



Gozdarski inštitut Slovenije

Adaptation to climate change in forestry

Questionnaire of European Forest Institute to collect information
from EU Member States

Ljubljana, julij 2008



GOZDARSKA KNJIŽNICA

K E
560



22008000107

COBISS 9

GIS BR - GOZD

Izdaja/ *Issued by*
Gozdarski inštitut Slovenije,
SI - 1000 Ljubljana, Večna pot 2, Slovenija
<http://www.gozdis.si>

Avtorji / *Authors*
dr. Mirko MEDVED, dr. Hojka KRAIGHER, dr. Dušan JURČ, dr. Marko KOVAČ, dr. Primož SIMONČIČ, dr. Miran ČAS, Špela FAJON, Anže JAPEL, Jaka KLUN, Milan KOBAL, dr. Nike KRAJNC, dr. Lado KUTNAR, mag. Mitja PIŠKUR, Tine PREMRL, mag. Robert ROBEK, Iztok SINJUR, dr. Urša VILHAR

Urednik/ *Editor*
Dr. Mirko MEDVED

Tehnični urednik / *Technical editor*
Iztok SINJUR, Tine PREMRL

Naslov uredništva / *Editor office*
SI - 1000 Ljubljana, Večna pot 2, Slovenija

QUESTIONNAIRE TO COLLECT INFORMATION FROM EU MEMBER STATES TO PROMOTE ADAPTATION TO CLIMATE CHANGE IN FORESTRY

The aim of this questionnaire is to survey existing and planned adaptation strategies to cope with climate change impacts on forest and forestry in EU 27 Member States.

This questionnaire was designed by European Forest Institute (EFI) and is part of the “Study on impacts of climate change on European forests and options for adaptation” that is undertaken for DG Agriculture and Rural Development. The results of the questionnaire will be summarized and presented in the report of the study.

If you need more information about questionnaire, please contact Marja Kolström (e-mail marja.kolstrom@efi.int, phone +358 10 773 4334)

1 Background information

Climate change is expected to strongly affect forests and forestry in Europe. EFI, together with collaborating institutes from Austria, France, and Italy is currently reviewing the state-of-knowledge on climate change and its potential impacts in European forestry. The following summary provides a short overview of potential climate impacts in different bioclimatic regions.

The main climate change impact factor in the boreal region is the projected change in temperature. The increase in temperature may prolong the growing season and enhance the decomposition of soil organic matter and increase the supply of nitrogen. This may further enhance forest growth, consequent timber yield and the accumulation of C in the biomass. Precipitation is expected to increase which will further benefit growth of forests and may contribute to alter the current forest composition. However, these changes can increase biotic (e.g. insects and pathogens) and abiotic (e.g. wind throws) disturbances with corresponding losses in forest productivity. Moreover, the increase in winter temperatures and precipitation may affect logging operations (especially in swampy areas).

Temperature is predicted to increase in the temperate oceanic zone and this will have a positive impact in northern and western parts (i.e. less water limited) and a negative impact on southern and eastern parts (i.e. water limited). In the southern parts of the Atlantic forests the summer precipitations are the main constraint factor of forest growth and productivity through their role in determining the frequency of droughts. Temperature and precipitation changes may increase biotic (e.g. insects and pathogens) and abiotic (e.g. wildfire and wind throws) disturbances with corresponding losses in forest productivity.

In the temperate continental zone, forest production is more constrained by water than in the temperate oceanic zone. The demand of water during the growing season is normally larger than the amount of rainfall. This indicates that if global warming is not accompanied by increased rainfall, water could limit growth to larger extent than today. Therefore, production decreases at sites vulnerable to water stress and increases in sites where the increased evaporative demand under the elevated temperature is balanced by an increase in precipitation. In temperate forests, milder winters may reduce winter hardening in trees, increasing their vulnerability to frost. Fire danger is likely to increase.

In the Mediterranean region, rising temperatures without increase in precipitation or with decreasing rainfall can lead to drought which is the most important impact factor in this region. This leads to an increase in the most important abiotic risk in the Mediterranean region, the fire risk. In addition, forest stands will be weakened by unfavourable environment which will increase the biotic risks. Consequently, ecosystem production, growth and yield under climate change have been found to decrease in Mediterranean areas.

Within these different bioclimatic regions appear differences. Each bioclimatic zone includes many forest types and different impacts of climate change vary from one forest type to other one. These differences can be highlighted in the answers about adaptation measures.

Information on respondent

Name: Mirko Medved

Organisation: Slovenian Forestry Institute

Email: mirko.medved@gozdis.si

Telephone: +386 1 200-78-00

Address: Večna pot 2, 1000 Ljubljana, Slovenia

Country representing: Slovenia

Role/involvement in forest sector: Research institute & Part of Public Forest Service

Are there impacts of climate change on forestry expected in your country?

- many
- some
- only few
- not at all

Why do you think climate change is important, and what aspects are important for your region?

- is not important at all
- affects productivity
- affects the conservation of soil
- affects provision of drinkable water
- affects wildlife habitat
- affects suitability for non-timber forest products
- affects suitability for environmental services
- affecting pests and diseases
- affecting abiotic damages (e.g. fire or storm risks)
- reduce regeneration success
- changes in wood quality
- reduced access for winter logging
- increases erosion
- other effects; which ones? Please specify:

Effects on soil ecosystem sustainability and role as C sink, changing into source; changes in eco-tourism and other nature-oriented functions of forests and forest landscape & others

Do you consider it necessary to have adaptation strategies to cope with climate change impacts on forests and forestry?

- investing resources on adaptation is important
- some measures are necessary
- only few measures are necessary
- not at all

Who are the stakeholders (e.g. forestry institutions, forest owners, forest workers, rural communities) most affected by climate change? And, is there any need to plan support for these interest groups?

Stakeholders affected	Need to plan support?	
1. Forestry institutions	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
2. Forest owners	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
3. Forest workers	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
4. Rural communities	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
5. Forest industry	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
6. Policy makers	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
7. Affected public	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No

1.1 EXAMPLE HOW TO USE TABLE FOR ANSWERS

1. Forest regeneration (including selection of species / provenances / genotypes).

For example: silvicultural system, regeneration technique, natural regeneration, plant protection.

<i>E</i>	<i>Ps</i>	<i>Pl</i>	<i>N</i>	<i>Measures to adapt forest and forestry to climate change in your country</i>
<i>x</i>				<i>using bigger seedlings which are not so susceptible to variable environmental conditions</i>
		<i>x</i>		<i>using provenances which are more resistant to drought for seedlings production at nurseries</i>
			<i>x</i>	<i>introduce new regeneration technique; using such kind of seedlings material which can cope with extremes of circumstances (e.g. drought), timing of planting</i>

Please read carefully and try to characterize each measure with the options provided.

Symbols in the table:

- the measure is an already existing adaptation strategy (E),
- potential adaptation strategy in the short term (1-2 years) (Ps),
- potential adaptation strategy in the long term (3-5 years) (Pl) or
- new ideas for adaptation (N).

If you need more space for your answer, please write more information under the question (writing direct to Word document) or provide additional pages (writing on paper). You can also attach documents to provide us more information about already documented adaptive measures.

2 Adaptive measures

The following questions are oriented to identify and characterize the current and potential measures suitable to adapt to the impacts of climate change on forestry.

2.2 Measures to adapt forest and forestry to climate change in your country

2.2.1 Forest regeneration

Including selection of species / provenances / genotypes.

For example: developing silvicultural system and regeneration technique (e.g. sowing)
(see explanation of the symbols E, Ps, Pl, and N above)

Table 1: Forest regeneration

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Natural regeneration is a basic system of forest regeneration in Slovenia (90 % of forests are regenerated annually and naturally – ecological stability of forests)
x				Trees species selection is suited to site conditions; using more adaptive autochthonous deciduous seedlings which are not so susceptible to variable environmental conditions
x		x		Promotion of the plant species/provenances /genotypes with a high potential to adapt to possible future changed climate conditions
			x	Considering the new climatic circumstances; landscape ecology management in forest area; using such kind of land-use which assure stability of multipurpose forest. Inclusion and maintenance of small pastures (the least 5% of surface) in mountain forest areas for herbivore wildlife (roe deer, red deer, chamois, mufflon) habitat suitability which protect young forest growth and seedlings against of injury damage (rub against small trunks, eat of buds, etc.), especially in rejuvenation areas of the destroyed older coniferous forest stands.
x				Promotion of site adapted species and local provenances.
x			x	Promotion of shelter-wood cutting to ensure natural regeneration (beech, fir). Introduction of new regeneration technique; using such kind of seedlings material which can cope with extremes of (e.g. drought), timing of planting
x				Regeneration should be performed in longer or shorter periods of time without multiple interventions.
x				Directives for production of Forest Reproductive Material (FRM) which support safeguarding the potential for future adaptability to potential environmental changes (i.e. in support of collecting seeds from a certain minimum number of seed trees, directives for silvicultural measures in seed stands etc); at burned sub-Mediterranean sites: sawing of a large number of different tree species
	x			Including all directives and recommendations for seed collection and tending of seed stands, which are written in the decree of approval, into the detailed silvicultural plans
x	x	x		Existing and long-term collaboration in international provenance trials, such as the international beech provenance trial;
x	x	x		Development and testing of new technologies for seed collections, treatment and storage for species which so far are not stored for longer period that over one or two winters
		x	x	Development of a flexible system for funding seed collection at the time of massive fructification; organization of a seed collecting group at the Slovenian State Forest Service
x	x	x	x	Support for research and development of genetic diversity and stress physiology studies for different tree spp & populations; development of the system for monitoring of forest genetic diversity and potential for adaptability to disturbances

2.2.2 Tending and thinning of stands

For example: modifying intensity and frequency of thinnings, influencing stand structure.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 2: Tending and thinning of stands

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Promoting of more adaptive deciduous trees in thinning of sensitive secondary coniferous forests stands
x				Maintaining of sustainable and close-to-nature management of forests*
x				Promoting uneven-aged stands with dense canopy, with even distribution of growth-phases (prevention of high water flows, floods and soil erosion)
x				Tending forest stands in a way that they are as close to the potential natural structure of forest (e.g. species composition, vertical and horizontal structure) as possible.
			x	Identifying forests which could suffer the most because of the potential climate change and elaborating special tending strategies (e.g. less intensive cuttings)
			x	Combination of different forest structure in mosaics or clusters (such as high forest, coppice etc) in regions where weather extremes, storms, snow and ice-breaks might become more frequent
x	x			Flexible detailed silvicultural planning & thinning depending on mast year, thus enabling seed collection and massive natural regeneration with genetically highly diverse natural regeneration



2.2.3 Harvesting

For example: modifying harvesting method and equipment.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 3: Harvesting

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
			X	Intervention protocols and field crews at the national level in the case of large scale natural disturbances (biotic and abiotic calamities)
X				Promotion of site adapted use of modern technologies and organizational forms
X				Clear cutting prohibition
X				Subsidies for forest mechanization and modernization
X				Support of work performed by professionals in private forest following calamities
X				Increasing forest work qualification for private owners
X				Intensifying modern forms of organization and promotion for private forest owners in the field of harvesting
X				Enabling development of competitiveness of professional forest services
	X			Operational programme for using wood biomass

2.2.4 Afforestation

For example: modifying afforestation techniques, species selection
(see explanation of the symbols E, Ps, Pl, and N above)

Table 4: Afforestation

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Using more adaptive autochthonous deciduous seedlings which are not so susceptible to variable environmental conditions
			x	Introduction of new regeneration techniques; using such kind of seedlings material which can cope with extremes of (e.g. drought), timing of planting
			x	Landscape ecology management in forest area; using such kind of land-use which assure stability of multipurpose forest. Inclusion and maintenance of small pastures (the least 5% of surface) in mountain forest areas for herbivore wildlife (roe deer, red deer, chamois, mouflon) habitat suitability which protect young forest growth and seedlings against browsing
x	x	x		In detailed silvicultural plans and in planting, use of a well planned mixture of tree spp and provenances which could adapt to different environmental conditions by surviving through time
	x	x		Development of nursery and planting services: use of seedlings, preinoculated with site-adapted ectomycorrhizal inoculum, use of containerized seedlings
	x	x		Use of alternative methods for protection of seedlings against browsing and grazing, such as big-carnivorous smell deterrents etc.
x	x	x		in detailed silvicultural plans and in planting, use of a well planned mixture of tree spp and provenances which could adapt to different environmental conditions by surviving through time

2.2.5 Management planning

For example: changing rotation length, developing species choice, developing decision support tools.

(see explanation of the symbols E, Ps, Pl, and N above)

Table 5: Management planning

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Adaptive forest management based on site and stand conditions as well as forest functions, with a flexible selection of a silvicultural system and measure optimal for specific conditions
x				Designing 10-year forest management plans for forest management units
x				Designing detailed silvicultural plans which are implementing plans of for forest management units (round 50 hectares of forests)
x				In more sensitive secondary coniferous forests promoting of more adaptive autochthonous deciduous trees in forests stands
			x	In more sensitive secondary coniferous forests promoting shorter rotation periods
x				Adaptive forest management based on site and stand conditions as well as forest functions, with a flexible selection of a silvicultural system and measure optimal for specific conditions
x				Monitoring of potential changes in forest species composition to support forest management planning.
	x			Promotion and conservation of species with wide ecological amplitude.
x				Identification and restoring sites suitable for selective thinning (plenterwald) stand structures.
x	x	x		Use (in planting and sawing) a big number / combination of plant species and in FMP adaptation of final cutting to mast years, planning of a mosaic of different stand structures and systems & forest types
X				Achieving optimal growing stock through accumulation of annual increment (CO ₂ fixation in 3.4 Kyoto protocol article)
X				Preserving forest surface at the same size and increasing when justified from economical, environmental and sociological point of view
X				Action Program on Reduction of Greenhouse Gas Emissions

2.2.6 Infrastructure and transport

For example: developing protection of infrastructure, transport equipment.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 6: Infrastructure and transport

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
X				Guidelines for building and maintenance of forest roads in protected forests considering increased storm frequency
	X			Adapting organisation of road construction to weather conditions (in spring or summer actions significantly decrease the risk of erosion near watercourses and catchments)

2.2.7 Nurseries and forest tree breeding

For example: searching for better adapted species or varieties.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 7: Nurseries and forest tree breeding

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
		x		Using provenances more resistant to drought for seedlings production at nurseries
	x			Searching for better adapted species and provenances in range of potential natural vegetation
	x	x	x	Development of nursery and planting services: development of practices enabling the use of seedlings, preinoculated with site-adapted ectomycorrhizal inoculum, use of containerized seedlings
x	x			Further development of the system for production, control and use of genetically & physiologically most suitable provenances & spp of FRM
x	x			Further development and implementation of the FRM certification system in the region (Central & SE Europe)
	x	x	x	Improving health care of saplings to prevent spread of new invasive harmful organisms into the forests
	x	x	x	Improving detection and control of harmful organisms in nurseries

2.2.8 Forest protection against biotic factors (e.g. pests and pathogens)

For example: monitoring of risk and damage, control new pest species and diseases.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 8: Forest protection against biotic factors (e.g. pests and pathogens)

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Conference “Climate changes – impact on forest and forestry” in year 2007 – different aspects of forest and forestry related to climate changes.
x				Spatial monitoring of risk and damage by bark beetles
x	x	x	x	Strong measures to eradicate every new invasive harmful organism should be put in force in legislation and implementation-operational plans
x	x			Extensive large scale monitoring of pests and diseases
x				Intensification of research to define potential harmful organisms introduction of which should be prevented (improvement of quarantine lists)
x	x	x		Research on new techniques for the detection of harmful organisms, their implementation into phytosanitary system

2.2.9 Forest protection against abiotic factors (e.g. fires, storm wind)

For example: decrease fuel in forest against forest fires.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 9: Forest protection against abiotic factors (e.g. fires, storm wind)

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Promotion of mixed uneven-aged stands to support better stability of forest stands.
x	x	x		Change of tree species composition to prevent fuel accumulation in forests (broadleaved forests instead of coniferous forests) on areas with high fire risk
	x	x	x	Intensification of afforestation in areas exposed to land- and snow-slide risks
x	x	x	x	Preventing and restoration of eroded sites in forests

2.2.10 Protective function of forests

For example: protecting against soil erosion, avalanches and landslides.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 10: Protective function of forests

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Mapping of forests with protective functions and application of different management regimes according to the degree of importance in the forest management plans every 10 years: 1. degree – no management; 2. degree – limited management; 3. degree – normal management
x				Reforestation and afforestation of non-forest areas with increased soil erosion, avalanche and landslide risk
		x		Development of measurable indicators for evaluation of the sustainability of the protective functions of forests
			x	Integration of forest management planning with the water management planning and land use planning for the improvement of management in the areas with increased soil erosion, avalanche and landslide risk
x				Promotion of tree species with deep root system in areas affected by sliding.
x				Introduction of tending measures in protective forests to sustain their protective role.
x				Establishing and maintaining (with selective thinning) strips of riparian vegetation (trees and shrubs) to avoid erosion and to decrease concentrations of pollutants and nitrogen in water courses.
	x			Implementation of adapted transportation regime to extreme weather events (during the period of heavy precipitation)
x				Support of studies of the effects of ski slopes on erosion processes
x				Support of studies of the effects of roots and mycorrhiza on soil aggregate structure & stability and thus on prevention of erosion processes
	x	x		Development of bioremediation & bioengineering technologies for stabilization of slopes through increase of soil aggregate stability by mycorrhizosphere interactions

2.2.11 Protected forests

For example: how to manage special habitats or protected forest types, increasing forest biodiversity.

(see explanation of the symbols E, Ps, Pl, and N above)

Table 11: Protected forests

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Protection of endangered habitats types and species
		x		Improving forest management plans to support Natura 2000 sites
x	x			Implement the recommendations derived from European research projects (NATMAN) on the needs for a mosaic distribution of Coarse Woody Debris of different spp., decay stages and DBH sizes into forest management planning

2.2.12 Recreational use of forests and other goods and services

For example: developing non-wood forest products, rezoning of recreational areas.

(see explanation of the symbols E, Ps, Pl, and N above)

Table 12: Recreational use of forests and other goods and services

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
			x	Zoning recreational areas with consideration of areas sensitive to recreational use (species which are not tolerant to any disturbances). Periods suitable for visiting the forests could prolong because of CC and disturbances would increase.

2.2.13 Research and monitoring

For example: monitoring of climate change impacts.
(see explanation of the symbols E, Ps, Pl, and N above)

Table 13: Research and monitoring

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Study of potential impact of climate changes on forest vegetation in country
	x	x		Study of adaptation potential of forests based on more realistic climate change scenarios (different climate scenarios for "high and low risk" geographic regions such as Alps, (Sub)-Mediterranean, (Sub)-Pannonian region)
x				Monitoring of carbon pools for LULUCF for forestry sector (NFI data for above and belowground biomass and for dead wood pool, additional pools – carbon in litter and organic carbon in mineral soils and assessment of carbon pool for HWP – Harvested wood Products)
x				Studies, establishment of plots for carbon flux measurements; join to the international programs and networks for carbon flux measurements/monitoring programs
	x			Research of carbon sink capacity of forests and forested landscapes
x	x		x	Forest Ecosystem Monitoring (large scale statistical approach) activities addressing: Crown condition assessments, including damage causes, soil properties and changes, assessment of ground vegetation (including invasive species), development of biodiversity indicators along with the assessment of the biodiversity status, tree growth and yield (carbon sink, dead wood assessment, lichens and diseases monitoring, ...
x	x		x	Forest Ecosystem Monitoring (small scale processes approach) activities addressing: Crown condition assessments, including damage causes, soil properties and changes, assessment of ground vegetation (including invasive species), development of biodiversity indicators along with the assessment of the biodiversity status, tree growth and yield (carbon sink), deposits, nutrients status, phenological observations, key meteo parameters, air quality (including O ₃ and other injuries caused by pollutants) and tree diseases monitoring, litterfall assessments ...
		x		Developing and testing adaptive capacity of tree species to a lack of water.
x	x	x		Support of research for the needs of development of the system for monitoring forest genetic diversity
				Support of process-oriented studies in support of forest monitoring
				Support of research of the role of biodiversity at different levels & its impacts on mitigation and adaptation to environmental changes, stress & disturbances
				Support of development of flexible silviculture, management and technology planning & services
				Support of development of technologies for sanitary cutting and afforestation efforts after extreme weather events and/or biotic interferences
	x	x	x	Improving border control to prevent introduction of new invasive harmful organisms

2.2.14 Training, education and communication

For example: increasing awareness of foresters and forest owners about climate change and impacts of it.

(see explanation of the symbols E, Ps, Pl, and N above)

Table 14: Training, education and communication

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
		X		Target oriented courses on all above possible consequences of CC for forest practice and forest owners
X	X			Promotion of forests and forest based sector in public awareness and for policy makers
		X		Promotion of wood use in wood processing industry and wooden products
		X		Stimulating substitution of materials which cause more green house emissions than wood
	X			Promotion of lower quality wood, wood wastes, used wood, used wood products for energy and bio fuels
X				Stimulating new boilers for reducing emissions from old burning devices, promotion of modern use of wood biomass
	X			Promotion of harvesting, further wood production and use in rural areas specially among forest owners (Following technological wood chain and added value)
			X	National campaign for safe operations in private forest
			X	Development of an international center of excellence for research and education in forests & forestry under the current (local & global) environmental demands

2.2.15 National or regional level adaptation options in risk management and policy (i.e. measures by public bodies outside of forestry)

For example: establishing adaptation programmes, risk minimization strategies, insurance options. (see explanation of the symbols E, Ps, Pl, and N above)

Table 15: National or regional level adaptation options in risk management and policy (i.e. measures by public bodies outside of forestry)

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Administration for Civil Protection and Disaster Relief on state and local level
		x		Interactions and harmonization of over-regulated legislation (between different sectors – forestry, environmental, agriculture).
		x		Establishing priorities between declared forest functions (avoid overlapping of forest land use).
	x			Common approach to water and forest management by different spatial management sectors.

2.2.16 Other suggestions for adaptation options

Do you have suggestions for adaptation options not covered above? (see explanation of the symbols E, Ps, Pl, and N above)

Table 16: Other suggestions for adaptation options

E	Ps	Pl	N	Measures to adapt forest and forestry to climate change in your country
x				Close-to-nature management practice such as single selection cutting or cutting of smaller forest area, permanent presence of litter or organic horizons, low soil compaction, to enhance the build-up of organic matter in soils, soil biodiversity and all soil functions such (according to "Thematic Strategy for Soil Protection")

3 Contents

1 Background information	4
1.1 Example how to use table for answers	7
2 Adaptive measures	8
2.2 Measures to adapt forest and forestry to climate change in your country.....	8
2.2.1 Forest regeneration	8
2.2.2 Tending and thinning of stands.....	10
2.2.3 Harvesting.....	11
2.2.4 Afforestation	12
2.2.5 Management planning	13
2.2.6 Infrastructure and transport.....	14
2.2.7 Nurseries and forest tree breeding	14
2.2.8 Forest protection against biotic factors (e.g. pests and pathogens)	15
2.2.9 Forest protection against abiotic factors (e.g. fires, storm wind)	15
2.2.10 Protective function of forests.....	16
2.2.11 Protected forests.....	17
2.2.12 Recreational use of forests and other goods and services.....	17
2.2.13 Research and monitoring	18
2.2.14 Training, education and communication	19
2.2.15 National or regional level adaptation options in risk management and policy (i.e. measures by public bodies outside of forestry)	20
2.2.16 Other suggestions for adaptation options	20
3 Contents	21

TABLES

Table 1: Forest regeneration 9

Table 2: Tending and thinning of stands 10

Table 3: Harvesting 11

Table 4: Afforestation 12

Table 5: Management planning 13

Table 6: Infrastructure and transport 14

Table 7: Nurseries and forest tree breeding 14

Table 8: Forest protection against biotic factors (e.g. pests and pathogens) 15

Table 9: Forest protection against abiotic factors (e.g. fires, storm wind) 15

Table 10: Protective function of forests 16

Table 11: Protected forests 17

Table 12: Recreational use of forests and other goods and services 17

Table 13: Research and monitoring 18

Table 14: Training, education and communication 19

Table 15: National or regional level adaptation options in risk management and policy (i.e. measures by public bodies outside of forestry) 20

Table 16: Other suggestions for adaptation options 20

