented itself on the above mentioned climate scenarios of the IPCC 2007 – focussing on the A2 and B2 scenarios, meaning:

The A2 scenarios are of a more divided world. The A2 family of scenarios is characterized by:

- A world of independently operating, self-reliant nations.
- Continuously increasing population.
- Regionally oriented economic development.

The B2 scenarios are of a world more divided, but more ecologically friendly. The B2 scenarios are characterized by:

Continuously increasing population, but at a slower rate than in A2.

- Emphasis on local rather than global solutions to economic, social and environmental stability.
- Intermediate levels of economic development.
- Less rapid and more fragmented technological change than in A1 and B1. [xiii]

Exemplarily visualized is the modelled range of hornbeam (Carpinus) today and in 2080 under the more and the less favourable scenario. This projection shall inseminate an idea of the ideal ranges (respectively: the niche) of tree species in the future – not of their actual dissemination in the projected year:

Figure 12 Present Modelled Range of Hornbeam (WWF 2011)

Figure 13 A2a (Economic Growth) Modelled Range of Hornbeam in 2080 (WWF 2011)

Figure 14 B2a (Ecologically Sound) Modelled Range of Hornbeam 2080 (WWF 2011)

As displayed - the biological components of forest formations will respond to changes in the climate as they have always done: some components of some formations may do better; others do worse; generally, the range of suitability for the present day forest formations will change. The models which were run in the study predict that conditions in the southern Caucasus will become less suitable for most forest classes that occur in the region; overall there could be a reduction of 8% of the AFM (Actual Forest Cover) under the ecologically more favorable climate scenario (B2) and a reduction of 33% under the ecologically less favorable climate scenario (A2) until 2080. As to be seen in the following table the losses will be strongest in Azerbaijan and Armenia and a bit less in Georgia.

Table 1Losses According to selected IPCC Scenarios in 2080 (WWF, 2011)

Forest Classes	Armenia		Azerbaijan		Georgia	
	B2A	A2A	B2A	A2A	B2A	A2A
	%	%	%	%	%	%
Dry woodlands	162.18	286.90	25.27	33.91	162.17	258.36
Betula_etc	-96.87	-99.27	-81.10	-95.34	-61.16	-77.87
Buxus			-100.00	-100.00	5.66	-25.35
Carpinus	-11.39	-100.00	-46.35	-96.15	9.10	-16.75
Castanea	-92.30	-100.00	-92.03	-98.86	13.87	-13.18
Fagus	-41.95	-100.00	-65.69	-96.66	10.16	-8.51
Parrotia	126.25	-100.00	-48.71	-95.10	23.39	-3.30
Picea_Abies	-3.29	-100.00	-57.39	-100.00	-23.72	-43.99
Pinus_pts					-55.56	-94.70
Quercus_Pinus	-15.84	-49.04	-50.09	-74.70	0.44	-3.80
Quer_casta	38.93	-100.00	-52.50	-94.77	15.36	-10.49
Quer_pedun	104.99	-100.00	-62.30	-98.45	40.62	-5.18
Taxus	-58.60	-100.00	-75.87	-98.54	8.72	-15.93
Zelkova			-79.78	-100.00	63.48	49.44
TOTAL	**-2.37**	**-52.08**	**-36.59**	**-62.08**	**9.81**	**-11.05**

Minus		Plus	
<20		<60	
20-40		60-120	
40-60		120-180	
60-80		180-240	
80-100		240-300	

6.2Cases of South Caucasus: Transformation Plots of the WWF in Armenia, Azerbaijan and Georgia

Taking into account the above described expected extent of climate change in the South-Caucasus Region WWF started on 1st March 2011 an EU-financed project for mitigation. The Project is aiming to increase the resilience of forest ecosystems in the Southern Caucasus against climate change impacts and to improve biodiversity and livelihoods of local populations.

To achieve this the project has begun to transform pilot plots in six monoculture / instable forest stands (two per country) into highly resilient, "close to nature" forest stands as role models for other transformation plots. Starting with acknowledging essential requirements

given by the impact of climate change:

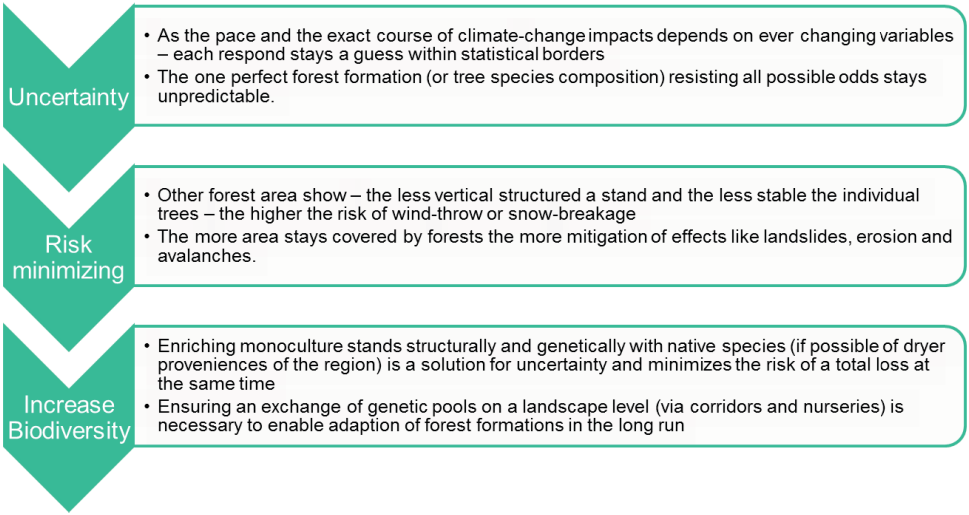


Figure 15: WWF Basic Approach on Responding Climate Change Impacts (PanForestal 2014)

The next described cases shall give a rough picture of lessons learnt on six plots were WWF and its contractors conducted. To choose the pilot plots WWF developed selection criteria for them as shown here:

Table 2 Selection Criteria for Transformation Pilot Sites (WWF 2011, compiled by PanForestal 2014)

Selection Criteria			
Nature conservation -Biodiversity indicators occurrence of endemic and/or endangered species - Importance to connect fragmentized habitats (eco-corridor)	**Silvicultural/Ecological** -Canopy cover -Dimension of the forest stand (average height and diameter) -Hydrological, soil and nutrient situation -Capacity of natural regeneration -Availability of site adapted planting material -Protective function of forest stand -Flood water protection -Water protection zone -Erosion Protection - Risk factors: Grazing / Fire	**Social- economic / legal** -Support and interest of local population and local government -Possibilities of involvement of local population in work process -Distance to villages -Importance for recreation and environmental education / -Land tenure -Status of forest land -Legal restrictions for forest transformation measures	**Others** - Sustainability of the action -Commitment of landowner -Capacity of land owner -Possibility of follow-up financing -Visibility

6.2.1 Set up of Pilot Plot

After identifying suitable pilot sites for transformation and adaptation measures the project staff took the following steps to implement the transformation plot:

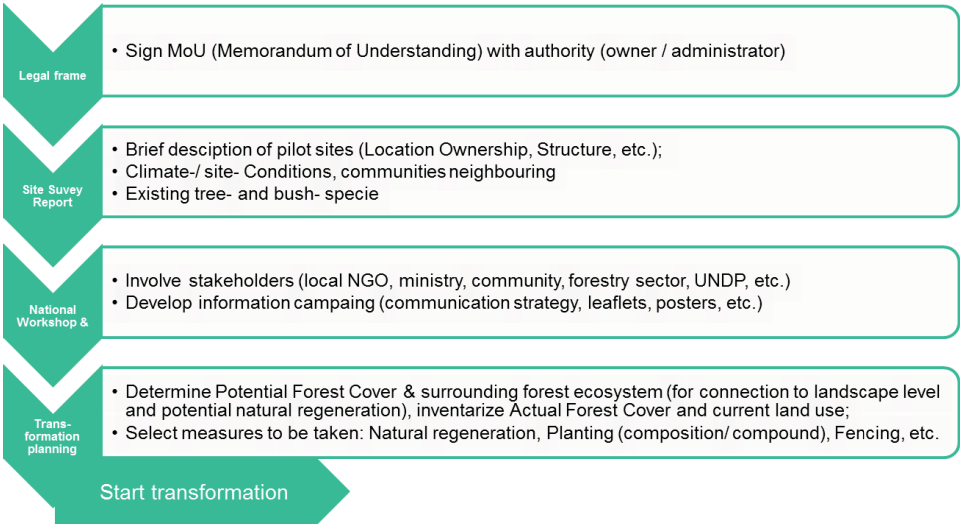


Figure 16 Implementation Scheme of Cases in South Caucasus (PanForestal 2013 according to WWF 2011)

6.2.2 Case Examples for Implementing Steps

The forests of Noyemberyan FE are located on the Gugarac Mountain Chain of the Small Caucasus mountain system, in the North-western forest region of Armenia. The highest Mountain is Mets Kanach Sar with the peak of 1 896 m (Mets Srbasar).

The selected pilot areas are currently used for timber harvesting and collection of fruits, berries and hay-making. Grazing is carried out only in some areas.
Model Natural Forest Type (according to Natural-Geographical Forest Vegetation Zone and Vertical Zone) for the Pilot Site Area.
The selected pilot area belongs to the lower forest zone, where the oak-hornbeam mixed stands are prevalent.
The matching tree and shrub species for the pilot sites in Koghb forest district area are as follows:

- Pine - Pinus silvestris L.
- Oak - Quercus iberica stev.
- Walnut - Juglans regia L.
- Maple - Acer campestre L.
- Ash - Fraxinus excelsior L

- Apple - Malus orientalis Uglitzkich
- Elm - Ulmus parvifolia Jacq.
- Cornelian cherry - Cornus mas L.
- Hawthorn - Crataegus caucasica
- Dog-rose - Rosa canina

The pilot area has been divided in several subplots (see Figure 17 Planned Subdivided Pilot Plots in Noyemberyan Area - Implemented Sites Differing (WWF 2011)) to enable planning of measures. In each plot has the existing vegetation (with focus on woody plants) been inventoried and taken into consideration when implementing the planting scheme. No bushes or else have been removed.

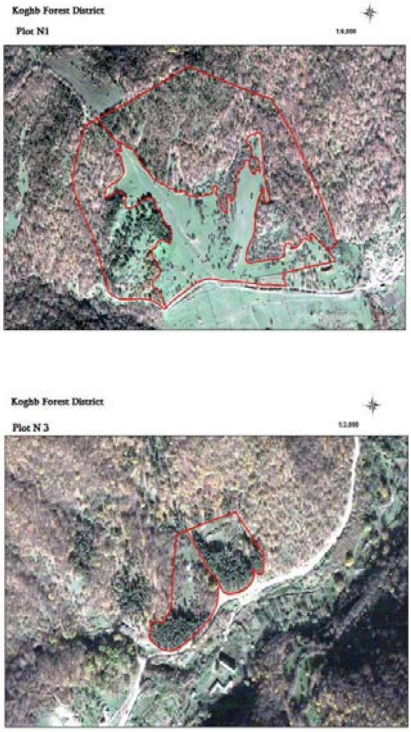


Figure 17 Planned Subdivided Pilot Plots in Noyemberyan Area - Implemented Sites Differing (WWF 2011)

The exemplary planting scheme for Quercus iberica stev.as main and Fraxinus Excelsior / Malus orientalis Uglitzkich as accompanying species is displayed in the next figure.

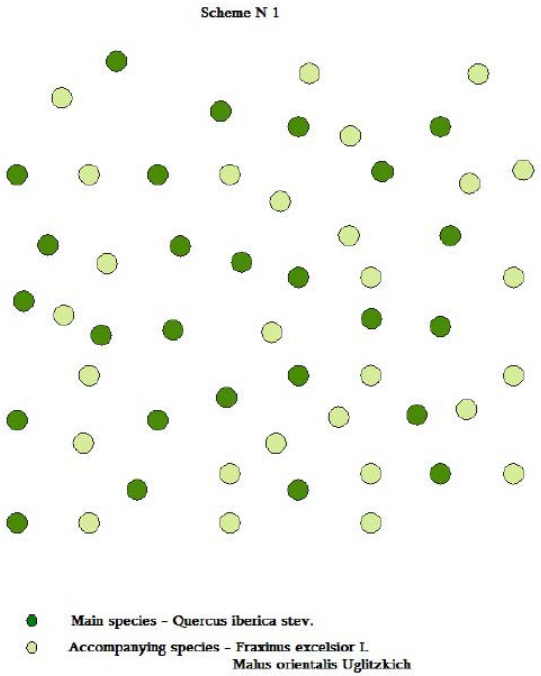


Figure 18 Example Planting Scheme for Noyembyrian Pilot Site (WWF 2011)

6.2.3 Cases Country Specific Lessons Learnt

Depending on training location the trainer will here take a closer look on the lessons learnt in this country the training is actual taking place – while experiences in neighbouring countries will stay on an abstract level.
To avoid confusions the following pages should only be displayed in the respective countries where the training is held.

Preferably shall the measures of one pilot site be described by an involved forester and/or the country coordinator of WWF.

6.2.3.1 Case Armenia

Noyemberyan: Stabilize Natural Succession with Local Support
Spitak: Transformation at the Tree Limit

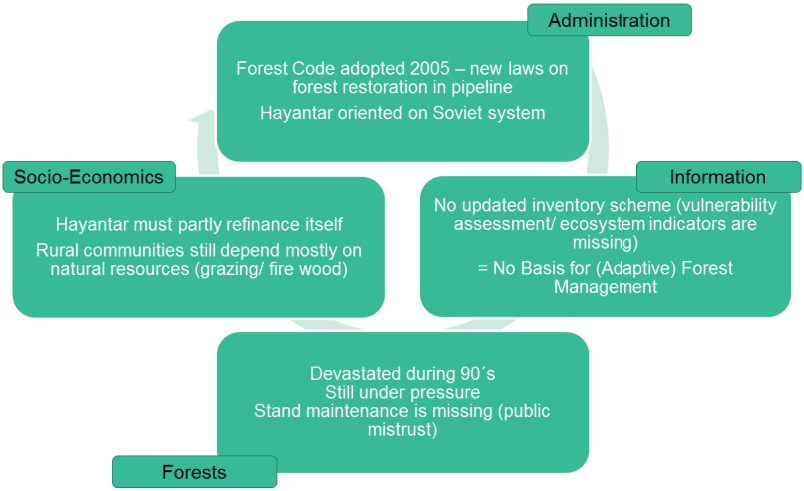


Figure 19 Fieldtrip Findings of Armenian Forestry (PanForestal 2014)

6.2.3.2 Case Caucasus: Azerbaijan
Non-Timber-Forest Products for Locals and Enriching River Banks

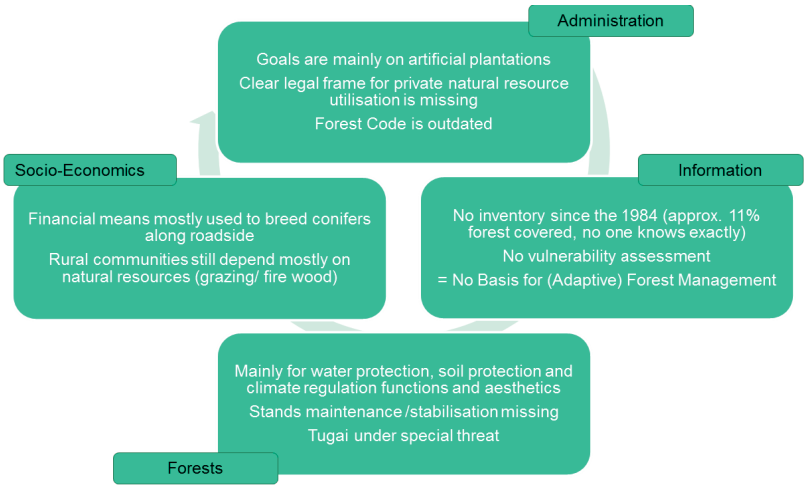


Figure 20 Fieldtrip Findings of Azeri Forestry (PanForestal 2014)

6.2.3.3 Case Caucasus: Georgia
Transformation close to urban and rural Communities

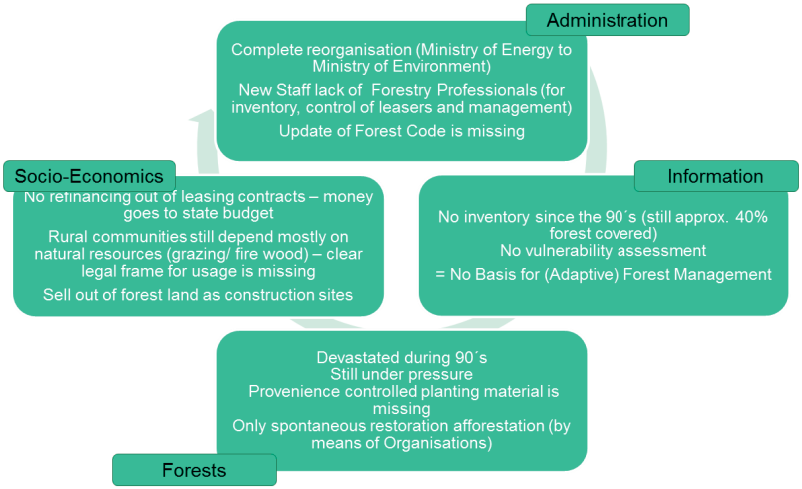


Figure 21 Fieldtrip Findings of Georgian Forestry (PanForestal 2014)

6.3 How Resilient/Stable is the Stand?

The last paragraph made visible that the climatic situation in the Southern Caucasus is changing. This paragraph shows the consequences of this change concerning forest ecosystems and their management.

As discussed in various papers and stated for the Southern Caucasus region by Publications of UNPD , WWF and others stated the Climate Change will bring a shift of climatic zones at a so far unknown speed. Along with this shift of the climate the species-composition of forests will shift accordingly to their ecological niches. Some species will get extinct were their niche is getting to tight and where there is no corridor into a more optimal retreat area for them. The next graph shows the coherence of climate and niche of specie[xvi]:

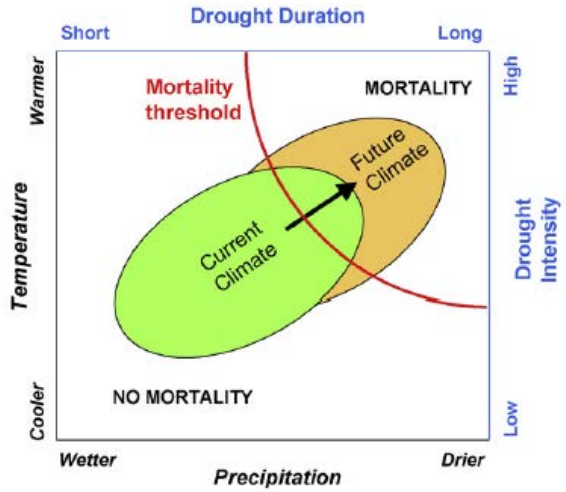


Figure 22 Climate and Mortality of Species (Allen et. al. 2010)

This figure indicates that if a planning wants to mitigate the impact of a climatic change the planning body has to have information on the current status and tree species distribution.

6.4 Inventory what is the Status and what the Prospect

As there have already been forest inventory systems in place during the Soviet time – and in fact in some countries also thereafter – there is existing data about the forest areas. But as the 90´s in all of the Southern Caucasus countries lead to a vast societal and economic transformation with partly tremendous effects on their natural resources, this data is mostly not up to date.

As the Southern Caucasus forests are – regarded ecologically – amongst the richest but also most complex forest-eco-systems in the Northern Hemisphere this lacking data is one of the biggest obstacles for sustainable management. Because these systems are threatened by overexploitation and are hardly to valuate economically – consequently forest administrations

rather lack financial means. Those three premises lead to the necessity that an applicable forest inventory system has to:

- take into account the richness of biodiversity;
- and also the human pressure acting upon the forest;
- deliver a practical and very cost-efficient approach.

Although there are existing a lot of well-established forest inventory systems in the world – each inventory system applied in the Southern Caucasus has to be adapted to these mentioned points and most likely some further country specifics. One probably helpful pilot project is just started in the Borjomi region in Georgia where the Austrian Forest Service implementing an adaptive inventory and management scheme.
However as an adapting forest management requires information of what to adapt to an ongoing monitoring of changes and calamities outside of the above mentioned inventory would be a helpful start.

I*nteractive Part:*
Which characteristics should a cost-efficient monitoring of calamities have to be easily applied by various forest professionals making sure that data filed by them is in the end comparable and easily shared?
Suggestions:

- Accessible via internet
- Transferable to databases
- Extendable (Categories, Names, etc.)

6.5 Including Climate Change in Management Planning

Adapting natural resource management to the climate change cannot be achieved only on the operational/stand level. Although this manual focusses on medium and lower levels it is obvious that some adaptations have to been applied on higher levels. In brief the following division was suggested in the European context :

a) Policy level (Ministry):
   - infrastructure and transport
   - nurseries and forest tree breeding
   - further adaptation options in risk management and policy

b) Forest Administration:
   - management planning
   - forest protection

c) Forester / Stand-manager:

[4] On implementation of an adaptive inventory and forest management plan, please contact: Ms K. Metrevelli (kattimet@yahoo.com) / Mr. Winfried Suess (winfried.suess@bundesforste.at), Team Leader, Adaptive sustainable management of forests in Borjomi Region

- forest regeneration
- tending and thinning of stands
- harvesting

As described this manual addresses mainly forestry professionals on the medium and lower level. The following decision matrix is designed for the medium level forest administration when analysing/interpreting actual inventory data or other information on stands and shall deliver exemplary orientation of the further planning:

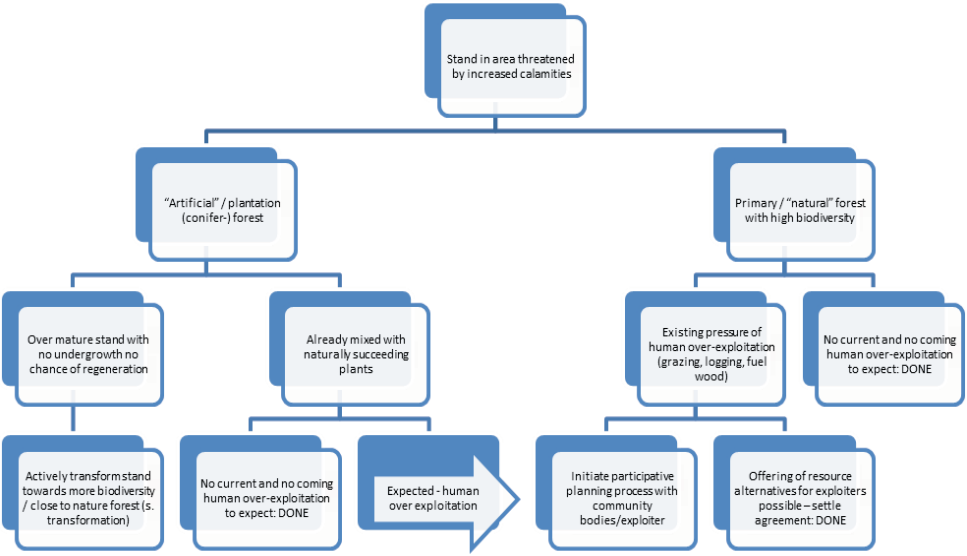


Figure 2 Decision Matrix for Endangered Forest Stands (PanForestal 2014)

Regarding this graph it is evident that there is a focus on human interaction with the natural resource. To manage this human-ecological interaction is the crucial success factor of each system were income-generation does rely on theses ecological resources. In other words: Cost-efficient sustainable management of natural resources can only achieved when management goals were agreed upon and in consequence controlled by the inhabitants of the area they are situated .

6.6 (Trans-)Form to Resilient Stands

The following scheme originates from a desk-top-study conducted by M. Garforth for the WWF at the start of the project. It summarizes steps for transforming a monoculture in to a resilient mixed stand.

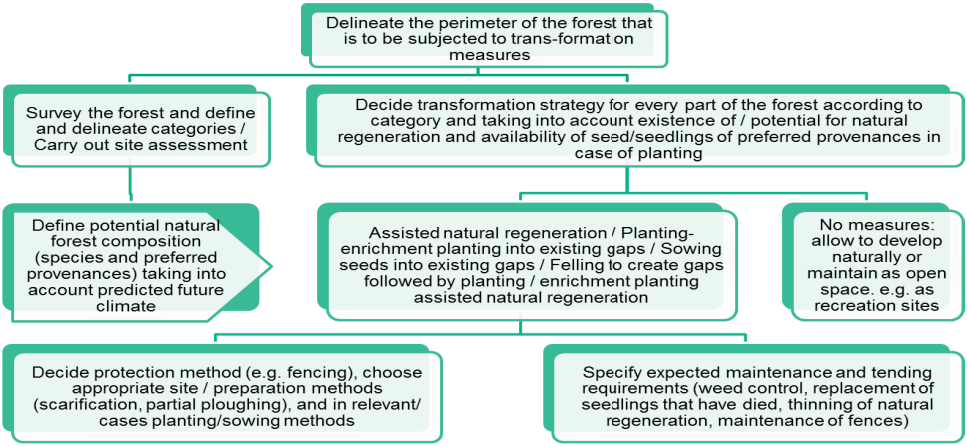


Figure 23 Steps of Stand Transformation (PanForestal adapted from Garforth 2012)

7 Recommendation

In this chapter the focus is laid onto recommendation for:

a. Establishing afforestation- /restauration sites

b. Adaptive forest management to mitigate impacts of climate change

The general recommendations result on the field trip in October 2013 (with various stakeholder discussions in all three countries) and the country specific recommendation mainly on the input of participant during the training, held in February 2014.

7.1 General Recommendation

7.1.1 On establishing afforestation-/restauration- sites

- Sylviculture:
  - Define terminology – the term "Forest-Transformation" used in EU context may be very similar to "Forest-Reconstruction" used during Soviet times;
  - If available, shrubs and bushes have to be mixed in;
  - Manipulation of species and stand composition;
  - Mixing seedlings from different seed stands;
  - Change to Oak seeding (Acorns) where possible - no Fraxinus Excelsior planting (endangered by the European Ash dieback)- and Acer only planting in microclimatic favourable spots (enough light but not exposed); plots (planting Acer rather within the rows);
  - Go without root pruning or if necessary train planters on cuttings / make sure planting holes are sufficiently deep;
  - Establish check-plots on each site – where no measure is taken but fencing – and if possible mark one check-plot outside the fence (with GPS -Coordinate) of similar starting point – to monitor impact of project
  - Provenance-management needed - controlled and as well monitored planting of dryer provenances (from nearby regions).
- Networking:
  - Get scientific feedback via cooperation with European faculties of Forestry / Agriculture about :
    - Provenience and Monitoring

5 http://www.fraxback.eu/index.php?option=com_content&view=article&id=76&Itemid=294

- Vulnerability Assessment
- Future Specie-Ranges (of forest-association indicator species) by crosscutting new data from inventories with climate projections and new satellite images (Rapid-Eye data is freely available for German Universities);

- Involve teachers and offer biological classes by:
  - Field trips to pilot sites – organise outdoor teaching and pupil planting
  - Trips to nurseries –and start school nurseries

7.1.2 On adaptive forest management

i. Ministerial Level:

- Design and implement inventory schemes that reflect ongoing changes of environmental and socio-economic factors (e.g. human population development, existing/ non-existing pasture management, illegal logging activities, etc.);
- Set overall objectives for Adaptive Forest Management (AFM), e.g.
  a. "The area of XY shall bare a forest cover of 32% wherein 10% shall be strictly protected, 30% shall satisfy community needs, 20% if for professional timber harvesting, 40% shall be regenerated close to nature"
  b. "The genetic variance shall be guaranteed by strictly controlled provenience management via seed collection and nursery standards";
- Ensure public information and awareness by campaigning and enable public participation by dialogue with NGOs.

ii. Planning- /Management Level:

- Make objectives of administration operational: Develop Maps of management areas – visualize the objectives in them – set species mixture ration in commercial and protection goals in protected forests;
- Organize/ collect/ analyse information from inventories;
- Develop a forest management (10-year) plan, taking into account the human development (e.g. community needs/ changing conditions for tree species-suitability/ranges – control its perform and revise if necessary;
- Coordinate provenience management by accrediting nurseries (or start nurseries at Agricultural Universities/ Botanical Gardens) – integrate more dry-resistant proveniences when planting new/restoring stands;
- Prioritize and coordinate measures and resources according to plan/new circumstances (calamities);

iii. Operative- / Implementation Level

- Perform and control management plans;
- Cost-efficient transformation/assisted regeneration prioritisation:
  a) Natural Regeneration (if not possible then go on to:)
  b) Seeding (if not possible then try :)
  c) Planting

- Monitor extraordinary changes (calamities & outcomes of measures like planting, fencing, etc.) – feed them back to Administration;
- Cooperate with local communities – collecting information on ongoing changes of natural resources (e.g. "Are your pastures getting dryer"; "Have you witnessed more landslides than you used to"; "Do you realized some plants vanished / or new plants appeared"; etc.) – sensitizing them for direct/indirect impacts of climate change;

7.2 Country Specific Recommendations(unvalued collection of Outcomes of Training Session): ARMENIA

7.2.1 On establishing afforestation-/restauration- sites

7.2.2 On adaptive forest management

i. Ministerial Level:

- Increase the state financing of the forestry sector in Armenia, including financing of "Hayantar" SNCO
- Revise the State Forest Policy to incorporate climate change and adaptation issues, also ecosystem services;
- Revise the State Forest National Program to make it more realistic (in terms of financial capacities) and with the approach of looking at forests as ecosystems, also to have the concept of high conservation value forests with respective regimes
- Revise the forest and environmental legal framework (forest legal framework is planned to be revised by the WB in the frames of the ENPI-FLEG 2 project)
- Institutional reforms at "Hayantar" SNCO with upgrading its status
- Human capacity building for the forestry specialists in Armenia, organization of study tours abroad for various target groups; qualified specialists are important for proper implementation of forestry measures
- In the field of forest management planning: full-scale inventory of forest resources with consideration of ecosystem services, most probably since 2015-2016 the FAO will finance it, the various climate change related indicators can be considered and assessed; and revision of the management plans in cooperation with the management level
- Management of watershed basins with use of ecosystem services provided by forests in terms of water generation; the business (for example, HPPs) can pay back to forests
- (Reduction of the price for gas)

ii. Planning- /Management Level:

- In the field of forest management planning: full-scale inventory of forest resources with consideration of ecosystem services, most probably since 2015-2016 the FAO will finance it, the various climate change related indicators can be considered and assessed; and revision of the management plans
- Active involvement of local population in the forest activities, as it also solve the livelihoods issue;
- Improvement of the forests age management, in 1990s 34% of forests in Armenia were mature and overmature; the annual allowable cut is very low in Armenia
- Provision of alternative livelihoods to communities to mitigate the pressure on natural resources;
- Consider establishment of specially protected nature areas in the sites of beech forests, as beech will probably suffer due to the predicted climate change;
- Planting material: the problem is that it is not known how much will be needed during the coming years, that is why the nurseries cannot plan and grow respective planting material; a regulation on seeds should be adopted, the principle of zonation should be reflected in it
- Communities are rather interested in having fruit species in the nearby forests, therefore for transformation measures it is recommended to use such species in the mixture of forest species
- Development of forest adaptation plans on the basis of models
- Regional cooperation within the ecoregion with consideration of ecosystem approach

iii. Operative- / Implementation Level

- Maintenance cutting – thinning is crucial if we want to talk about real transformation; in general, thinning should be regulated and properly understood by the society as the necessary forestry measure resulting in healthy forest; during the Soviet times thinning in monoculture pine stands used to be done before the new year so that the thinned trees are used as Christmas trees; in monoculture pine stands thinning is crucial to present forest fires (along with introduction of other broad-leaf species); maybe to have pilot thinning plots for demonstration to change the wrong approach by the society
- Regional cooperation within the ecoregion with consideration of ecosystem approach

7.3 Country Specific Recommendations (unvalued collection of Outcomes of Training Session): AZERBAIJAN

7.3.1 On establishing afforestation-/restauration- sites

7.3.2 On adaptive forest management

i. Ministerial Level:

ii. Planning- /Management Level:

- Soil- and Vegetation Mapping is needed;
- Include improvement of lively hood

iii. Operative- / Implementation Level

- Working together with local farmers when planting

7.4 Country Specific Recommendations (unvalued collection of Outcomes of Training Session): GEORGIA

7.4.1 On establishing afforestation-/restauration- sites

7.4.2 On adaptive forest management

i. Ministerial Level:

- Forestry Seed and Breeding-Law is badly needed;
- Participants for a neutral observer outside forestry administration to control taken measures – e.g. a certification of the Georgian forestry

ii. Planning- /Management Level:

- A strict control scheme of the leasers of commercial forest areas is needed – otherwise the danger of devastating those stand is extremely high;
- The demand for inventory (classical forest-, vegetation and vulnerabilities- Inventories) is expressed by various stake-holders;
- As in respect of climate-change adaptive planning the modelling of vegetation scenarios (Future Tree ranges) on forest department scale is wanted and needed;
- Forest practitioner asked for independent control level for forestry planning - certification scheme

iii. Operative- / Implementation Level

8 Perspective

This is the final part of the training. Out of the above displayed input and the general recommendations by PanForestal participants are encouraged to identify potential environmental and socio-economical fields of activity tackling the ongoing climate change in their local region.

- Field of Action I: Income situation and natural resource management with/for local communities

Most of the rural communities suffer severe economic shortcomings. Their population is often cut off from other income possibilities and therefore exploiting the surrounding natural resources. The unregulated/uncontrolled human pressure (caused by lacking legal frames or capacity to control this frames) on forest resources is even more immanent than the impacts of climate change. Therefore each measure to mitigate the negative impact of climate change has to address in addition the communities relying on the resources. Measures proposed here are:

- o Offering fuel wood alternatives (by means of coppice forests or short rotation coppice outside of the forests) and fruit-/nut- trees close to communities on forest edges;
- o Capacity building in sound pasture-management, e.g. by close coperation with the Clima East project of UNDP ;
- o Capacity building in entrepreneurship for small scale enterprises & local products.

- Field of Action II: Obtaining current data on Forest Ecosystems (and neighbouring ecosystems) and Monitoring Changes

In the project region of the South Caucasus the lack of current data on existing forest ecosystems is evident. If there are actual inventories, their scheme is based on very basic informations which do not allow an adaptive forest management planning. Measures proposed:

- o Networking with EU-Forestry Administrations to finance and establish a comparable forest inventory scheme in the Southern Caucasus (transfer and adaptation of forest inventory schemes and testing on the ground);
- o Offering possibilities for EU-University stuff (PHD-candidates) to make researches in the field of vegetation and soil mapping;
- o Establish network with Forestry Research Institute, Baden-Württemberg / MANFRED for mapping future tree ranges;

6 http://www.climaeast.eu/

- Establish a stakeholder (Forestry Administration, NGO, Community Associations) round table in each country which supervise inventories.

- Field of Action III: Refinance adaptive natural resource management measures

  The lack of financial capacity in the various forest administrations is evident. As described above that is caused by poor state budgets for forestry and natural resource managers at the start - as well as a lacking possibility to refinance the measures the forestry administrations delivers. To enable an adaptive management for forest ecosystems the following measures have been proposed:

  - Displaying the real monetary benefits of ecosystem services provided by the forests of the region in order to:
    - raise awareness at political level;
    - find solutions to market these services;
    - find sponsors for parts of these services.
  - Reform forestry legislation towards a more autonomous forestry administrations by the means of:
    - market thinning/maintenance wood;
    - applying fees for forestry law violations (especially in countries leasing forests to private companies)

- Field of Action IV: Capacity building for Adaptive Forest Management
  - Strengthen Forest Ecosystem Studies at Universities via
    - Campaigning on importance of natural resource management (foreign donor financed);
    - Networking with EU-Forestry Univerities on widening studies with management and political skills;
    - Better Job opportunities.
  - Strengthen on the ground capacities for local communities
    - Establish Forestry training centers/schools for operational works (seeding, planting, harvesting, fencing etc.).

9 Annex Hand Outs

9.1 Starting Questionnaire

Date: Place:

When I think of climate change: .... (Please jot down three notes what you think when you hear Climate Change)

1. ...

2. ...

3. ...

comes to my mind

Back to your everyday business
Which part of your everyday work could be affected by Climate Change:

Please jot down a few aspects

9.2 Case I – Forest Calamities in the Federal State Baden-Württemberg

The German constitution grants the federal states sovereignty about their forestry legislation – as long as they stay in the frame of the Federal Forest Act. So each federal state has formulated an own Land Forest Act accordingly on which forest owners have to orientate their management and the forest policies are stipulated.

9.2.1Description of the Case: Forestry Sector Baden-Württemberg 1980-2000

In this case study the focus is laid on the federal state of Baden-Württemberg which has changed its forest policies in the last 25 years quite progressively.

In the 1980´s more and more calamities hit the forestry sector of the country. Subsequently of the Acid Rain (caused by coal firing power plants, intensive animal husbandry and transport) a lot of the mountainous forests all over Germany suffered of the "Waldsterben" (Forest Dieback). Although the air pollution with SO2 was reduced due to filters and catalysers the debate lingered on and produced a hypercritical public opinion against the forestry sector. At the same time the price for timber decreased as the timber-market was internationalised more and more. The 1990 started with the strongest storms by the name of "Vivian & Wiebke" that the sector experience so far. The storm years were always followed by insect calamities (mostly Ips typographus) which easily spread out in the damaged monoculture stands. The next figure shows clearly that:

- Although the share of spruce has been "only" 45% - its wind-throw share was significantly higher (63%)
- All the other tree species were damaged less than their share in the forest stands.

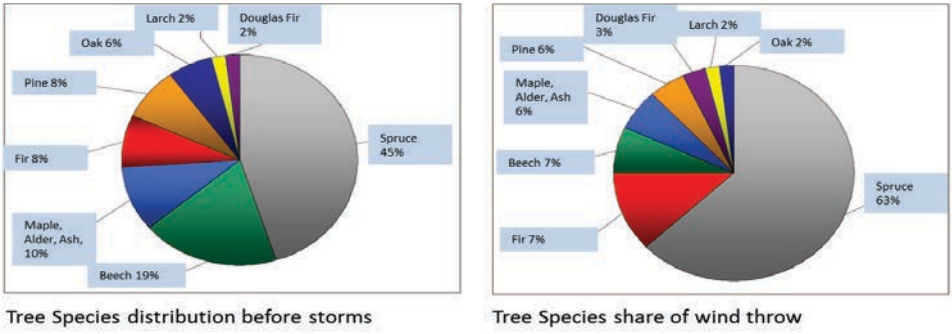


Figure 24 Left Tree Species Distribution before storm - Right Tree Species Share of Wind Throw (Source: MLR 2008, compiled PanForestal 2013)

The following figure shows the share of the so called "Randomly Harvest" (meaning caused by calamities) of the total cut since the early 80´s. The red arrows indicate climatic extreme events like storms and an extraordinary heat-wave in 2003.

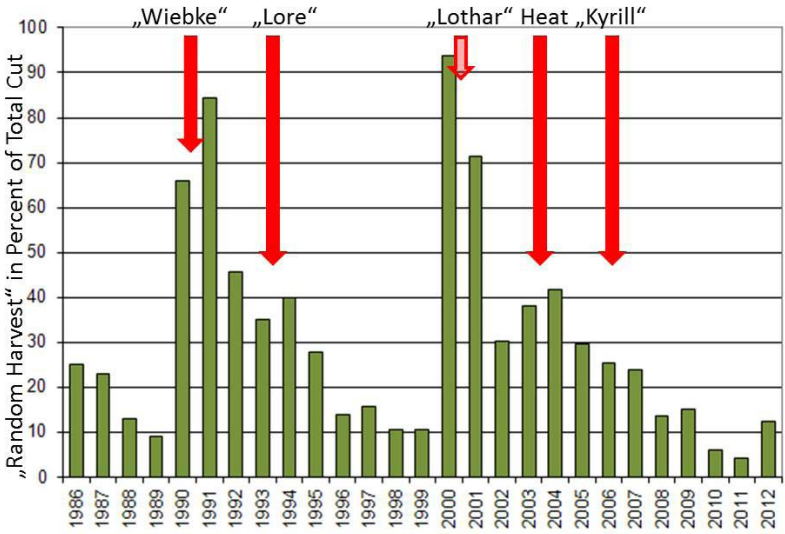


Figure 25 Share of "Randomly Harvest" on total Cut (Source: Delb et. al 2013, modified PanForestal 2014)

Summarizing this case Baden-Württemberg´s forestry sector faced the following factors:

- Environmental Frame:
  - -Acid Rain (due to intensive animal husbandry and Transport) causing Soil Acidification and in succession Forest Dieback
  - - Storms Vivien & Wiebke (1990–15 Mil.Cm3) - Lothar (1999 - 29 Mil.Cm3 wind throw)
  - - With dryer summers and after storms more and more Picea Abies -stands are seriously damaged by bark beetles
  - Social-Economical Frame:
  - - „Waldsterben" (Forest Dieback)-Debate at early 1980´s creating hypercritical public opinion against Forestry Sector;
  - - From 1980´s Wood prices were sinking - labour costs rising - the forestry sector did not work profitable anymore
- Climate
  - - Less total precipitation
  - - More heavy precipitation
  - - More storms
  - - Rising temperature

9.2.2 Interactive Part: Brainstorm on Solutions for the Case

In the next 60 minutes the audience shall:

- Form groups á 4-6 persons;
- Discuss the Case of the forestry sector under the following questions (20 min/group):
  - o What are the priority fields of action?

o How shall the forest administration react on the increasing calamities?

- Make a small presentation in their language (10min/group);
- Discuss presentation in their language (5min/Presentation).

[i] S. Rahmstorf 2008: "The 5 most important data sets of climate science" derived from Website http://www.pik-potsdam.de/~stefan/5data-sets_rahmstorf.pdf on 13.12.2013.

[ii] Prather, M. 2001 & Rekacewicz, P. "Indicators of the human influence on the atmosphere during the industrial era". Derived from the Website: http://www.grida.no/graphicslib/detail/human-influences-on-the-atmosphere-during-the-industrial-era_11a7 on 17.12.2013.

[iii] IPCC http://ipcc.ch/organization/organization.shtml#.UtyXTLQwfcs Website on 13.12.2013.

[iv] FAO 2012: Forests and Climate Change Working Paper 10 Forest Management and Climate Change: a literature review. Derived of www.fao.org/climatechange/61880/en/ on 14.01.2014.

[v] Garforth, M. 2012. Adaptation of Forests to Climate Change - Report of
Desk-Based Research on Resilience of Forests to Climate Change and Transformation
Measures. M. Dzneladze (ed.). Report prepared for the EU funded Project
DCI-ENV/2010/221391. WWF Caucasus Programme Office, Tbilisi.

[vi] UNDP 2011. Regional Climate Change Impacts Study for the South Caucasus Region. UNDP, Tbilisi

[vii] ENVSEC 2012:"Climate Change in the South Caucasus – A Visual Synthesis" ZOI Environment Network 2011.

[viii] UNDP 2011. Regional Climate Change Impacts Study for the South Caucasus Region. UNDP, Tbilisi

[ix] ENVSEC 2012:"Climate Change in the South Caucasus – A Visual Synthesis" ZOI Environment Network 2011.

[x] Delb Horst, Bublitz Thomas, John Reinhold, Metzler Berthold, Schumacher Jörg (2013): Waldschutzsituation 2012/2013 in Baden-Württemberg. AFZ-Der Wald 7/2013, S. 8-11. Derived from Website: http://www.waldwissen.net/waldwirtschaft/schaden/fva_waldschutz_2012/index_DE on 05.01.2014.

[xi] MLR: Ministry of the Environment, Climate Protection and the Energy Sector 2008: Jahresbilanz 2008. Derived at 14.12.2013 from, http://www.mlr.baden-wuerttemberg.de/mlr/presse/Jahresbbilanz2008.pdf.

[xii] Hanewinkel Marc (2010): Baumarteneignung Fichte und Buche bei Klimawandel. http://www.waldwissen.net/wald/klima/wandel_co2/fva_klimakarten/index_DE. Online Version: 13.03.2012

[xiii] IPCC (Intergovernmental Panel on Climate Change). (2007). Summary for policymakers. In S. Solomon, D. Qin, M. Manning, Z. Chen, M. Marquis, K. B. Averyt, M.Tignor and H. L. Miller (Eds.), Climate change 2007: The physical science basis. Cambridge, UK and New York, NY, USA: Cambridge University Press.

[xiv] Garforth, M. 2012. Adaptation of Forests to Climate Change - Report of
Desk-Based Research on Resilience of Forests to Climate Change and Transformation
Measures. M. Dzneladze (ed.). Report prepared for the EU funded Project
DCI-ENV/2010/221391. WWF Caucasus Programme Office, Tbilisi.

[xv] UNDP 2011. Regional Climate Change Impacts Study for the South Caucasus Region. UNDP, Tbilisi

[xvi] Allen et Al 2010: "A global overview of drought and heat-induced tree mortality reveals
emerging climate change risks for forests " in "Forest Ecology and Management" Derived from http://www.fort.usgs.gov/Products/Publications/22509a/22509a.pdf

[xvii] Lindner, M. et al 2011: "Biodiversity conservation and forest management in European forest ecosystems in times of climate change" Forest Biodiversity in a Changing Climate: Understanding Conservation Strategies and Policies, Freiburg, Germany, 22-23 September 2011.

[xviii] Motive Project: Potential impacts of climate change on forest goods and services. Website on 05th Nov. 2013 http://www.motive-project.net/img/uplf/MOTIVE_factsheet_temperate%20continental_final.pdf

[xix] Delb Horst, Bublitz Thomas, John Reinhold, Metzler Berthold, Schumacher Jörg (2013): Waldschutzsituation 2012/2013 in Baden-Württemberg. AFZ-Der Wald 7/2013, S. 8-11. Derived from Website: http://www.waldwissen.net/waldwirtschaft/schaden/fva_waldschutz_2012/index_DE on 05.01.2014.

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