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REPUBLIC OF MACEDONIA
MINISTRY OF ENVIRONMENT
AND PHYSICAL PLANNING

THIRD NATIONAL COMMUNICATION ON CLIMATE CHANGE



FORESTRY AND CLIMATE CHANGE

VULNERABILITY ASSESSMENT AND ADAPTATION MEASURES



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FORESTRY AND CLIMATE CHANGE

This publication summarizes the key findings of a report assessing the vulnerability of the forestry sector to climate change and potential adaptation measures.

This assessment was made as part of the Republic of Macedonia's Third National Communication on Climate Change to the United Nations Framework Convention on Climate Change by the Ministry of Environment and Physical Planning with support from the United Nations Development Programme (UNDP) and the Global Environment Facility (GEF).

The full report is available at:
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Authors:

Professor Nikola Nikolov, PhD
Professor Ljupco Nestorovski, PhD

Adaptation:

Matthew Jones

Additional Sources:

"Шумарство: Клучни показатели" Државен завод за статистика, n.d. Web. 14 Apr. 2014.
"EFISCEN." European Forest Institute. EFI, n.d. Web. 14 Apr. 2014.

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Ljubomir Stefanov

THE IMPORTANCE OF FOREST ECOSYSTEMS

Covering approximately 30% of the Earth's land surface, forests are habitats that sustain great biological diversity and provide an extensive range of goods and services critical to the ecosystem and to human survival.

Forests serve as natural climate regulators and play a significant role in carbon storage and sequestration, contributing to the carbon cycle on both a local and global scale.

Forests also regulate the hydrological cycle, protect watersheds and their vegetation and provide habitats for a great variety of species, many of which are endemic or threatened.

In addition, the direct use values of forests include many cultural, recreational, and educational opportunities.

Forests cover some 988,835 hectares of the Republic of Macedonia—more than a third of the territory. They are one of the country's greatest natural resources, serving a variety of environmental, socio-cultural, and economic functions while maintaining a key role in the preservation of carbon balance and biodiversity and the mitigation of changes in the climate system.

Forests are increasingly under threat from a range of destructive agents. One of the greatest and most complex of these threats is the challenge of climate change.

Being dependent on climate in both their function and structure, forests are highly vulnerable to climate change. Some of the main climate-induced stressors that affect the growth, quality, and survival of forests include increasing air temperatures, droughts due to reduced rainfall and waterlogging from more intense rainfalls, changes in the timing of seasons, and increased hazards such as wildfires and insect outbreaks. It is therefore imperative to mitigate the impacts of climate change by developing a set of effective strategies to enhance the adaptive capacity of forests.





At national level, the following major sources of exposure to climate change have been identified as jeopardizing the health of forests:

- rising temperatures
- extreme weather events such as floods, storms and droughts
- forest fires
- disease and pests
- wood supply and carbon sequestration
- changes in species composition

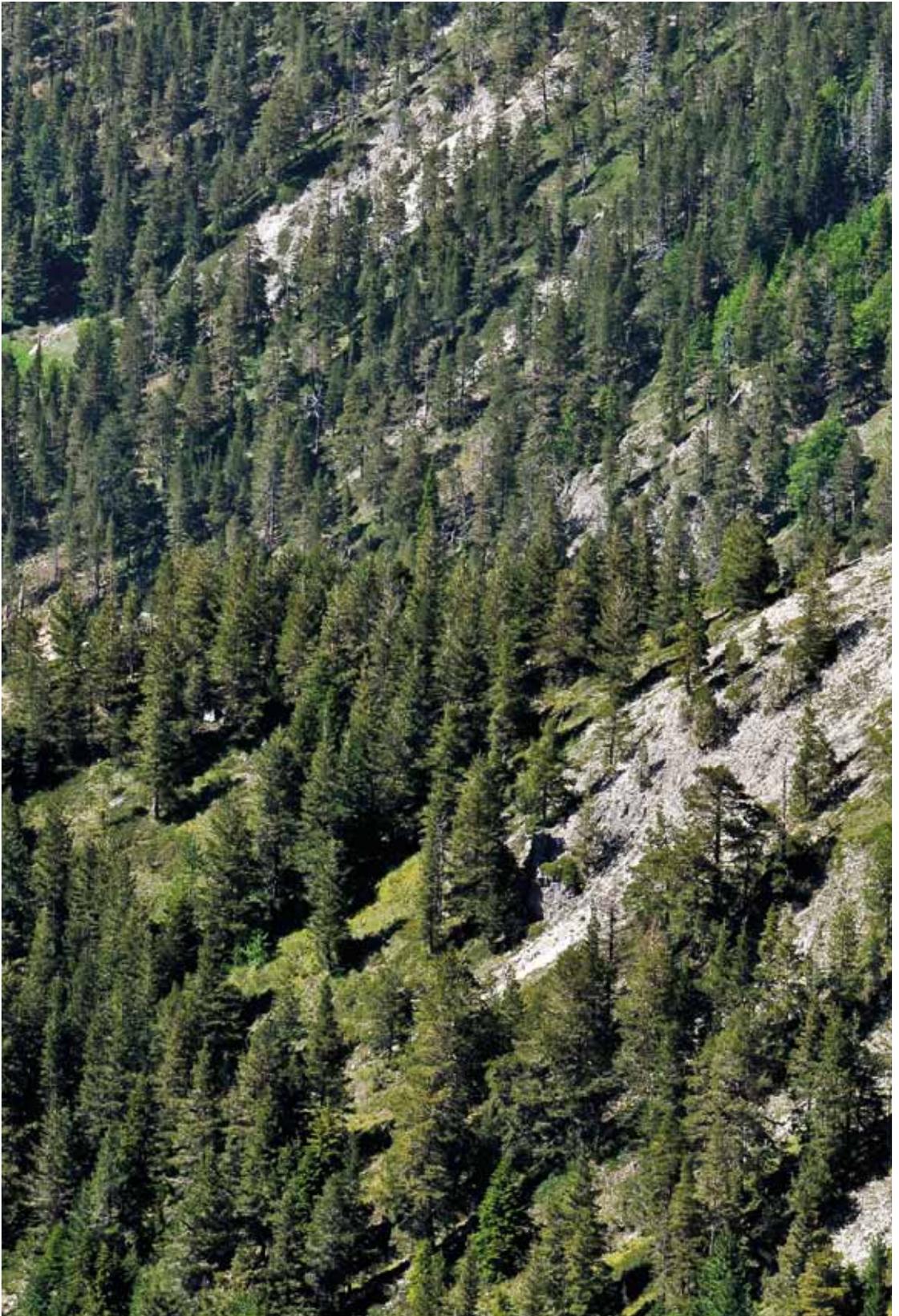
Such a variety of climate change impacts on the forest ecosystems in this country indicates the importance of researching planning, and developing adaptation measures and strategies.

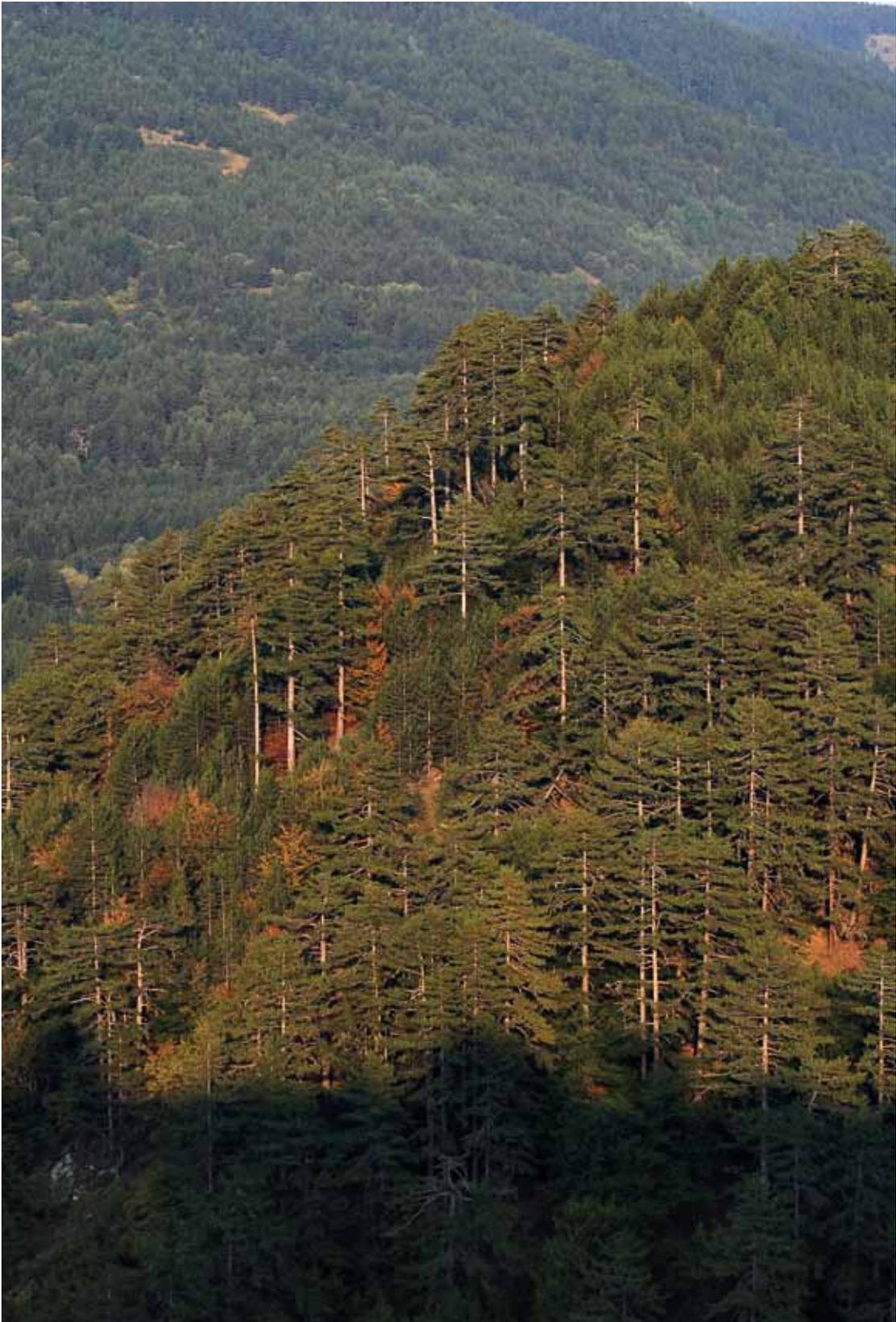
To help the Republic of Macedonia meet this need for adaptation, UNDP supported the Ministry of Environment and Physical Planning in producing its three National Communications to the UN Framework Convention on Climate Change (UNFCCC). Within this project, a special vulnerability assessment was made of the forestry sector.

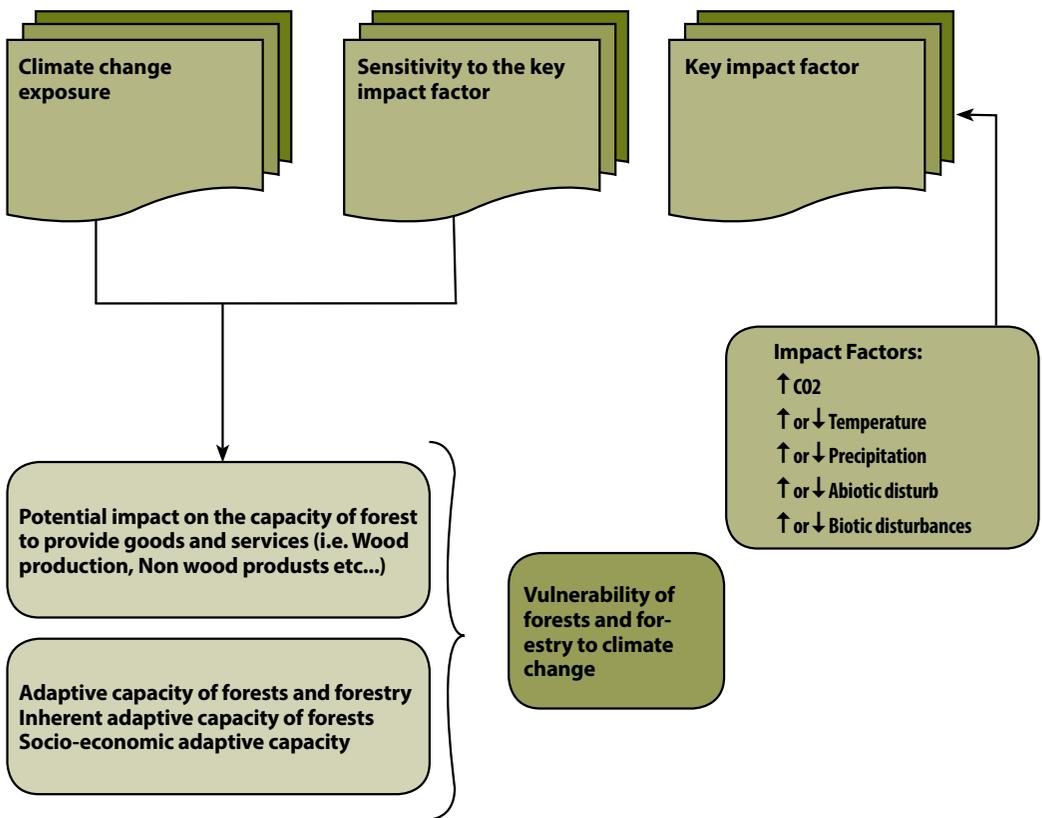
MODELLING THE IMPACTS OF CLIMATE CHANGE ON FORESTRY

Modelling the impacts of climate change on forests involves a complex methodology encompassing a number of factors, including the heterogeneity of forest site conditions, the carbon cycle, differences in temporal and spatial scales, the diversity of stakeholders, and the uncertainty related to extreme events and natural disturbances. As many of these factors are not exclusive to the forestry sector but are relevant across sectors, a valid assessment needs to be modelled around a methodology that aggregates across all the sectors and disciplines associated with forests and forestry.

In order to arrive at relevant conclusions and map out pertinent adaptation strategies, a methodological approach previously used to assess climate change impacts and vulnerability in European forests was adopted and applied to the forestry sector in this country.







In order to meet the goals of the Third National Communication to UNFCCC for the forestry sector, the following direct and indirect impact factors were assessed:

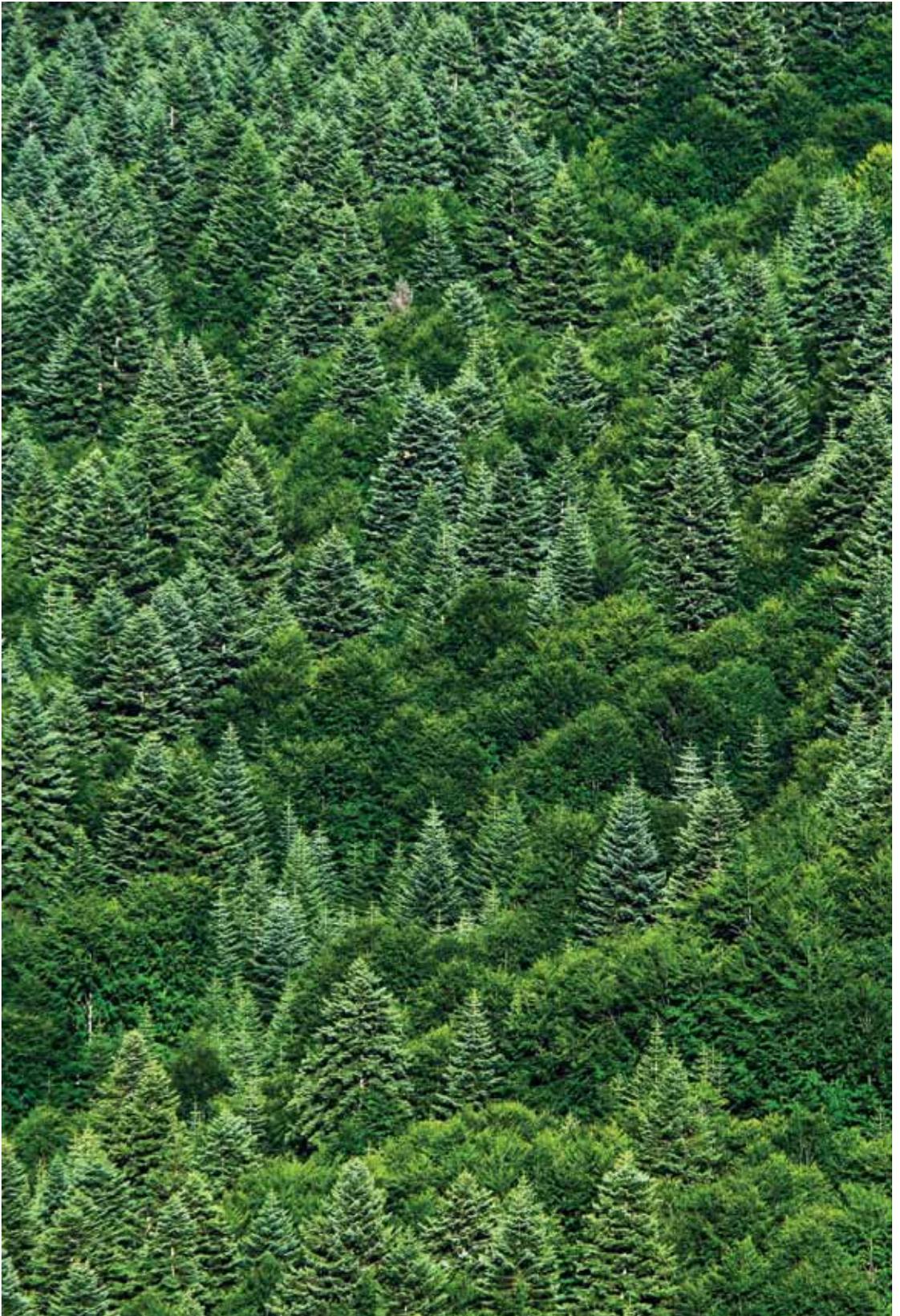
- changes in temperature
- changes in precipitation, flooding, drought duration and frequency
- abiotic disturbances (changes in fire occurrence, changes in wind storm frequency and intensity)
- biotic disturbances (frequency and consequences of pest and disease outbreaks)
- uncertainty of forest management

In spite of the scope of this approach, it should be pointed out that there is still a lack of official harmonized tools and indicators for assessing the impacts of climate change. In view of this limitation, the assessment methodology was based on data obtained mainly from local experience and knowledge.

FINDINGS OF THE ASSESSMENT

The key findings of the assessment review several major impacts of climate change on forest ecosystems in this country:

- Impact on the health condition of forests
- Crown transparency
- Water availability
- Forest fires
- Impact on forest ecosystem services
- Productivity
- Carbon storage and sequestration
- Impact on forest management.





IMPACTS OF CLIMATE CHANGE ON THE HEALTH CONDITION OF FORESTS

In the evaluation of the impacts of climate change on the health condition of forests, the Report used the results of the ICP Forests' (International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests) assessment of this country, conducted in accordance with the official methodology for Europe, USA and Canada for the assessment of forest conditions in relation to air pollution and climate change. The overall assessment covers 29 plots over a span of twenty years from 1991–2011.

Crown Transparency

It can be concluded that no significant changes in the crown transparency of trees occurred in the period between the Second and Third National Communications (2006–2013). Around 50% of the assessed trees show no signs of crown transparency. At the same time, however, around 45% of the trees demonstrate small to moderate loss of needles/leaves (>10<60%). The prediction is that these trees will be the most sensitive to climate change in the following period.

Water Availability

The results show that water availability was insufficient in the period of the assessment for around 65% of the 29 assessed plots. Given the soil type and the properties of the assessment period, such findings are not unusual but should nevertheless be taken into consideration in future assessments of the risks of climate change for this sector.

The changes projected in the official 2012 scenario for climate change include an increment in air temperatures of 1.2–2.0° and a 4–10% reduction in precipitation. These changes are not expected to bring about significant impacts on the health condition of forests. However, it should be emphasized that the 2012 scenario does not include predictions of climate excesses (such as short and severe dryness and extreme air temperatures) as stressors detrimental to the physiological strength of trees. Any climate excesses will cause negative changes in the health condition of forests in this country.

Forest Fires

An increase in forest fires is one of the most widely recognized consequences of climate change. In the past two decades this country has had a significant problem with forest fires. Some 2,800 forest fires were recorded in the period 1999–2012, resulting in the burning of approximately 130,000 hectares of forest land. The total damage (direct and indirect) has been estimated at around 67 million euros.

Although no assessments have yet been made of the occurrence of forest fires under various climate change scenarios, an increase in such fires is highly likely in the coming period. This is because the projected changes in air temperature, combined with reduced precipitation, especially in the summer months, will produce conditions for further outbreaks of forest fire.

In the coming period, changes in temperature and precipitation regime are also expected to trigger changes in species composition. However, according to the climate change scenario, by 2025 such climate changes will have reduced in impact, thus allowing easier adaptation. Increases in temperature of 1.1°C and decreases and changes in the precipitation regime are expected to affect the annual growth and yield of forests, but this may be mitigated by the different needs of different tree species.

Forestry is the only sector that actually absorbs greenhouse gases, thus helping to mitigate the negative effects of climate change. Forest fires not only reduce this mitigating capacity by decreasing the overall extent of forests but also lead to the emission of greenhouse gases.





IMPACTS OF CLIMATE CHANGE ON FOREST ECOSYSTEM SERVICES

Productivity

The impact of climate change on productivity varies depending on geographical area, tree species, stand composition, tree age, soils, CO₂ effects, nitrogen fertilization, and the interaction of these factors.

In this country, the period between the Second and Third National Communications saw no significant changes in forest productivity. It is generally expected that by 2025 forest productivity will have increased due to rising temperatures and CO₂ fertilization. Productivity can decrease as a result of water deficits, though such impacts are not expected to result in forest dieback. Natural disturbances that cause damage to standing trees are another factor that may lead to a decrease in forest productivity.

Carbon Storage and Sequestration

Since the capacity of carbon sinks depends on forest productivity, the factors affecting forest productivity also affect the forests' potential for carbon sequestration.

Forest ecosystems in the Republic of Macedonia are expected to increase their carbon sequestration potential provided there are no dramatic changes in the number and intensity of forest fires.

Conducting an assessment of the carbon sink capacity of local forests is a complex and long-term commitment that needs to be made in this country. This can be done by using the European Forest Information Scenario Model (EFISCEN), a forest resource model suitable for large-scale (>10,000 ha) and long-term (20–70 years) analyses of the future development of forest resources in Europe. This model provides insight into issues such as sustainable management regimes, wood production possibilities, climate change impacts, natural disturbances, and carbon balance issues.

2008 saw the launch of a national Tree Day project aimed at the reforestation of bare non-agricultural land in the country. The project has been supported both financially and logistically by the Government, the Ministry of Agriculture, Forestry and Water Economy, the Makedonski Šumi Public Enterprise, the Ministry of Environment and Physical Planning, and other NGOs and bodies. As a result of the planting dynamics and the amount of seedlings planted, the total new afforested area in the period 2008–2012 is around 1% of the country's total forest area, which is a significant increment. This should improve the forests' capacity for carbon accumulation, especially in view of the fact that these are young trees with great growth capacity and productivity. A problem, however, arises from the selection of species for the chosen locations. The planted seedlings are chiefly black pine (*Pinus nigra*), known to be extremely sensitive to pest attacks, animal grazing and fires, and *Cupressus arizonica*, a drought-tolerant species more suitable for a climate with poor soils and higher resistance to forest fires. In addition, most of the afforested area will be in monocultures—1 to 3 species— which makes these forest areas highly vulnerable to all factors of climate change.

IMPACTS OF CLIMATE CHANGE ON FOREST MANAGEMENT

According to the climate scenario for the Republic of Macedonia, and on the basis of previous experiences, the following aspects of forest management will be most vulnerable in the period up to 2025:

- **Forest management planning.** The planning of forest management activities within the ten-year management period will be very difficult. It is most likely that interventions in management plans and activities will be necessary.
- **Forest utilization.** In the given period, this sector will be mainly affected by activities that must be implemented in accordance with current laws, but which do not bear substantial economic justification (e.g. post-fire management, infestations, the dieback process, infrastructure damages).
- **Forest protection.** The costs of extinguishing forest fires, monitoring the health condition of forests and other forest protection activities are expected to be high.
- **Hunting and tourism.** Due to climate change, it can be predicted that wild animal populations will be under threat by 2025. At the same time, these disturbances will result in a decrease in the recreational/tourism value of forests.
- **Silviculture.** Many forest management techniques and practices are long-term, spanning from 20 to 60 years. Such processes need to be modified and harmonized with new conditions arising from climate change.
- **Land-use changes.** While permanent land-use changes are not expected, it is predicted that temporary land-use changes will occur as a result of forest fires and clearcutting, but these will be eliminated in 3-5 years after their first occurrence. In addition, a tendency to natural forestation has been noted in the mountainous areas, where many villages are abandoned and the previous agricultural land is taken over by forests.



ACTION PLAN

The country's forests—especially the boreal forests—are expected to experience major impacts from climate change. To mitigate these impacts and derive maximum economic benefit from forestry, the Report proposes an Action Plan consisting of short-term and long-term adaptation measures. The actions outlined in the Plan are as follows:

Short-Term Measures

- Developing a programme for adaptation of forestry to global climate change
- Establishing five monitoring stations in forest regions to follow climate changes
- Purchasing adequate vehicles and equipment for the suppression of forest fires (early response/first attack)
- Developing an educational / training centre for sustainable forest utilization
- Biomass stocking

Long-Term Measures

- Adaptation of the management plans in forestry practices in accordance with climate change trends
- Introduction of technologies for the efficient use of biomass in forestry
- Promotion of possibilities for producing green energy
- Implementation of a pilot project for the production of renewable energy from forest and agricultural biomass.