Chapter 7
Cyprus

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7.1 Development of Forest Inventories in Cyprus

Cyprus has a long forestry tradition dating back to 1873 when M. De Montrichard prepared a report on the forest resources of the island. In 1878, another French forester prepared reports on the state of the forests and made recommendations for their future management (Polycarpou 1959). However, no National Forest Inventory (NFI) was carried out in Cyprus, although many operational inventories were designed and performed at the local level (Cyprus Forest Department 1994, 2003).

In 1897, the first inventory was designed and carried out based on sample plots which were established in various areas of the forests (Polycarpou 1959). The main objectives of the first inventory were to estimate the volume of growing stock, volume increment and diameter and height growth through stem analysis.

The second forest inventory was performed during 1922–1924. Randomly located sample plots at a sampling proportion of 5% by area were introduced (Peonides 1978). The main purposes of this inventory were to estimate timber volume, volume increment and allowable cut.

In 1936, the Department of Forests carried out an inventory of State Forests using systematic sampling (Peonides 1978).

In 1953, a new inventory method for State Forests featuring 2.7 ha, randomly located, permanent circular sample plots was introduced. The plots were measured every 10 years. The main purpose of this inventory was to provide forest planners the necessary quantitative and qualitative information for management planning.

In 1980, a great effort was made to modify the entire forest inventory and forest management regime. A new "Continuous Forest Inventory" method based on sampling was introduced. This inventory system was used for the Calabrian pine (*Pinus brutia*) dominated forest areas of the productive main State Forests with an area of 43,200 ha (Cyprus Forest Department 1994). The total forest area is 172,800

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ha. Aerial photographs were used to classify the State Forests stocked with Calabrian pine into productive and non-productive classes and artificial regeneration area.

For management purposes, the productive pine forests, dominated by Calabrian pine, were grouped into two Management Units: Management Unit I covers 16,200 ha, and Management Unit II covers 27,020 ha.

Until the present, the productive area was inventoried three times using randomly selected circular units of 0.2 ha: 1981–1982, 1991–1992 and 2001–2002. The Management Units were considered as two entirely separate units for sampling purposes.

The foremost aims of the two inventories of the exploitable area in 1981–1982 and 1991–1992 were:

- To provide estimates of timber volume and other relevant statistics used in forest management planning
- To provide data for calculation of annual allowable cut
- To monitor forest changes and trends

Field work for the forest inventory (2001–2002) was augmented by collecting information on the ecology and environment of the productive areas as a means of monitoring ecosystem changes and trends (Cyprus Forest Department 2003).

In 1996, a forest inventory was conducted for Tripylos Nature Reserve in which the protected endemic species Cyprus cedar (*Cedrus brevifolia*) is distributed. The protected area covers 823 ha. Stratified random sampling was applied with circular permanent sample plots of 0.1 ha. The main purposes of this inventory were to estimate the present state of Cyprus cedar and to establish a grid of permanent sample plots for monitoring ecosystem changes and trends (Cyprus Forest Department 2000).

In 2005, a forest inventory for non-productive areas was carried out to collect information for all State Forests. The method was the same as that used for the inventory of productive forests so that the two sets of results would be statistically compatible. The non-productive areas were grouped into Management Units as the productive areas: Management Unit I covers 6,403 ha, and Management Unit II covers 16,512 ha.

The Department of Forests has exclusive responsibility for forest inventories including planning the design, methods, field measurements, calculating estimates, and publications.

7.2 The Use and the Users of the Results

7.2.1 General Use

The main objective of forest inventories in Cyprus is to obtain qualitative and quantitative information about the forest resources and their physical environment for a specified time. Their main goal is to report the status of the forests with respect

to volume and volume distribution by diameter classes, volume increment, number of stems, regeneration, and expected changes and trends. Because of increasing multiple uses of forest resources in recent years, the inventory aims have been expanded to include collection of information that can be used to evaluate the potential of the forests for wildlife habitat and other uses.

The forest inventory provides information for national and international reporting to bodies such as the Food and Agriculture Organization of the United Nations (FAO) and its Forest Resources Assessment and the Ministerial Conference on the Protection of Forests in Europe (MCPFE).

7.2.2 The Use of NFI Data in UNFCCC Including Kyoto Reporting

For the last 5 years, information gathered by the various forest inventories has been used either directly or indirectly to estimate carbon pools. In future forest inventories, the field work will be augmented with the variables necessary to estimate parameters related to LULUCF under the United Nations Framework Convention on Climate Change (UNFCCC).

7.2.3 The Role of Forest Inventories in Assessing the Status of Biodiversity

Many forest variables assessed by the forest inventories are related indirectly to biodiversity such as diameter distribution, height distribution, age distribution and volume distribution as well as numbers of trees and regeneration. In addition, since 1995 information for the following variables were collected in order to broaden the forest biodiversity assessment:

1. All shrubs found in a circle with a radius of 10 m from the centre of the sample plot are recorded and the percentage of the shrub cover of each shrub species is estimated.
2. The crown cover of the main stand is estimated and recorded in one of the following classes: 0–30%, 31–60% and 61–100%.
3. Stand type is recorded and classified into one of two classes: pure or mixed. In mixed stands, neither the coniferous nor the broadleaved component accounts for more than 75% of tree crown cover.
4. The stand origin is recorded as artificial or natural regeneration.
5. Stand structure is recorded as even-aged, uneven-aged, or all-aged.
6. The degree of erosion is described and classified into one of the following classes: none, negligible, medium or intensive.
7. Trees with resin signs are recorded.
8. All information regarding fauna and historical monuments are recorded.

7.3 Current Estimates

The basic forest resources estimates are given in Tables 7.1a and b. The forest area estimate can be given on the basis of the reference definition of COST Action E43 (Table 7.2).

7.4 Sampling Design

For management purposes, State Forests are divided into two main categories: productive and non-productive forests. Also, each category is divided into two

Table 7.1a Basic area estimates

Quantity	Estimate (1,000 ha)	Percent	Description
Forest land	172.8	18.7	Spanning more than 0.5 ha with trees higher than 5 m and a crown cover of more than 10%, or trees able to reach these thresholds in situ. Land predominantly under agricultural or urban use not included.
– State	107.0	11.6	
– Private	54.0	5.8	
– Hali land	11.8	1.3	Scattered land throughout the island, not regularly exploited for the last 300 years. Never been claimed by anyone due to heavy property and farming taxes imposed by the Ottoman administration. Later on, declared as common lands and ownership passed to state. Some have been naturally forested. Periodically, part of these areas are declared as state forests.
Other wooded land	213.8	23.1	Not classified as forest, spanning more than 0.5 ha with trees higher than 5 m and a crown cover of 5–10%, or trees able to reach these thresholds in situ or with a combined cover of shrubs, bushes and trees above 10%. Land predominantly under agricultural or urban use not included.
– State	50.7	5.5	
– Private	144.3	15.6	
– Hali land	18.8	2.0	
Other land	538.5	58.2	All land that is not classified as forest or other wooded land.
State forest land	107.0	11.6	
– Productive state forests	43.2	4.7	All forested areas with Calabrian pine of the Permanent Forest Reserve and of the National Forest Park which can be cultivated by machinery. Includes all stands with tree crown cover above 10% and area of more than 1 ha.
– Non-productive state forests	22.9	2.5	
– Other state forest areas	40.9	4.4	
Total land area	925.1	100	

Table 7.1b Basic volume estimates

Quantity	Estimate (million cubic metre)
Growing stock in productive forests (2001–2002)	
– Management Unit I	0.95
– Management Unit II	2.13
Growing stock in non-productive forests (2005)	
– Management Unit I	0.28
– Management Unit II	0.57
Annual increment of growing stock in productive forests	
– Management Unit I	0.01
– Management Unit II	0.03
Annual increment of growing stock in non-productive forests	
– Management Unit I	0.003
– Management Unit II	0.02

Table 7.2 The availability of estimates based on national definitions (ND) and reference definitons (RD)

Estimate	ND	RD	Responsible	Remark
Forest area	Yes	Yes	Department of Forests	ND = RF
Growing stock volume	Yes	No	Department of Forests	
Above-ground biomass	No	No	Department of Forests	
Below-ground biomass	No	No	Department of Forests	
Deadwood volume	Yes	No	Department of Forests	
Deadwood volume by decay stage classes	No	No	Department of Forests	
Afforestation	No	No	Department of Forests	
Deforestation				
Reforestation				
(Kyoto 3.3)				
Forest type	No	No	Department of Forests	

Additional definitions are:
Permanent Forest Reserve: an area designated for wood production.
National Forest Park: area designated for the provision of special services, mainly recreation.

Table 7.3 Sampling information of the Cyprus forest inventory

Stratum	Management Unit	Year	Number of plots	Sampling intensity (%)
Productive forest	I	1981–1982	600	0.7
		1991–1992	750	0.9
		2001–2002	750	0.9
	II	1981–1982	700	0.5
		1991–1992	900	0.7
		2001–2002	900	0.7
Non-productive forest	I	2005	110	0.3
	II	2005	210	0.2

Management Units, and these units are considered as two entirely separate units for sampling purposes.

Since 1980, the Department of Forests has adopted simple random sampling without replacement. The number of plots for each Management Unit was

computed based on the intended relative standard error of the number of stems, ±5% for productive areas and ±10% for non-productive areas. The number of plots and sampling intensity (100 × area of the plots/forest area) in each forest inventory are shown in Table 7.3.

References

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