

THE REPUBLIC OF CYPRUS
MINISTRY OF AGRICULTURE, RURAL DEVELOPMENT AND ENVIRONMENT

CYPRUS'

NATIONAL FORESTRY ACCOUNTING PLAN

IN ACCORDANCE WITH REGULATION (EU) 2018/841

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Title of Report	National Forestry Accounting Plan for Cyprus
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Contents

- 1. General Introduction 5
 - 1.1 General description of the forest reference level for [the Member State] 5
 - 1.2 Consideration to the criteria as set in Annex IV of the LULUCF Regulation..... 6
- 2. Preamble for the forest reference level..... 7
 - 2.1 Carbon pools and greenhouse gases included in the forest reference level 7
 - 2.2 Demonstration of consistency between the carbon pools included in the forest reference level 7
 - 2.3 Description of the long-term forest strategy 7
 - 2.3.1. Strategic objective 1: enhancement of the environmental role of forests..... 7
 - 2.3.2. Contribution of the strategic objective 1 to the strategic intentions 8
 - 2.3.3. Operational objectives 8
 - 2.3.4. Overall description of the forests and forest management in [the Member State] and the adopted national policies..... 9
 - 2.3.5. Description of future harvesting rates under different policy scenarios 10
- 3. Description of the modeling approach..... 11
 - 3.1 Description of the general approach as applied for estimating the forest reference level.. 11
 - 3.1.1. Area and ownership of Cyprus forests 11
 - 3.1.2. Floristic composition of Cyprus forests 12
 - 3.2 Documentation of data sources as applied for estimating the forest reference level 14
 - 3.2.1. Documentation of stratification of the managed forest land 14
 - 3.2.2. Estimation of Forest Reference Level based on specific criteria..... 14
 - 3.2.3. Documentation of sustainable forest management practices as applied in the estimation of the forest reference level 16
 - 3.3 Detailed description of the modeling framework as applied in the estimation of the forest reference level..... 16
- 4. Forest reference level..... 17
 - 4.1 Forest reference level and detailed description of the development of the carbon pools .. 17
 - 4.1 Consistency between the forest reference level and the latest national inventory report . 20
 - 4.2 Calculated carbon pools and greenhouse gases for the forest reference level..... 21
- 5. References..... 23

1. General Introduction

This document has been prepared for Cyprus as a European Union Member State and shall be referenced as the “National Forestry Accounting Plan of Cyprus”, which includes the forest reference level for the member state. The document is in accordance with the Regulation (EU) 2018/841 and shall be submitted to European Commission (DG CLIMA).

1.1 General description of the forest reference level for [the Member State]

The forests of Cyprus are an important national resource as they provide renewable wood and non-wood products and services.

They are threatened, however, by various risks and pressure exerted from several directions and is constantly facing new challenges as the result of changing needs and demands of society and changes in local, regional and global level. The main risks, the forests of Cyprus are facing, are forest fires, biotic and abiotic factors, the development for tourism, residential and industrial purposes, illegal logging, grazing, etc.

The area of state forests is kept constant while the area of private forests was reduced during the last years due to fires and development. In some cases, forests are expanding due to natural afforestation of abandoned agricultural land especially in mountainous and hilly areas.

The forests of Cyprus are also characterized by high biodiversity, which is threatened mainly by forest fires, excessive development, climate change, overgrazing and the introduction of alien plant species in areas with wild natural vegetation.

Climate change is expected to affect the Mediterranean region and cause serious problems to Cyprus forests, both with increasing temperature and with decreasing rainfall and increasing frequency and intensity of droughts.

Cyprus adopted the following definition of Forest for GHG reporting under the Convention and the Kyoto Protocol:

Forest comprises of land covered by forest trees which covers at least 0.3 hectares, where the tree crown cover is at least 10 per cent and the minimum tree height is of 5 meters (at maturity).

The forest definition adopted by Cyprus is in line with the Forest National Law of 2012 (25 (I)/2012) and in accordance with the definition used for its reporting for the Global Forest Resource assessment under the Food and Agriculture Organization of the United Nations (FAO FRA 2015). This definition is also consistent with the guidance of the national definition of forest contained in Decision 16/CMP.1.

It should be noted that the Department of Forests (Department of Forests, CY-1414 Nicosia, Cyprus) applied the following definition of forest in its reporting under the FRA 201564: Forest comprises land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more

than 10 percent, or trees able to reach these thresholds at maturity in situ. It does not include land that is predominantly under agricultural or urban land use.

It should also be noted that according to the Forest National Law of 2012 (25 (I)/2012) the area threshold of 0.3 hectare is to be implemented in all future reports covering any period since the year 2012.

The Forest Land category for GHG reporting under the Convention and the Kyoto Protocol contains all lands that meet the definition of forest. It also includes forest roads, cleared tracts, firebreaks and other small open areas within the forest as well as reforested areas or burnt areas or other areas that temporarily have low plant cover due to human intervention or natural causes, but does not include municipal parks and gardens. Forest land contains only areas covered with trees that according to the Forest National Law of 2012 (25 (I)/2012) are considered as forest trees.

The forest land is further divided into two subcategories: coniferous forest and broadleaved forest based on the dominant tree species.

1.2 Consideration to the criteria as set in Annex IV of the LULUCF Regulation

A. Criteria and guidance for determining forest reference level

The available and more recent data was utilized for the determination of forest reference level. In summary, the forest reference level was determined by taking into account the national forest inventories for *Pinus brutia*, conducted by the Department of Forests for the years 2001 and 2011, which was considered the reference period. *Pinus brutia* is the main species for Cyprus forested land and accounts for a large percentage of the carbon removals. The average biomass increment has been determined for the period and assuming constant harvesting rates the FRL has been determined as $\Delta C\text{-conifers} + \Delta C\text{- broadleaves} + \text{Harvested Wood Products}$ for the period 2011-2025. For its calculation the forest area was stratified into two main categories, conifers and broadleaves. For broadleaves, due to lack of data, default emission factors were used as applied in the NIR. Also, the level of Harvested Wood Products emissions was calculated using the template utilized for NIR using FAO Stat as an average for the period 2001-2011 and reporting the results for the Production Method.

B. Elements of the national forestry accounting plan

The national forestry accounting plan has been reported according to the criteria set out in the Regulation utilizing available data for the reference period. The pools that were determined were living biomass (above + below) and Harvested Wood Products in CO₂ emissions.

2. Preamble for the forest reference level

2.1 Carbon pools and greenhouse gases included in the forest reference level

Forest comprises of land covered by forest trees which covers at least 0.3 hectares, where the tree crown cover is at least 10 per cent and the minimum tree height is of 5 meters (at maturity).

The forest definition adopted by Cyprus is in line with the Forest National Law of 2012 (L.25 (I)/2012) and in accordance with the definition used for its reporting for the Global Forest Resource assessment under the Food and Agriculture Organization of the United Nations (FAO FRA 2015). This definition is also consistent with the guidance of the national definition of forest contained in Decision 16/CMP.1.

The forest land is further divided into two subcategories: coniferous forest and broadleaved forest based on the dominant tree species. The carbon pools calculated were living biomass for coniferous forests, living biomass for broadleaved forest and Harvested Wood Products.

2.2 Demonstration of consistency between the carbon pools included in the forest reference level

2.3 Description of the long-term forest strategy

2.3.1. Strategic objective 1: enhancement of the environmental role of forests

The forests of Cyprus are an important national resource as they provide renewable wood and non-wood products and services.

They are threatened, however, by various risks and pressure exerted from several directions and are constantly facing new challenges as the result of changing needs and demands of society and changes in local, regional and global level. The main risks, the forests of Cyprus are facing, are forest fires, biotic and abiotic factors, the development for tourism, residential and industrial purposes, illegal logging, grazing, etc.

The area of state forested land is kept constant while the area of private forested land was reduced during the last years due to fires and development. In some cases, forests are expanding due to natural afforestation of abandoned agricultural land especially in mountainous and hilly areas.

The forests of Cyprus are also characterized by high biodiversity, which is threatened mainly by forest fires, excessive development, climate change, overgrazing and the introduction of alien / invasive plant species in areas with wild natural vegetation.

Climate change is expected to affect the Mediterranean region and cause serious problems to Cyprus forests, both with increasing temperature and with decreasing rainfall and increasing frequency and intensity of droughts.

Within this framework, the department aims in enhancing the environmental role of forests. The protective role of forests is crucial, especially for the protection of soil and water. This is partly due to the mountainous nature of forests and because of the fact that most forests are located in the major water catchment areas. Along with the protection of soil and water, forests help to prevent floods affecting agricultural lands, infrastructure and settlements located downstream.

2.3.2. Contribution of the strategic objective 1 to the strategic intentions

The specific strategic objective contributes to the achievement of the following strategic intentions:

1. Promotion of Green and Blue Development, contributing to the restructuring of the economy
2. Protection of the environment and promotion of resource efficiency
3. Reduction of greenhouse gas emissions, climate change adaptation and risk prevention

The strategic intention "Protection of the environment and promotion of resource efficiency" is achieved through the protection of forests from fires, overgrazing, human interventions and other biotic and abiotic factors that affect them. It is also achieved through the maintenance and improvement of biodiversity in forests. In particular, the conservation of biodiversity is enhanced by the protection of flora and fauna and the protection and restoration of their habitats.

The strategic intention "Reduction of greenhouse gas emissions, climate change adaptation and risk prevention" is achieved through the creation of new forest areas and the prevention and remediation of damages to forests, actions leading to increased carbon storage.

Furthermore, the measures proposed under Strategic Objective 1, contribute to the strategic intention related to the "Promotion of Green and Blue development, contributing to the restructuring of the economy" because, forests are one of the most important terrestrial ecosystems on the planet and the goods and services derived from them are an important part of the green economy.

2.3.3. Operational objectives

- a) Protection and expansion of forests
- b) Protection of biodiversity and other functions of forest ecosystems

2.3.3.1. ACTIONS/ ACTIVITIES UNDER OPERATIONAL OBJECTIVES

- a) Operational objective 1:
 - a) Protection of forests
 - b) Expansion and tending of forests and greenery
- b) Operational objective 2:
 - a) Protection of habitats and species of flora and fauna
 - b) Raising public awareness

2.3.4. Overall description of the forests and forest management in [the Member State] and the adopted national policies

2.3.4.1. Criteria and Indicators for Sustainable Forest Management

The Department of Forests has formulated and adopted a set of Criteria and Indicators for the Sustainable Management of Forests in Cyprus, based on the Improved Pan-European Criteria and Indicators, as they were finalized and adopted by the Ministerial Conference on the Protection of Forests in Europe in 2002. The Criteria and Indicators for the Sustainable Management of Forests in Cyprus which were published in 2006, analyze the state of Cyprus forests for the period 1993 – 2003, setting the basis for a quantitative and qualitative assessment of Cyprus forests and their management, as well as for the monitoring of future changes.

2.3.4.2. Forest Inventories

Forest inventories cover only the area of state forests. The purpose of the inventory is the collection of all the necessary data (raw data) on forests, aiming at the rational design of forest management as well as monitoring the dynamic development of stands.

In 2013, Management and Computerization Sector of the Department of Forests, presented the results of the fourth Forest Inventory (2011 – 2012). Inventory covered Exploitable Forests, Non Exploitable Forests and Reforestations.

2.3.4.3. Climate Change and Forests

According to the United Nation Framework Convention on Climate Change (UNFCCC), the term of climate change means «a change of climate which is attributed directly or indirectly to human activity» differentiating the term by climate variability due to natural causes.

Recently, at the 21st Meeting of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC - COP21), an agreement (the Paris Agreement) was reached, which culminated in a series of efforts by the global community to tackle climate change effectively.

The Republic of Cyprus ratified the Paris Agreement on 9 December 2016, while internationally entered into force on 4 November 2016.

Cyprus Forests unfortunately could not remain uninfluenced by Climate Change and other Changes. In particular, the period 2005 – 2008 was affected by prolonged droughts, resulting on Cyprus forests ecosystems been intensively stress due to lack of soil moisture, high temperature and high competition between forest species.

The Department of Forests adopts and applies mostly repeated actions which are designed to adapt on forest stands (natural and artificial) to climate change. Also the object of these actions is the reduction of emissions and increase the absorption of greenhouse gases. These actions can be grouped into three main areas as listed in the Statement of Forest Policy:

- Protecting forests against forest fires

- Adaptation of forests to climate change and enhancing the contribution of forests in addressing climate change and improvement of main forests and forested areas
- Improvement and expansion of forests. Such measures are:
- Protection of forests from illegal logging: With the implementation of Law 139 (I) / 2013 is controlled most the available firewood locally and criminal penalties for any illegal or uncontrolled logging and / or disposal of the local timber market without authorization
- Reforestation of Amiantos (asbestos) Mine as well as restoration of abandoned mines in cooperation with the Competent Authority (the Mines Service)
- Protection of forests and enhancement of their structure and resistance to climate change through the Rural Development Program 2014 – 2020.
- Production in forest nurseries resistant to drought plants and trees (e.g. *Olea europaea*, *Ceratonia siliqua*, *Pistacia lentiscus*) to be used in afforestation or reforestation.
- Participation of the Department of Forests in co-funded projects (e.g. Life Kedros), aiming to develop management tools (management rules) aimed at protecting, preserving and further upgrading protected forest habitats.

In particular, on the Rural Development Program, a number of activities and actions have been integrated under Measure 8 (Investments in forest area development and improvement of the viability of forests). The Action 8.5.3 includes thinning operations in thick stands created by afforestation / reforestation, with the purpose of:

Improving the structure of forests created by afforestation or/and reforestation operations. Furthermore, they will help in the adaptation of forest stands in climate change as well as contribute to the adaptation of forest stands to climate change, the reduction of emissions and increase the absorption of greenhouse gases.

The implementation of targeted thinnings is expected to improve stability and resistance capacity to other disturbances, such as drought, increase in average temperatures and prolonged heat waves (as a result of climate change).

2.3.5. Description of future harvesting rates under different policy scenarios

Implementation of targeted thinning of the forest is expected to improve stability and resistance capacity to other disturbances, such as drought, increase in average temperatures and prolonged heat waves (as a result of climate change).

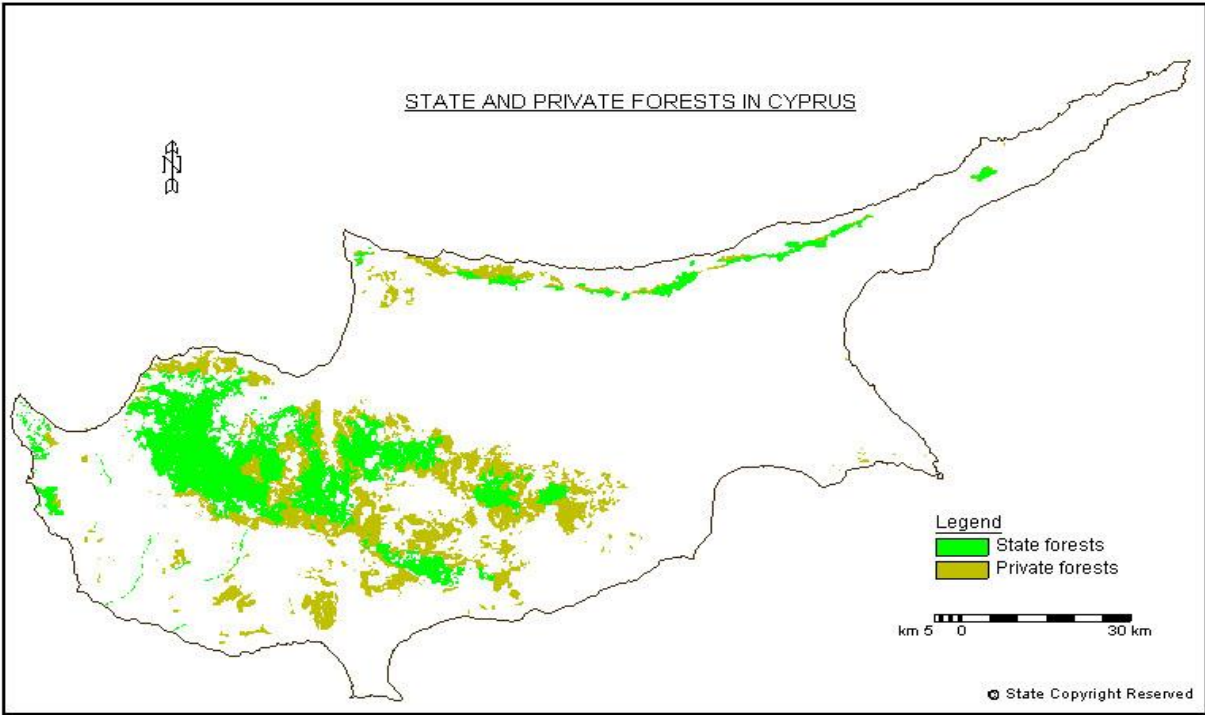
3. Description of the modeling approach

3.1 Description of the general approach as applied for estimating the forest reference level

3.1.1. Area and ownership of Cyprus forests

The total area of State forests (high forests) is about 172,700 ha and forest occupies the 11,57 % of the total area of Cyprus. An area of about 139,053 ha or 80,46 % of the total State forest area is situated in the area under the control of the Government whilst the remaining 19,54 % is found in the area of Cyprus beyond the control of the Government. According to the last survey, private forests and other forested State land cover 24,74 % of the total area of Cyprus (Map.1).

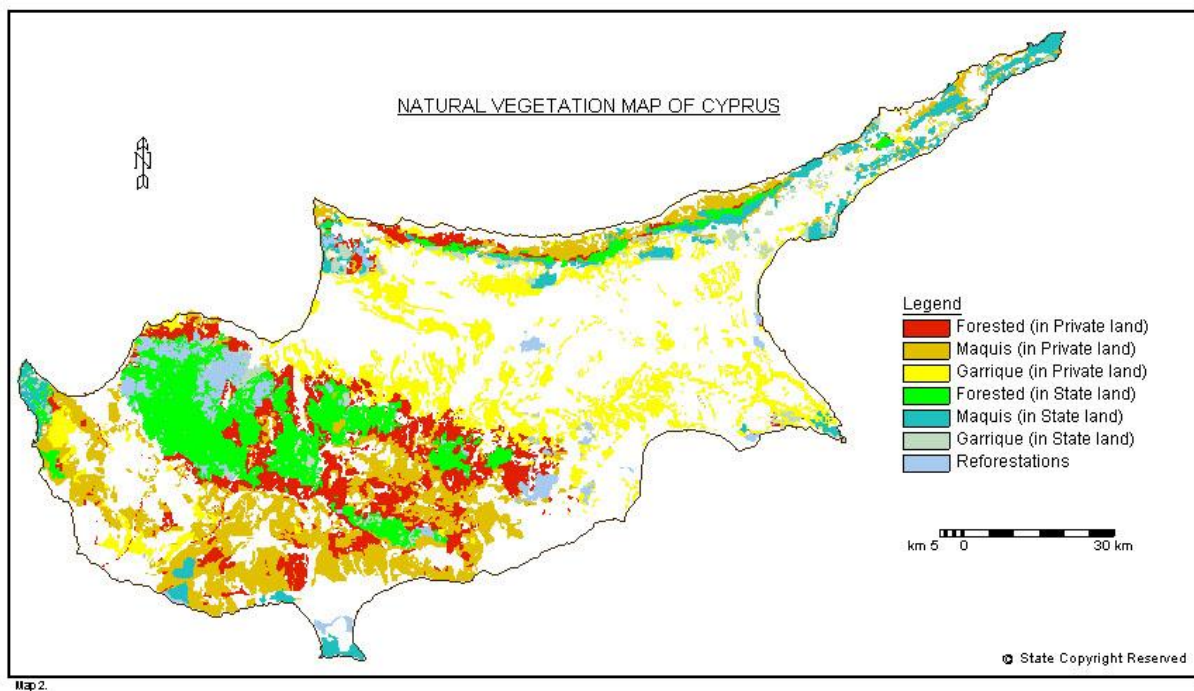
Private forests are small holdings scattered all over Cyprus and are mainly located in distant mountainous and rural areas. However, the practice of private forestry as such, is not existed in Cyprus. The existence of these forests is due to the emigration of people from the mountainous or semi-mountainous to urban areas, the abandonment of agricultural land adjacent to the State forests and the natural expansion of the forest vegetation. The emigration of people resulted in the declination of grazing, in the reduction of the needs for fuel wood, in the reduction of forest fires on the lands outside State forests and in the transformation of parts of them into forest.



Map 1 State and Private Forests in Cyprus (Source: Department of Forests)

3.1.2. Floristic composition of Cyprus forests

Nearly half the area of the island is covered by tree vegetation that has been degraded by human activities. Forest is composed mainly of coniferous species like the Calabrian pine (*Pinus brutia*), the black pine (*Pinus nigra* subsp. *pallasiana*), the Cedar (*Cedrus libani* subsp. *brevifolia* (Hook. f.) Meikle) and the Cypress (*Cupressus sempervirens* L.). Maquis vegetation includes species like Lentisk (*Pistacia lentiscus* L.), Juniper (*Juniperus phoenicea* L.), Maple (*Acer obtusifolium* Sm.) and Strawberry tree (*Arbutus andrachne* L.), while garigue lands consist of the Rock rose (*Cistus* spp.), Thyme (*Thymus capitatus* L.), Thorny-broom (*Calycotome villosa* (Poir.) Link), Thorny gorse (*Genista fasselata* Decne. var. *fasselata*) and Spiny burnet (*Sarcopoterium spinosum* L.). There are also minor areas consisting of young coniferous plantations (source: Forest Department, Ministry of Agriculture, Rural Development and Environment, Cyprus).



Map 2. Natural Vegetation map of Cyprus. (Source: Natural Resources Information and Remote Sensing Center, Ministry of Agriculture, Natural Resources and Environment).

The changes in the land use in the public forests are prohibited by the Forest Laws of 1967, 1987, 1991 and 2012. Changes in the use of the private forests or of the other wooded land is not restricted by any law or regulation. Private forests may be transferred at any time to other uses and private treeless areas may be afforested. The main reason of private forest land use change is the building of country houses or ecotourism development or the conversion into agricultural lands.

For the time being, there is no information regarding the number of private forest owners or the area each-one-owns. This is mainly because private forest areas were small abandoned agricultural lands where natural vegetation invaded from the adjacent State forests. In many cases, these lands are owned by more than a single individual.

According to Forest Law (Law 14 of 2012), the State forest is classified into: Main State Forest and Minor State Forest.

The Main State Forest is further sub-classified into:

The Main State Forest is further sub-classified into:

- **Permanent Forest Reserves**, which are areas that are used in perpetuity for forestry;
- **Nature Reserves**, which are forests that provide complete and permanent protection of the flora and fauna;
- **National Forest Parks**, which are forests providing amenities and recreation opportunities to the general public.

On the other hand, Minor State Forest is sub-classified into:

- **Communal Forests**, which are forests assigned by the Council of Ministers to the inhabitants of a village in order to be used and enjoyed communally for the purpose of amenity and recreation;
- **Municipal Forests**, which are forests assigned by the Council of Ministers to a municipality for the purpose of obtaining fuel, timber and other forest products for their needs or for the purpose of amenity or recreation;
- **Grazing Areas**, which are areas assigned by the Council of Ministers to the inhabitants of a town or a village for the purpose of grazing their cattle;
- **Nursery Areas**, which are areas reserved by the Council of Ministers for the production of seedlings, including fruit trees, bushes and other ornamental shrubs and flowers for use in any State forest or for sale to other Governmental Departments or to the general public;
- **Multiple Use Forests** are forests which can be leased by the Director of the Department of Forests for different kinds of use, not necessarily related to forestry, such as the cultivation or production of agricultural crops, the breeding and production of livestock or any other use approved by the Council of Ministers.

Table 1. Forest area occupied by the main forest communities within the State forests (Department of Forests Database)

Major Forest Communities	Area in hectares
<i>Pinus brutia</i> community	88.790
<i>Pinus nigra</i> community	2.640
Mixed <i>Pinus brutia</i> – <i>nigra</i> community	2.330
<i>Cedrus brevifolia</i> community	230
<i>Cupressus sempervirens</i> community	6
Mixed <i>Cupressus sempervirens</i> – <i>Pinus brutia</i> community	177
Mixed <i>Cupressus sempervirens</i> - <i>Quercus alnifolia</i> community	2
Mixed <i>Cedrus brevifolia</i> – <i>Pinus brutia</i> community	167
Mixed <i>Pinus brutia</i> – <i>Quercus alnifolia</i>	5.870
<i>Quercus infectoria</i> community	0,1
<i>Eucalyptus</i> community	137
Riparian community (<i>Platanus</i> and <i>Alnus</i>)	1459,6
<i>Salix alba</i> community	45

The State forests of Cyprus are made up of the following plant communities; the *Pinus brutia*, the *Pinus nigra*, the mixed *Pinus brutia-nigra*, the *Cedrus brevifolia*, the mixed *Cedrus brevifolia-Pinus brutia*, the *Quercus alnifolia*, the mixed *Pinus brutia - Quercus alnifolia*, the *Eucalyptus* and the Riparian community. The area of the State forest that each one of the above communities occupies is stated in table 1.1.4 above.

The *Cedrus brevifolia* community covers an area of 230 ha, as shown above in Table 1. The natural stands cover 102,4 ha are natural stands while the rest are plantations. The *Eucalyptus* community is mainly concentrated around Fasouri 137 ha of Eucalypts are also grown in various sites around the island, mainly near streamlines.

Regarding the private forests, the areas occupied by the main forest communities are as follows:

Table 2 Forest area occupied by the main forest communities in the private forests (Department of Forests Database)

Major Forest Communities	Area in hectares
<i>Pinus brutia</i> community	48.954
<i>Cupressus sempervirens</i>	218
Mixed <i>Quercus infectoria-Q. alnifolia</i>	1368
<i>Eucalyptus</i> community (Plantations)	260
Riparian community (<i>Platanus</i> and <i>Alnus</i>)	610
<i>Quercus infectoria</i>	77

3.2 Documentation of data sources as applied for estimating the forest reference level

3.2.1. Documentation of stratification of the managed forest land

Forest inventories are the tool for the rational design of forest management as well as monitoring the dynamic development of stands. As stated in paragraph 3.1 the managed forest land includes the *Pinus brutia* community of the major state forest land which covers an area of 88790 ha. The nearest National Forest Inventory to the Reference period (2000 – 2009) of the Forest Reference Level was conducted during 2011 – 2012. Inventory covered only the area of *Pinus brutia* state forests which were stratified in three different strata: a) Exploitable Forests, b) Non Exploitable Forests and c) Reforestations.

Regarding the broadleaved forests, the attempt to estimate the forest reference level was based on archive data due to lack of real inventory data.

3.2.2. Estimation of Forest Reference Level based on specific criteria

The forest structure is defined as characterized by an uneven-aged forest. Although there is a forested land area represented by an even-aged structure (coniferous reforestations). Stratification of the high forest ecosystems in Cyprus was based on three main criteria according to the available

data provided by the National Forest Inventory: a) Species composition, b) Function of the forest and c) Silvicultural practices. Further information about each stratum is given below:

- a) **Species composition:** The species composition criterion is mainly affected by the area covered by coniferous and broadleaved forests.
- i) **Broadleaved Forests:** As stated above in 3.1 Paragraph (Tables 1 and 2), the broadleaved forests consist of rare and sensitive ecosystems like *Quercus infectoria*, *Eucalyptus* community and Riparian communities. The *Eucalyptus* community is artificial community and it was not considered as managed forest land during the Reference period 2000 – 20009. The Riparian communities cover areas along river lines and consist of *Platanus*, *Alnus* and *Salix* species. The Riparian communities are protected habitats under the Habitat's Directive (Annex I) and are included in the Natura 2000 network for Cyprus by the codes 92CO, 92AO and 92COx92AO. The FRL for the broadleaved forests, covering an area of 3958 ha in total was calculated following the same methodology used for the NGHG Inventory which is based on expert judgement and past estimations on the net increment while the harvest ratio is based on data from the Annual Reports of the Department of Forests.
- ii) **Coniferous Forests:** The coniferous forests consist of pine, cypress and cedar forests and cover the majority of the managed forest land in Cyprus. The *Cedrus brevifolia* community is a protected habitat (9590*) included in the Natura 2000 Network. It covers a small area and is characterized as a nature reserve. The *Cupressus sempervirens* community consists mainly of communal forests scattered all over the island which are according to the Forest law they are to be enjoyed communally for the purpose of amenity and recreation by the inhabitants of each community. The remaining forest area is covered by pine forests consisted by pure stands of *Pinus brutia*, mixed stands of *Pinus brutia* and *Pinus nigra* and pure *Pinus nigra* stands. The *Pinus nigra* forest land is scattered at the higher range of elevation of Troodos Mountain, covering the area above 1400 m. there is a transitional zone where the mixed stands of *Pinus brutia* and *Pinus nigra* grow between 1300 -1700 m of altitude. Starting from sea level up to 1400 m of altitude lays the zone of *Pinus brutia*. The *Pinus brutia* forests cover the vast majority of the managed forest land of Cyprus which covers an area of 88790 ha. The data for the National Forest Inventory are derived from permanent plots which are scattered throughout the *Pinus brutia* forests. Consequently, the data available for estimating the forest reference level are those derived from the National Forest Inventory and cover an area of 81.575,42 ha of *Pinus brutia* community within the state forest area. An area of 6024 ha is covered by other coniferous species like *Cedrus*, *Cupressus* and *Juniperus*. For the estimation of the FRL the net increment as well as the harvest ratio and deadwood ratio derived from the National Forest Inventory of *Pinus brutia* were taken into account due to lack of actual inventory data of the other coniferous species. This was assumed by the fact that they belong in the coniferous family so the increment could not differ significantly. The FRL was estimated for an area of 143 768 ha in total consisted of coniferous forests around the island.

b) *Function of the forest: Exploitable, non-exploitable and reforestations*

Following the main stratification of species composition, the next level of stratification of the managed forest land in Cyprus, was based on the functions assigned to the forests. Cyprus' forests consist of (i) Exploitable forests and ii) Reforestations, where active management practices take place (i.e. particularly for wood production) and (iii) Non-exploitable forests, which are managed via "close to nature" silviculture, covering the forest areas characterized as nature reserves, national forest parks, multiple-use permanent forest reserves, and forests with other non-specified functions.

c) *Management Practices:*

Considering the functions of the forests of the previous strata, the MFL was further stratified in accordance of the silvicultural practices that take place at each stratum. At exploitable forests and reforestations targeted thinnings are applied following the principles of sustainable forest management providing wood harvested products. As for the stratum of non – exploitable forests a "close to nature" silviculture is applied which mainly aims to a sustainable conservation of the forest stands. The main management practice applied is a conservative single selection system.

3.2.3. Documentation of sustainable forest management practices as applied in the estimation of the forest reference level

The National Forest Inventory, the Forest Management Plans, the Natura 2000 Management Plans and the Annual Reports are the documents that describe in detail the common forest management practices while providing the data used to estimate the forest reference level.

3.3 Detailed description of the modeling framework as applied in the estimation of the forest reference level

The data provided from the National Forest Inventory were the inputs for calculating a ratio of harvest and deadwood to standing biomass in relation to different diameter classes. Statistical data of the National Forest Inventory held at 2001 and 2011 were processed for each stratum. For the purpose of modeling, the strata of exploitable forests and reforestations were considered one stratum due to the same forest managed practices that are applied. The non – exploitable forests consisted a different stratum.

The model was based on the increments for the different strata which were differentiated according to the evolution of maturity (diameter) classes in each stratum. The net increment and its feedback from management (changes in structure) were used to provide the gains of biomass. Fixed ratios of harvest and of the deadwood to standing biomass were applied to the diameter classes and that led to the calculation of the net gains. Afterwards the gains were calibrated to the Greenhouse Gas Inventory (GHGI) and were used to project the FRL.

4. Forest reference level

4.1 Forest reference level and detailed description of the development of the carbon pools

The forest area was first determined utilizing the previous detailed mapping that was conducted by the Department of Forests as follows (Table 3):

Table 3. State and Private Forest and Shrublands by species classification

Main Forestry Species	Year of mapping	State Forests	Haliland Forests	Private Forests	Total
		Area (Hectares)			
Pinus brutia community	1997	88790		48954	137744
Pinus nigra community	1997	2640			2640
Mixed brutia – nigra community	1997	2330			2330
Mixed <i>Olea europaea - ceratonia siliqua</i>	1997			5720	5720
<i>Eucalyptus</i> community (Plantations)	1997	137		260	397
Mixed <i>Pinus brutia – Quercus alnifolia</i>	1997	5870			5870
<i>Cedrus brevifolia</i> community	2012	102,4			102,4
Mixed <i>Cedrus brevifolia – Pinus brutia</i> community	2012	167,3			167,3
<i>Cedrus brevifolia</i> community plantations	2012	118,6			118,6
<i>Cupressus sempervirens</i> community	2012	5,5656	217,7966		223,3622
Mixed <i>Cupressus sempervirens - Pinus brutia</i> community	2012	177,0756	14,1339		191,2095
Mixed <i>Cupressus sempervirens - Quercus alnifolia</i> community	2012	2,0578	4,9657		7,0235
Mixed <i>Cupressus sempervirens - Juniperus phoeniceae</i>	2012	3,4992	3,5144		7,0136
Mixed <i>Cupressus sempervirens - Platanus orientalis</i>	2012		5,8248		5,8248
Mixed <i>Cupressus sempervirens - Olea europaea - ceratonia siliqua</i>	2012		0,6414		0,6414
Mixed <i>Juniperus oxycedrus - Pinus brutia</i>	2012	1			1
Mixed <i>Quercus alnifolia - Juniperus foetidissima</i>	2013	18,7			18,7
<i>Juniperus foetidissima</i> community	2013	210,8			210,8
Mixed stands <i>Juniperus (J. foetidissima) - Pinus nigra</i>	2013	30,7			30,7
Shrublands of <i>Juniperus excelsa</i>	2013	0,3569	25,1804		25,5373
Mixed shrublands <i>Quercus alnifolia - Juniperus excelsa</i>	2013		1,5098		1,5098
Shrublands of <i>Juniperus foetidissima</i>	2013	5,3			5,3
Mixed shrublands of <i>Juniperus oxycedrus - Pinus brutia</i>	2013	2,1			2,1
Shrublands <i>Juniperus phoenicea</i>	2013	4354,307	506,0657		4860,373
Mixed scrublands of <i>Juniperus phoenicea - Φρύγανα ή Λειμώνες</i>	2013	754,364	750,2289		1504,593
Mixed scrublands of <i>Juniperus phoenicea - Pinus brutia</i>	2013	0,0692	10,5915		10,6607
Mixed shrublands of <i>Juniperus phoenicea - Olea europaea - ceratonia siliqua</i>	2013		213,6507		213,6507
<i>Quercus infectoria</i> community	2013	0,0798	77,4298		77,5096
Mixed <i>Quercus infectoria - Quercus alnifolia</i>	2013		1368,1701		1368,17
Riparian community (<i>Platanus</i> and <i>Alnus</i>)	2013	1459,6329	610,0713		2069,704
<i>Salix alba</i> community	2013		44,5314		44,5314
		107180,908	3854,3064	54934	165969,2

From this, the area of conifers and broadleaves was determined and kept constant for the calculations. The total area for the reference period was 147.726,3 ha as follows:

	Area for FRL (ha)
Coniferous	143767,9
Broadleaves	3958,4
Total	147726,3

The average increment per hectare per year for the conifers was determined from calculation derived from inventories taken in 2001 and 2011 for Pinus brutia plots in the state forest and was found to be 0,903 m³/ha/year. Even though, there is some data available for the diameter classes of the trees, the increment per diameter class was not determined at this stage. Harvesting was assumed to be constant.

Emissions were calculated for conifers as follows:

<u>Coniferous Forest</u>	
$\Delta CG = A * Gw * (1+R) * CF$	
A - Coniferous Forest land (ha)	143767,875
lv/A	129768,795
Gw=lv*BCEFI	
lv= m ³ /ha/yr	0,903
BCEFI= t dm/m ³	0,450
Gw (tdm/ha/y)	0,406
R	0,280
CF (tC) * wood	0,470
$\Delta CBiomass$ (tC/yr)	35.131,008
Emissions (ktCO ₂)	-128,814

For broadleaves the default value used in the NIR was used as well as the average harvest volume for the reference period used in the calculations for the NIR.

Emissions for broadleaves were calculated as follows:

<u>Broadleaved Forest</u>	
$\Delta CG = A * Gw * (1+R) * CF$	
B - Broadleaved Forest land (ha)	3958,4
lv/A	
Gw=lv*BCEFI	
lv= m ³ /ha/yr	2,000
BCEFI= t dm/m ³	0,550
Gw (tdm/ha/y)	1,100
R	0,280

Broadleaved Forest	
CF (tC)* wood	0,470
Δ CG (tC/yr)	2.619,511
H (m3/yr)*{average 2001-2011}	1.116,964
BCEFR (t biomass/m3 wood volume)	0,890
R	0,280
CF (tC/t biomass) wood	0,470
Δ CL(wood-removals) (tC/yr)	598,049
Δ CBiomass (tC/yr)= Δ CG- Δ CL	2.021,461
Emissions (ktCO ₂)	-7,412

Since a constant harvesting rate and a constant increment was applied, removals for the period 2011-2025 from living biomass were constant as follows:

	Year	Conifers	Broadleaves	Estimated total removals from living biomass in ktCO₂
1	2011	-128,8	-7,4	-136,2
2	2012	-128,8	-7,4	-136,2
3	2013	-128,8	-7,4	-136,2
4	2014	-128,8	-7,4	-136,2
5	2015	-128,8	-7,4	-136,2
6	2016	-128,8	-7,4	-136,2
7	2017	-128,8	-7,4	-136,2
8	2018	-128,8	-7,4	-136,2
9	2019	-128,8	-7,4	-136,2
10	2020	-128,8	-7,4	-136,2
11	2021	-128,8	-7,4	-136,2
12	2022	-128,8	-7,4	-136,2
13	2023	-128,8	-7,4	-136,2
14	2024	-128,8	-7,4	-136,2
15	2025	-128,8	-7,4	-136,2

The Harvested Wood Products were calculated as in the NIR using the average values for the period 2001-2011 and extrapolated to 2025.

The results were as follows:

	Gg CO ₂ /yr	Gg CO ₂ /yr	Gg CO ₂ /yr	Gg CO ₂ /yr	Gg CO ₂ /yr	Gg CO ₂ /yr
Inventory Year	Stock Change	Atmospheric Flow	Production	Annual harvest	Annual CO ₂ release	Total Contribution
1990	-143	74	-6,56	-67	60	-7
1991	-127	82	1,39	-57	59	1
1992	-186	90	5,10	-48	53	5
1993	-155	84	-9,58	-57	47	-10
1994	-165	86	-4,86	-50	45	-5
1995	-186	88	-4,10	-51	47	-4
1996	-125	88	-7,12	-48	41	-7
1997	-155	103	4,24	-44	48	4
1998	-137	103	-2,38	-38	35	-2
1999	-132	103	-5,50	-39	33	-5
2000	-138	127	12,98	-22	35	13
2001	-173	136	22,07	-20	42	22
2002	-204	165	24,06	-16	41	24
2003	-271	118	25,41	-13	38	25
2004	-227	124	25,58	-11	36	26
2005	-277	135	25,95	-10	36	26
2006	-276	147	25,58	-8	34	26
2007	-258	149	18,59	-21	40	19
2008	-225	148	16,72	-21	38	17
2009	-106	150	23,98	-11	35	24
2010	-151	111	24,70	-10	34	25
2011	-114	120	24,60	-9	34	25
2012	-180	164	20,04	-14	34	20
2013	-185	162	19,93	-13	33	20
2014	-186	159	19,63	-13	32	20
2015	-181	160	19,17	-13	32	19
2016	-179	162	18,78	-13	32	19
2017	-171	163	18,18	-13	31	18
2018	-162	164	17,55	-14	31	18
2019	-155	164	17,51	-13	30	18
2020	-149	165	17,62	-12	30	18
2021	-153	166	17,09	-12	29	17
2022	-154	170	16,43	-13	29	16
2023	-158	175	15,73	-13	29	16
2024	-156	175	15,38	-13	28	15
2025	-154	176	15,02	-13	28	15

4.1 Consistency between the forest reference level and the latest national inventory report

Comparison of FRL and NIR

Forest Area

	Area used for calculations for FRL (ha)	Average Area for 2001-2011 from NIR (ha)
Coniferous	143767,9	157423,0
Broadleaves	3958,4	642,9
Total	147726,3	158065,9

Emissions calculated for NIR2019 and FRL (2011-2017)

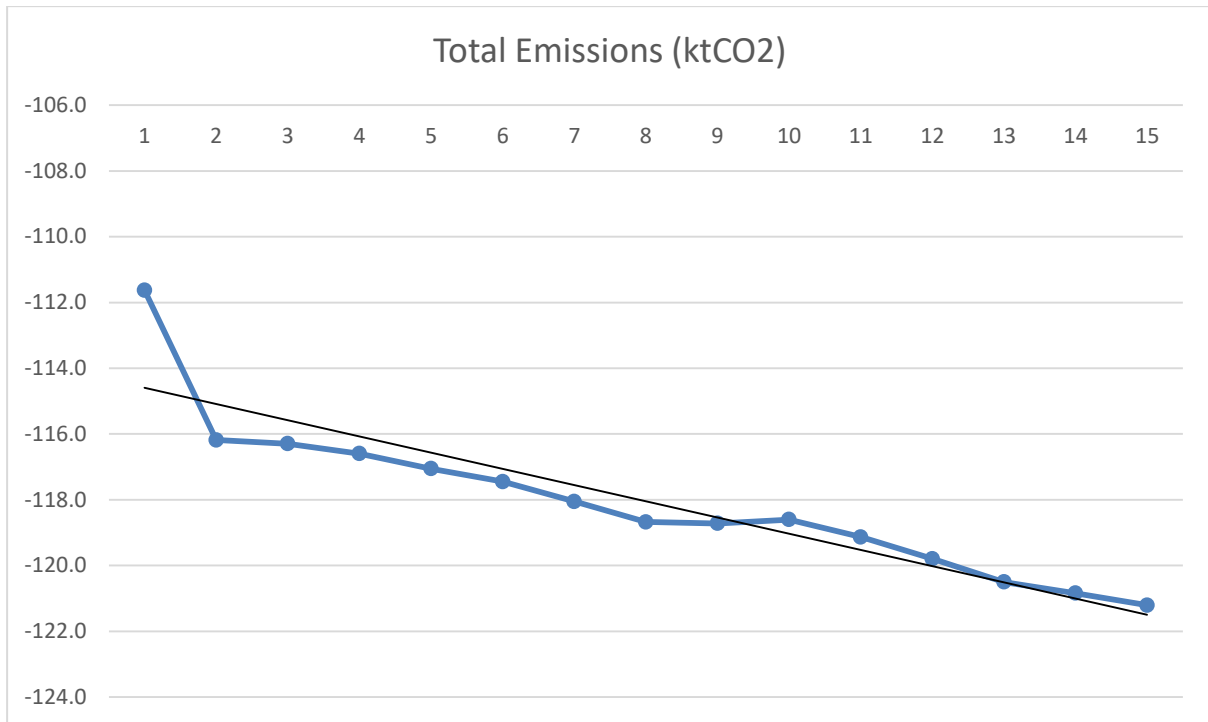
	NIR2019			FRL		
	F -> F	HWP	Total	Living biomass	HWP	Total
2011	-130,4	24,6	-105,8	-136,2	24,6	-111,6
2012	-123,5	23,7	-99,7	-136,2	20	-116,2
2013	-140,1	24,0	-116,1	-136,2	19,9	-116,3
2014	-141,5	23,2	-118,2	-136,2	19,6	-116,6
2015	-140,7	23,3	-117,4	-136,2	19,2	-117,1
2016	116,6	23,6	140,2	-136,2	18,8	-117,5
2017	-130,1	23,6	-106,4	-136,2	18,2	-118,1

Except for year 2016 the rest of the removals/ emissions are quite comparable. In 2016 due to forest fires Cyprus reported net emissions from Forest Land.

4.2 Calculated carbon pools and greenhouse gases for the forest reference level

The final emissions were calculated by adding emissions from the production method for Harvested Wood Products to the estimated emissions from living biomass (+ signs=emissions, - signs=removals). The final results are shown below:

	Year	Estimated total removals from living biomass in ktCO ₂	HWP	Total Emissions (ktCO ₂)
1	2011	-136,2	24,6	-111,6
2	2012	-136,2	20,0	-116,2
3	2013	-136,2	19,9	-116,3
4	2014	-136,2	19,6	-116,6
5	2015	-136,2	19,2	-117,1
6	2016	-136,2	18,8	-117,5
7	2017	-136,2	18,2	-118,1
8	2018	-136,2	17,6	-118,7
9	2019	-136,2	17,5	-118,7
10	2020	-136,2	17,6	-118,6
11	2021	-136,2	17,1	-119,1
12	2022	-136,2	16,4	-119,8
13	2023	-136,2	15,7	-120,5
14	2024	-136,2	15,4	-120,8
15	2025	-136,2	15,0	-121,2



Overall, removals show an increasing trend due to decreasing emissions from the Harvested Wood Products pool.

5. References

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