

# THE FORMER YUGOSLAV REPUBLIC OF MACEDONIA

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## **Summary of climate change dimensions**

Acknowledging the significance of the climate change problem and the need to take effective actions for its mitigation, the Republic of Macedonia ratified the UN Framework Convention on Climate Change (UNFCCC) on 4 December 1997 (Official Gazette of Republic of Macedonia – International agreements 61/97), and became a Party to the Convention on 28 April 1998. As a Party to the Convention, the country has produced the First National Communication (FNC) to the Conference of the Parties (CoP).

## **Macedonia's First National Communication under UNFCCC**

The FNC of Macedonia is the very first national report on the country's condition regarding climate change issues, prepared following the guidelines adopted by the Conference of the Parties (CoP) for preparation of national communications by Parties not included in Annex I to the Convention. Preparation of the FNC is seen as an initial step in the actual implementation of the UNFCCC in the country. It allowed development of expertise in each sector involved in the preparation of the FNC, enhancing institutional and technical capacities in these fields and increasing public awareness concerning the UNFCCC and climate change-related issues. The report contains the analyses, results and recommendations of technical experts, prepared by specialist institutions in the country that implemented complex activities in the thematic areas, fully utilizing the resources and results of relevant prior or ongoing national and related international activities. At the same time, the report has served as a basis for future actions.

In that document, the forestry sector is referred to in the chapters on national circumstances; inventory of GHG emissions; GHG abatement analysis and projections of emissions; vulnerability assessment and adaptation measures; national action plan; and research and systematic observation.

The GHG emissions inventory was prepared according to IPCC Guidelines for National Greenhouse Gas Inventories (IPCC, 1996), taking into consideration the three main GHGs: carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>) and nitrous oxide (N<sub>2</sub>O). GHG absorption and emission from the forestry sector are result of two processes: changes in biomass stocks, and conversion of forests to grassland. Based on estimations for 1990, annual CO<sub>2</sub> emissions from the forest sector were 415 Gg, absorption was 820 Gg, with net absorption of 405 Gg.

According to the vulnerability assessment and adaptation measures in the FNC, changes in the forests and forestry have been recorded and predicted. The health condition of the oak and the fir stands, especially the oak, in the last decade of the 20th century showed rapid deterioration. Migration of tree species to regions at higher altitudes could be expected, together with increased wildfires and consequent burnt-over areas.

Forestry should take measures for adaptation and mitigation of the effects of climate change, including:

- Controlling the oak dieback process, as well as for other tree species, with a sanitary cut that could lead to prevention of development of some specific tree diseases and proliferation of harmful pests.
- Increasing significantly the extent of protection of forests from forest fires.
- Afforestation of about 150 000 ha of barren land to increase the forest fund to about 1 150 000 ha, an increase of about 15%.

### **Biodiversity Strategy and Action Plan**

The strategy, as a basic planning document, defines an integrated approach to the conservation and sustainable use of the components of biodiversity, while the action plan encompasses specific activities that must be accomplished in order to achieve the overall aim and guiding objectives enumerated within the strategy.

The issue of climate change, forests and forestry is addressed in the chapter on *Key threats to biodiversity*. Also, in the biodiversity action plan, there are several actions relevant to climate change, forests and forestry, mainly in terms of monitoring of climate change effects in forests, and improvement of forest management in line with climate change and biodiversity.

### **Second national ecological action plan**

This National Environmental Action Plan (NEAP) identifies the national environmental challenges, establishing at the same time the measures, directions and activities required to improve the environment during the next 6 years. The obligation to develop a NEAP derives from the Law on Environment (Official Gazette of RM nos. 53/05 and 81/05).

In the frame of the chapter on *Forest management*, emphasis is placed on forests as a valuable natural resource, and their important role in the process of air, water, soil and biodiversity protection. Amongst others things, forests can serve as global stores of carbon and biodiversity.

There is a list of key *Problems and Priorities with Objectives and Measures*. In the list of planned actions, the most relevant for the issue of climate change are the assessment of potential for GHG abatement through reforestation in respect of CDM project implementation, and the development of strategy for forest fire prevention.

### **Strategy for sustainable development of forestry**

The Republic of Macedonia is a signatory to many international agreements and conventions on forests and environmental protection that influence the forestry sector. The EU orientation of the country implies the necessity for harmonization of forestry policy with EU commitments. The strategy reflects contemporary trends in world forestry. At the same time, it gives methods for solution of the numerous problems in national forestry in correlation with the demands of the sector, as well as with its significance for sustainable development, reflecting the intention of the Republic of Macedonia to become a full member of the EU in the near future. Although the issue of climate change and forestry (from the biological and economic points of view) has received adequate treatment in all parts of the strategy, the key chapter is that on forestry and the environment.

Forest, as the most valuable part of the ecosystem and capable of significantly improving the general quality of life, occupies a special position in the global concept of environmental protection. Besides this, the role of forests in carbon sequestration from the atmosphere should be taken into account in relation to the Kyoto Protocol. Therefore, forests deserve special treatment by an appropriate system of protection, care and usage, with emphasis on sustainable development.

The strategy ensures the maintenance of protective forest functions and increased positive contributions of the forest sector to environmental, water and soil protection; the protection of the populace and infrastructure against natural hazards; local and global GHG emission reduction; etc. In particular, two proposed measures combine forestry and climate change, namely increasing the area under forest and undertaking appropriate silviculture that increases CO<sub>2</sub> sequestration; and encouraging sustainable forest management practices, taking into account the possible implementation of forestry activities under UNFCCC and the Kyoto Protocol.

### **Re-establishment of plots (Level I) and assessment according to ICP Forest methodology**

The first survey at Level I in Macedonia (applying ICP Methodology, on a 16 × 16 km grid) was in 1988, with over 40 plots surveyed. In 1990, that survey was repeated more precisely on a 4 × 4 km grid of plots. With disintegration of Yugoslavia, the plot surveys stopped. There were several attempts for their re-establishment, but without success until 2006. By the initiative of the Forestry Faculty in Skopje (Department for Protection of Forests and Timber), the Ministry of Agriculture, Forestry and Water Economy in 2006 made a decision to re-establish the plots and to conduct the survey on a Level I grid (16 × 16 km) in collaboration with the International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests (ICP Forests).

Among other objectives, ICP Forests has the objective to contribute by means of monitoring activities to other aspects of relevance for forest policy at national, pan-European and global levels, such as effects of climate changes on forests, sustainable forest management and forest biodiversity. The key findings in terms of crown condition of the trees were that, from a total of 644 trees assessed, 305 (47.4%) showed no signs of defoliation; 162 (25.1%) were in Class 1 (with 10–25% defoliation); 168 (26.1%) were in Class 2 (with 25–60% defoliation) and 9 (1.4%) were in Class 3 (with 60–100% defoliation). No totally dry trees were registered. The assessment also showed 476 trees (73.9%) with no signs of discoloration; 148 (23%) in the first category of discoloration (10–25%); 16 (2.5%) in the second category (25–60%); and 4 (0.6%) were in the third category of discoloration of the crown (>60%).

Crown transparency, along with previous two assessments, gives the whole image of the condition of the tree crown. The conclusion was that 283 trees (43.9%) have no symptoms of crown transparency; 156 (24.2%) were class 1 (10–25%); 194 (30.2%) were class 2 (25–60%); 11 (1.7%) were class 3 (60– <100%); and none of the trees had reached class 4 (100%). These results, together with others from the report, show the condition of the forests in Macedonia in terms of climate change and other factors. It is a basis on which the Ministry of Agriculture, Forestry and Water Economy and the Government of Macedonia can take decisions concerning forests and the forestry sector.

### **Assessment of the plots (Level I) according to ICP Forest methodology**

Following the recent re-establishment of the plots, the second Level I survey was done in 2007. However, 2007 was an extreme year regarding forest fires, with 635 fires recorded, leaving a burnt out area of about 35 000 ha. Because of that, monitoring activities on plots were seriously interrupted. The report of the survey noted:

*The process of dieback is practically at the same levels as in 2006. We have identified several groups of causative agents, of which the most important are insects, fungi, abiotic factors, forest fires, human activities and other undetermined factors.*

*In 2007, forest fire incidence was extremely high, and there have been large areas of damaged or destroyed forests by forest fires. This seriously affected the quality of assessment of the plots. A large number of plots were not assessed, which has had a negative effect on the overall quality of results.*

### **Macedonia's Second National Communication under UNFCCC**

As a continuation of the FNC under UNFCCC the Second National Communication (SNC) was prepared. The main goal for GHG inventorying was to prepare national GHG inventories for 1999–2002 (with 2000 as the base year), according to the guidelines for the preparation of National Communications (17/CP.8). The main source of information was the State Statistical Office (official yearbooks), as well as official data from other national institutions, such the Ministry of Agriculture, Forestry, and Water Economy and the Ministry of the Interior.

The forestry sector inventory covers emissions of CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, and CO, using the Tier 1 methodology, both for the re-calculated period within the Initial National Communication, and for the period 1999–2002. No new gases were included. The main problems during this inventory derived from uncertainties in the activity data for the forest area, stock and annual forest growth, changes in land use, as well as loss of biomass due to commercial logging, illegal logging, wood decay in forest and the processing industry. The annual balance of emissions of GHG gases, as well as the percentiles for different gases, for the period 1990–2002, in this sector are shown in Table 1. The highest contribution to GHG gases comes from the subsector Conversion of Forest and Grassland, as well as from the on- and off-site burning of biomass.

**Table 1. Contribution of individual GHGs to the total CO<sub>2</sub>-eq emissions in the LULUCF sector.**

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	
[kt]	CO <sub>2</sub>	257.73	21.87	385.30	689.47	248.31	5.15	46.78	161.39	81.01	90.47	1,711.95	291.90	31.65
	CH <sub>4</sub>	14.76	1.25	22.07	39.49	14.22	0.30	2.68	9.24	4.64	5.18	98.05	16.72	1.81
	N <sub>2</sub> O	1.50	0.13	2.24	4.01	1.44	0.03	0.27	0.94	0.47	0.53	99.51	16.97	1.84
	CO	9.66	0.82	14.45	25.85	9.31	0.19	1.75	6.05	3.04	3.39	64.20	10.95	1.19
	<b>Total</b>	<b>283.66</b>	<b>24.07</b>	<b>424.06</b>	<b>758.82</b>	<b>273.29</b>	<b>5.67</b>	<b>51.49</b>	<b>177.63</b>	<b>89.16</b>	<b>99.57</b>	<b>1973.70</b>	<b>336.53</b>	<b>36.49</b>
[%]	CO <sub>2</sub>	90.86	90.86	90.86	90.86	90.86	90.86	90.86	90.86	90.86	86.74	86.74	86.74	
	CH <sub>4</sub>	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	5.20	4.97	4.97	4.97	
	N <sub>2</sub> O	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	0.53	5.04	5.04	5.04	
	CO	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.41	3.25	3.25	3.25	
	<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Land Use, Land-Use Change and Forestry (LULUCF) is a very important sector for investigation for the overall balance of GHG gases for specific countries and globally, because it is the only sector that absorbs the emissions that are emitted from this and other sectors. The main emissions from this sector come from the annual loss of biomass for commercial harvest, changes in biomass stock, on- and off-site burning of biomass, wood decay, and changes in land use. For the period analysed, this sector absorbs all of its emissions at the national level, except for 2000, because of the enormous number of forest fires, where the balance between absorption and emission is negative.

In line with scenarios for climate change to 2100 year in Macedonia, an assessment was made of climate change impacts on the forestry sector. The possible climate change impacts on the forestry sector are:

- More intensive processes of forest dieback, particularly in the fir and oak belt.
- Increased population of some pests (particularly insects and fungi), because of physiological stress of trees.
- Migration of tree species towards higher altitudes, and change in floristic composition of current forests.
- Increase in number of forest fires and burnt areas.

These impacts will increase expenditure in the forestry sector and are expected to cause significant economic damage. In response, and reflecting the climate change scenarios, the proposed adaptation measures are:

- Forest rehabilitation using the local endemic oak species and other endemic species through introduction of silvicultural and planning measures, improvement of species composition of forests (natural and reforested), using endemic tree species with more resistance to climate change.
- Strengthen preventive measures that improve forest management and minimize the risks of fires.

- Increase monitoring and observation plots in the most vulnerable and economically valued forests. This will enable government and foresters to take a more systematic and longer-term approach towards the most viable (economically and ecologically) and pro-sustainability options for forest management, thus minimizing the occurrence and magnitude of damage from wildfires and pests.
- Development of a good quality database is essential for reconstruction of the Integrated Crop Protection forests network in the country, and is a pre-condition for monitoring of the health national forests, although it will satisfy only part of the real needs.

Establishment of sample plots of certain forests types is the next step in order to monitor all meteorological elements regarding climate change. However, the existing network of meteorological stations in the country is insufficient to monitor climate change influence on forests and forestry, and its modernization and enhancement is essential.

Reforestation is one measure for reclaiming bare lands and cleared areas, usually in oak forests. The domestic oak species the most resistant to climate change are Downy oak (*Quercus pubescens*), Macedonian oak (*Quercus macedonica*) and Kermes oak (*Quercus coccifera*). Other species resistant to climate change are Oriental hornbeam (*Carpinus orientalis*), Manna ash (*Fraxinus ornus*) and Turpentine tree (*Pistacia terebinthus*). In addition to broadleaved species, for forestation domestic coniferous species can be used: *Pinus nigra* and *Juniperus excelsa*.

### **National Strategy for Sustainable Development of the Republic of Macedonia**

The European Partnership, concluded in June 2004, indicates the main priority areas for the Republic of Macedonia's preparations for further integration into the EU, based on the analysis in the Annual Report 2004. The European Partnership also provides guidance for financial assistance to the Republic of Macedonia. The Republic of Macedonia in early 2005 adopted a plan, including timetables and action details, for how the country intends to address the European Partnership priorities. Within the European Partnership, the development of a National Strategy for Sustainable Development (NSSD) ("...in line with the acquis, including a comprehensive plan for the implementation of the recommendations set out in the conclusions of the United Nations World Summit on Sustainable Development in Johannesburg 2002") has been identified as a short-term priority (i.e. for the next 1–2 years). NSSD was adopted in 2008.

NSSD sets a vision, mission and objectives for balanced economic, social and environmental development. By joining the global movement of sustainable development, the Republic of Macedonia needs to provide its citizens with a clear direction and road map for the country's development, as well as to motivate their hope and trust in the future.

The belief that social, economic and environmental goals should be complementary and interdependent throughout the development process lies at the heart of the concept of sustainable development. All Macedonian citizens should understand the sustainable development philosophy, as they have a crucial role in building a sustainable society. In the situation of unfavourable demographic trends in the country, including rapid aging of the population and intense emigration, the sustainable development concept is extremely important for achieving sustainability of the national human capital.

In the frame of the NSSD, the forestry sector is shown as a sector with the potential to create a lot of activities, which will lead toward economic and social prosperity. The issue of climate change has a significant place in the field of forestry and environment.

### **National Strategy for the Clean Development Mechanism**

Preparation of the National Strategy for the CDM was conducted under the auspices of UNDP, in collaboration with the UNDP Regional Programme in Bratislava, the Ministry of Environment and Physical Planning, international and national experts, and other relevant stakeholders.

CDM is defined in Article 12 of the Kyoto Protocol. It allows Annex I Parties to invest in projects that reduce GHG emissions and contribute to sustainable development in non-Annex I countries. CDM is the only flexible mechanism that Macedonia can access under the Kyoto Protocol. The two primary goals of CDM are:

- to assist Annex I countries in reaching their emission reduction targets; and
- to contribute to sustainable development in non-Annex I countries (developing countries and some transition economies in southeastern Europe and CIS).

The goal of the National Strategy for the CDM is to facilitate transfer of investment and technologies through CDM for implementation of projects that reduce GHG emissions and contribute to Macedonia's national sustainable development priorities. This strategy outlines a course of actions that the Government of Macedonia, together with its national and international partners, will pursue during the first commitment period of the Kyoto Protocol (2008–2012) to achieve this goal. *Inter alia*, one of the priority areas identified in this Strategy for implementation of CDM projects in 2008–2012 is the forestry sector.

Forests are the most significant natural resource in the system of maintenance, restoration and promotion of primary natural resources (water, soil and air). According to the Physical Plan of Macedonia, forests, forest crops and intensive plantations occupy an area of 934 128 ha (36.7% of the total national area). Net absorption of CO<sub>2</sub> by Macedonian forests is estimated to be in the range of 2.2 Mt CO<sub>2</sub>-eq/yr. However, the level of CO<sub>2</sub> absorption can be significantly ameliorated: almost 71% of the nominal forest area is currently occupied by scrub and degraded forests. Activities leading to reforestation of degraded forest areas are technically eligible to be registered under CDM mechanisms and generate CERs in the amount corresponding to the increase in GHG sinks in re-forested areas.

However, CDM rules impose certain limitations on Afforestation/Reforestation (A/R) activities, which have tended to reduce their attractiveness relative to other CDM projects. There is also a lack of approved CDM methodologies for this category and, furthermore, A/R projects sequester carbon over long periods and often take 10 years or more before they generate significant volumes of CERs, which makes them economically less attractive than normal CDM projects, such as landfill gas (LFG) or biogas) that have a quicker pay-back period and higher returns.

## **Status of assessment and research on climate change**

### **Research activities and programmes on climate change**

The basic research institution for forestry and climate change is the Faculty of Forestry in Skopje. It is a state facility. In its almost seventy years of existence, many researchers have worked, directly or indirectly, on climate or climate change in different forestry sectors.

Within the Department for Forest and Wood Protection, research areas include ecoclimatology; the influence of abiotic factors (climate) on the health condition of the forest and assessment of damage (biological and economic) caused by them; and forest fires, which are related to climate change. This department, on behalf of the Ministry of Agriculture, Forestry and Water Economy of the Republic of Macedonia, is responsible for ICP Forest (data collection, analysis and preparation of an annual report) (Figure 1). Other departments of the faculty which could work on climate change issues are the departments for Forest management and for Silviculture.



**Figure 1. Network of the Level I permanent plots (16 × 16 km).**



### Systematic climate observations

The main institution responsible for systematic hydrometeorological and climate observations in Macedonia is the Hydrometeorological Service of the Ministry of Agriculture, Forestry and Water Economy. Hydrometeorological activities have long and rich tradition in the country. Meteorological measurements and observations started in early 1891, and an organized hydrometeorological station network has existed since 1923. Until 1947, from time to time there were interruptions in measurements and observations, depending on the circumstances. That year, the Hydrometeorological Service of the National Republic of Macedonia was established and a new hydrometeorological network was formed. Today the Hydrometeorological Service has 236 employees, of which 63 with university education. In recent years the scope of the Hydrometeorological Service has extended beyond classic observing of weather, climate and water and their forecasting. It is impossible to imagine national social and economic development without the information that this institution provides for solving the problems in the fields of climate change, water resources management, phenomena mitigation and environmental degradation. At present there are 14 main, 18 climatological and 2 special stations (Figure 2) available in the country, with an additional 122 precipitation stations and 31 phenological observation points.



**Figure 2. Meteorological monitoring network in Macedonia.**

Macedonia as a sovereign and independent state has been a member of the World Meteorological Organization since 1993, which is a Specialized Agency of the United Nations. Membership in this organization created new possibilities and prospects for development of international cooperation in the fields of meteorology, hydrology and environmental monitoring through participation in the work of congresses, working bodies, commissions and working groups at regional and global levels. Therefore the Hydrometeorological Service, as the agency responsible for hydrometeorological monitoring activity in the country, functions as the National Meteorological Centre. The Service carrying out and co-ordinating international obligations with its research and development programme has participated in numerous national and international projects (MED-HYCOS, EMEP, MEDSEEME-PEP, etc.), it has signed bilateral and multilateral agreements and coordinated with international hydrometeorological and other institutions (UNDP, UNESCO, FAO, ICSU, PHARE, JICA, World Bank, etc.). Its scope of activities is very comprehensive:

- to organize a net of meteorological stations throughout Macedonia;
- to conduct measurements and data collection;
- data analysis;
- data distribution to all stakeholders and institutions; and
- to lead or participate in research projects (domestic and international) in collaboration with similar institutions internationally.

## **Proposed areas for cooperation**

### **Establishment of permanent plots for monitoring and assessment of the climate change dimensions and impacts of forest and forestry**

The influence and consequences of climate change on the forests and forestry in Macedonia are noted in many documents. That was one of the reasons for re-establishments of the IPC Forests Level I plots. Also, the regular activities and many projects of the Department of Forest and Wood Protection address this issue. However, although it provides basic information and knowledge about climate change and forests, it is insufficient to understand the impact of climate change on forestry in Macedonia.

Taking into consideration that vulnerability assessment is crucial for measures of mitigation and adaptation, it is more than obvious that the Macedonian forestry sector needs more precise knowledge on this issue. In order to allow the forestry sector in Macedonia to create sustainable forestry in an age of climate change, permanent plots should be established for monitoring and assessment of climate change dimensions and impacts on and of forests and forestry. Reflecting the tree species composition of the Macedonian forests, it would focus initially on the oak and beech forests. The need for this kind of project has been emphasized many times and in many documents. Expected outputs of this project would be:

- permanent monitoring of forests and climate;
- impact assessed of climate change on forests and forestry;
- measures defined for mitigation of the impacts of climate change on forests and forestry and measures for adaptation; and
- forest management adapted in agreement with predicted future climate change.

### **Study for climate change, forest fires and forestry**

Forest fires are highly sensitive to weather and climate. Under current climate change projections, fire frequency and severity can be expected to increase significantly in parts of Macedonia. The economic losses caused by forest fires in Macedonia in the last 10 years are estimated to be about € 50 million. There is no precise evaluation of ecological losses in the same period. In addition, forest fires release carbon from organic matter into the atmosphere. Estimation of GHG emissions



was prepared according to the IPCC Guidelines for National GHG Inventories (IPCC, 1996) in the frame of FNC and SNC to UNFCCC, including emissions from forest fires. Despite all this, there remain considerable gaps in understanding of the connections between forest fires, climate change, forestry, GHG emission from forest fires, etc. In particular, there is need for a well organized campaign to raise public awareness of this topic. In particular the project could cover:

- determination of the relation between climate change and forest fires;
- impact assessment of the fires of forest and forestry;
- ensuring the data can identify land use changes;
- improvement of the quality of the GHG inventory related to forestry; and
- developing well organized campaigns for public awareness raising.

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