

RESEARCH PROJECT

**Global Climate Change: The Science, Social Dimensions and Public Health Impact
of a World Environmental Crisis**

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**THE IMPACTS OF CLIMATE CHANGE ON FORESTRY IN
CYPRUS**

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Introduction

Climate change is already happening. Actually it was always happening, but nowadays is happening more rapidly than before, representing one of the greatest threats of the planet. The impacts of those abnormal variations to the Earth's climate, are several and affecting many sectors like environment, economy, health.

The warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global mean sea level. The Earth's average surface temperature has risen by 0.76 °C since 1850. Most of the warming that has occurred over the last 50 years is very likely to have been caused by human activities ([Environment - Climate Change, 2009](#)).

In 2007, the [Intergovernmental Panel on Climate Change \(IPCC\)](#), published its [Fourth Assessment Report \(AR4\)](#), which projects that if we don't take any further action to reduce the greenhouse gas emissions, then the global average surface temperature is likely to rise by a further 1.8-4.0°C this century, and by up to 6.4°C in the worst case scenario. Projected global warming this century is likely to trigger serious consequences for mankind and other life forms, including a rise in sea levels of between 18 and 59 cm which will endanger coastal areas and small islands, and a greater frequency and severity of extreme weather events ([Environment - Climate Change, 2009](#)).

Cyprus is not excluded from the threat of climate changes. Although, its position in the Eastern Mediterranean region and the fact that it's an island, is not an exception for facing problems like increase of temperature and droughts. In general, it is not the first time that the island is facing droughts, some of them severe and long-lasting.

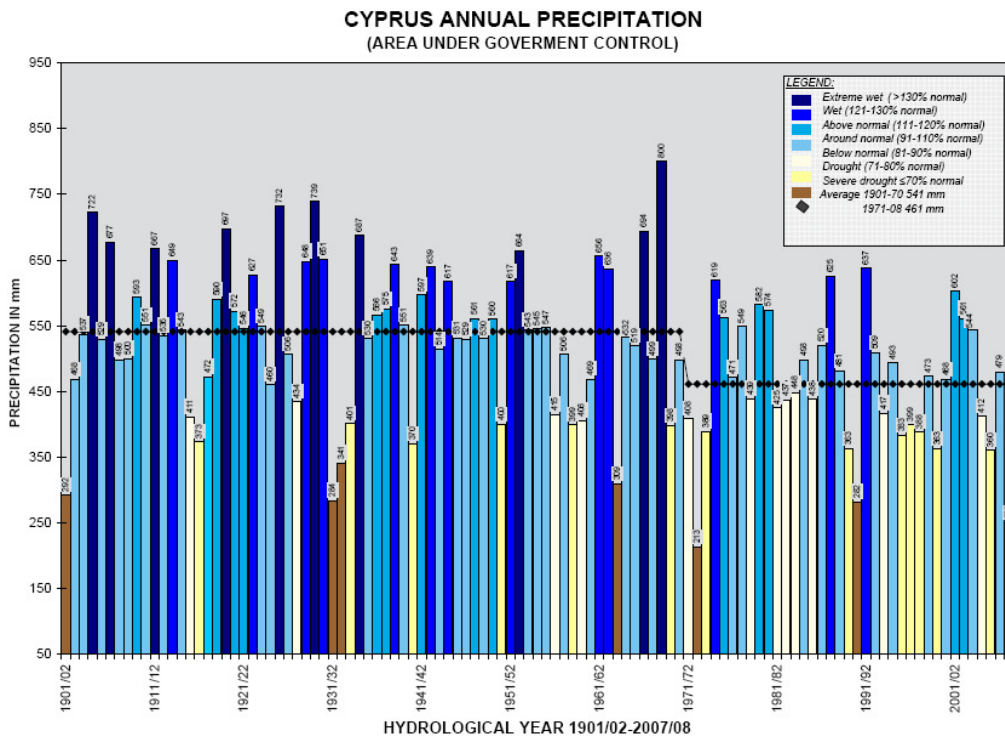


Figure 1: Cyprus Annual Precipitation (Area Under Government Control)

The Problem

Climate change and forests are intrinsically linked. On the one hand, changes in global climate are already stressing forests through higher mean annual temperatures, altered precipitation patterns and more frequent and extreme weather events. At the same time, forests and the wood they produce trap and store carbon dioxide, playing a major role in mitigating climate change. And on the flip side of the coin, when destroyed or over-harvested and burned, forests can become sources of the greenhouse gas, carbon dioxide (FAO, 2008).

Nowadays, there is an increasing trend for utilizing forests as carbon sinks. This function of forests is very important since forests are the largest terrestrial biotic carbon store; in this way they help to mitigate the global climate change. Under Cyprus' conditions with the increasing urbanization and rising carbon emissions, from combustion of fossil fuel, this role of forests is becoming more important.

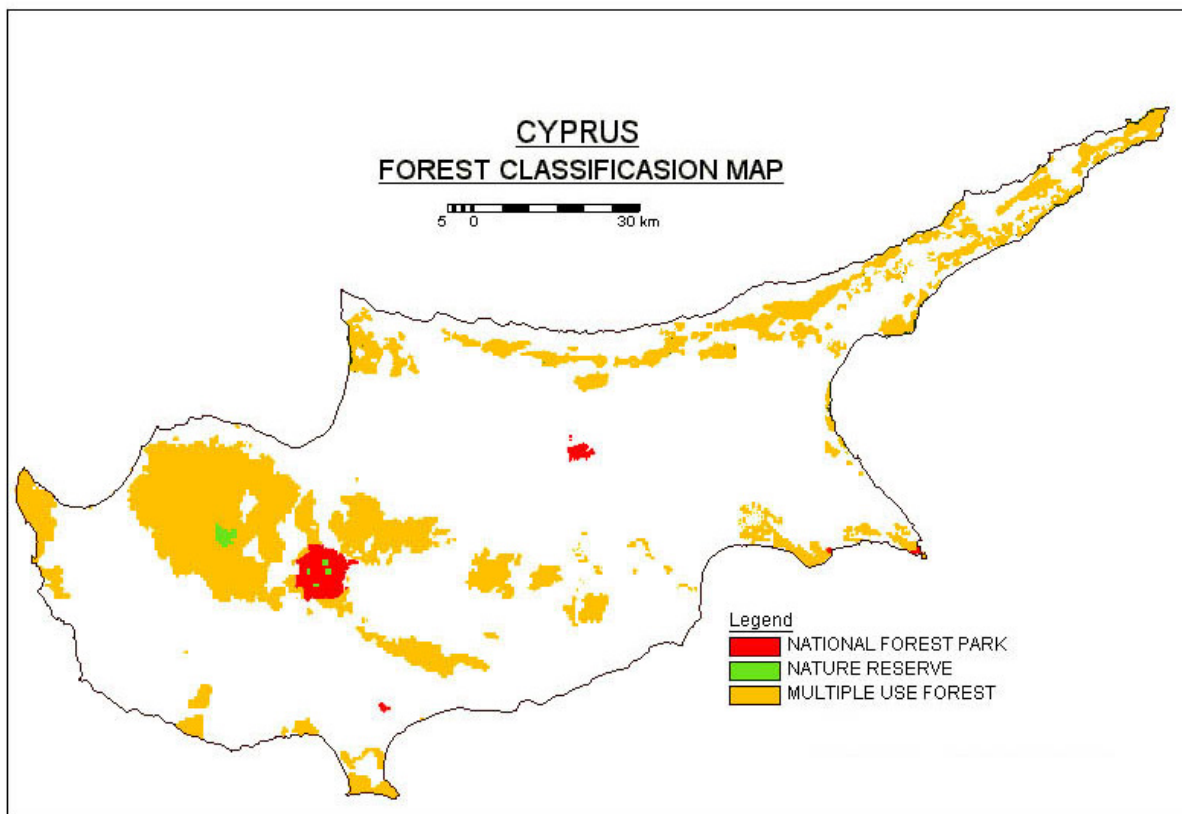


Figure 2: The distribution of National Forest Parks and Nature Reserves.

The climatic conditions of the island, i.e., a short rainy season in the winter and a long dry summer, mean that water supplies are limited. Moreover, the increasing demand in water supplies, due to the large number of tourists, results in water shortage, which is an acute problem for the island. Among the most important measures that have been taken to solve this problem is the construction of water dams and reservoirs for better utilization of the rainwater as well as the construction of desalination plants. Consequently, the forested areas of the island are highly valued as water catchments having also an anti-desertification influence (Forestry Outlook Study for Cyprus, 2005).

Any changes in the frequency and availability of precipitation, affects the plant growth in general and the forest cover in particular. Precipitation tends to decrease (the average precipitation in the last 30-year period is 17% less than in the period 1901-1930) and temperature to increase (increasing trend of 0.01 °C per year). It is expected that by 2030 Precipitation will decrease by 10 - 15% and Temperature will increase by 1,0 - 1,5°C compared to the normal values of the period 1961- 1990. In Cyprus, the impact of droughts is significant for the health of the forest ecosystem. For example, an increase of the temperature only for 1-2 °C, might be the end of the specie of *Pinus nigra* at the top of Troodos mountains. Thus, the [Department of Forests](#) in Cyprus has taken action. Since the implications of droughts and high temperatures are severe for our forests, the Department decided to proceed with an Action Plan, so we will be ready to face such problems. The Action Plan is prepared by the Research, Publicity and Silviculture Sector.

The Department of Forests in Cyprus

The main mission of the Department of Forests is to promote sustainable forest management and protection of the state forests in Cyprus which cover an area of 163520 hectares representing 17,74% of the total area of the island. Out of these 123910 hectares (13,44%) are found in the government controlled areas and 39610 hectares (4,30%) are situated in the areas occupied by Turkey. In addition, the Department of Forests is responsible for implementing the government Forests Policy and the Forest Law.

The main object of the State Forest Policy is forest development through sustainable management of the forests and the forestry sector in general, through a system of multiple use, conservation of the biodiversity and upgrading and promotion/ utilization of all functions of forest ecosystems, aiming at providing a longer and better quality life to modern society and preserving at the same time the forests for future generations. The second basic object of the Department, is to protect the Cyprus State Forests and in general the Cyprus rural areas from fires and various other dangers ([Department of Forests-Mission](#), 2009).

Monitoring of Forests and Environmental Interactions in the Cyprus Forests

A serious decline in the forests of Europe has been observed since the beginning of 1980. This decline is characterized by a die-back of trees, excessive loss of foliage, insect attacks, reduction of vitality and productivity of forests and, in certain cases loss of ecological stability.

The decline of forests was attributed mainly to the atmospheric pollution and, due to the international dimension of the problem, a world program for the monitoring of effects of atmospheric pollution on the forests (*International Co-operative Program on the Assessment and Monitoring of Air Pollution Effects on Forests, ICP-FORESTS*) has been developed by UN in 1985. In addition to the above program, the European Union has developed a similar program (*Protection of Communal Forest against Atmospheric Pollution*), the activities of which are included in regulation 2152/03 EC (*Monitoring of Forests and Environmental Interactions in the Community, Forest Focus*).

Cyprus has joined the ICP – Forests program in 2001. The adoption of the program was the result of the increasing necessity for a better monitoring and understanding of forest

ecosystems in Cyprus. The Cyprus Department of Forests, of the [Ministry of Agriculture, Natural Resources and Environment](#), has been nominated as the National Focal Centre of the ICP-Program in Cyprus, being responsible for the collection, validation, evaluation, storage and management of the monitoring data. The National Focal Centre collaborates with the Coordinating Centers of the Program in Europe, which have the responsibility of aggregating, processing and presenting the research part of the program on a European and an international level ([Department of Forests-Atmospheric Pollution](#), 2009).

Research Activities of the Program

A systematic network of 19 permanent plots has been established in Cyprus State forests aiming at the collection of the necessary data, relevant to the above activities. These plots are divided in two categories according to the type of observations to be done and data to be collected:

“Systematic large scale monitoring plots”

Fifteen plots, covering an area of 0,1 ha each, have been established for monitoring Calabrian pine (*Pinus brutia*), Black pine (*Pinus nigra*), and Cyprus cedar (*Cedrus brevifolia*) ecosystems. In these plots, annual observations of crown conditions and periodic sampling and analysis of soil and needles are carried out.



Figure 3: *Pinus brutia*



Figure 4: *Pinus nigra*

“Intensive monitoring plots”

Four plots, covering an area of 1ha each, have been established for monitoring Calabrian pine (*Pinus brutia*) and Black pine (*Pinus nigra*) ecosystems. In two of these plots, all research activities, mentioned above, are carried out. These plots are furnished with appropriate instruments and equipment for the collection of samples, data and information.

The other two plots are partially equipped and only some research activities are carried out ([Department of Forests-Atmospheric Pollution, 2009](#)).



Figure 5: [Cedrus brevifolia](#)

The current Climate Action Plan of Department of Forests in Cyprus

Many forestry areas, especially at the low and middle altitudes have damaged, due to the extreme dry period of 2005-2009. As a result, forest trees died and others affected by insects, leading many animals to starvation. Moreover, the danger of forest fires increased because of the increase of temperature and the decrease of precipitation. All these can lead to soil erosion, increase of dust in the atmosphere, insect and pathogens outbreaks, effects to aquifers and surface water storage status, Biodiversity loss – (163 plant species are threatened (IUCN criteria) due to small population size and distribution area) and many other which can finally create health problems to the human population. Unfortunately, as a worst case scenario, Cyprus will face the consequences of desertification, if the weather events continue with the same patterns. Thus, the Forest Department decided to take measures to be prepared for further implications of the climate change. The plan is called “Short-term Action Plan for the Confrontation of the Implications of Drought at the Cyprus Forests”.

Desiccation Results from the Government Forests due to the Drought of 2007-2008					
Forest Region	Total Forest Covered Area (ha)	Area with Serious Desiccation Problems (ha)	Area with Serious Distress and few Desiccation (ha)	Total Forest Area with Problems (columns 3+4) (ha)	Percentage (%)
<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>
Paphos	69386	70	1307	1377	1.98
Troodos	33760	453	1835	2287	6.78
Nicosia, Larnaca, Famagusta	18422	1479	1474	2953	16.03
Forestry College	2342	0	16	16	0.68
Total	123911	2002	4631	6633	6.37

Figure 6: [Table of the desiccation results from the government forests of Cyprus](#)

The Plan consist of 8 sectors regarding the research assessment of the forest health condition, the silviculture, the afforestation and reforestation, the forest reproduction, the woodcutting, the forest fauna, the protection of the forest fires and the publicity. These sectors contain 20 measures and 35 actions in total. Briefly, the Plan includes taking of measurements regarding the quality and health of the trees by sampling and analysis of needles and leaves of forest trees, estimation of growth and yield of forest stands, meteorological observations, sampling and chemical analysis of deposition (precipitation, snow, hail), more constructions of water storage tanks near the forest areas, removable of dead trees from the tuft, insect control, reforestation program, reduction of woodcutting, fire control with the use of the “Forest Fire Early Warning System”, watering of plants where there is need, protection of old/ancient trees. Finally, the Department will aware the public for the results, the current situation of the health of forests, and the implications of climate change to the local and especially the indigenous flora, by publications, interviews and announcements in the media.



Figure 7: Desiccation at Stavrovouni area



Figure 8: Desiccation at Kionia area

Conclusion

The implications on the forests due to climate change, is significant. A small change in the biodiversity, could lead to severe problems in the food chain and ecosystem balance. If flora is damaged, especially in a forest ecosystem, which is of the most complicated ones, many species are endangered. Vanishing of flora species, could lead to the elimination of some fauna species, including mammals, birds and other animals.

The Department of Forests of the Cyprus Republic, is taking seriously the impacts of Climate Change on the Forests. Except of the local decisions, the Department is participating in many other plans, including the [Standing Forestry Committee](#) of the [European Commission](#) which is currently working on the Climate Change mitigation. Also, is participating in [Echoes Cost Action](#) which has as main objectives to mobilize and integrate the existing scientific knowledge for European forest policymakers and

managers. The Action begun at 2008 (May) and has a duration of 4 years. There are three working groups: Impacts, Adaptation and Mitigation.

Some of the mitigation measures, include the decrease of timber extraction by Use of longer rotation periods, increasing the forest areas mainly through afforestation of bare lands and reforestation of abandoned agricultural lands, use of species with higher carbon sequestration ability (for plantations) and well adapted to hard climatic conditions and minimize of tillage and associated practices.

Climate change is an issue that we should all take care. Our health and life depends on the sustainability of the world and the environment we live in. Protection and respect for our nature is a prerequisite to live in a better place, in a healthy balanced planet.

List of authorities, departments, organizations and people who are or should working on the protection of Cyprus Forests from climate change:



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