National Forest Inventory Reports

Chapter 15
Greece

Ioannis Meliadis, Theocharis Zagkas, and Thekla Tsitsoni

15.1 Development of the Greek National Forest Inventory

Greece, a typical Mediterranean country, is located on the eastern edge of Europe. Greece occupies 128,900 km^2 (excluding water) and is a predominantly mountainous country with an elevation range from sea level to 3,000 m. In this area three floristic units are joined, the Mediterranean, the middle-European and the Iranokaspic.

An inventory was conducted in 1836, although it was not based on scientific or statistical planning. The results were published in 1842 by the consul of Bavaria and Hannover. The area of the entire country at that time was only one third of the total area today (Kontos 1921). Kontos (1929) published the results of a second inventory but did not provide any information about the methods used.

The First National Forest Inventory (NFI) in Greece was initiated in 1963 and covered 11,377,000 ha or 86.2% of the entire country (National Inventory of Greece 1992). Areas not covered were primarily agricultural lands which amounted to 1,819,000 ha or 13.8% of the country area. This inventory was conducted as a joint project between the Hellenic Forest Service and the Food and Agriculture Organization of the United Nations (FAO). However, this forest inventory was conducted in ten inventory regions of unequal sizes (Fig. 15.1).

The inventory regions of the 1963 Greek NFI were:

1. Central Greece (or "Work 81")
2. Mornos
3. Evinos
4. Peloponnisos
5. Western Greece
6. Eastern Macedonia, Thraki

I. Meliadis
National Agricultural Research Foundation, Forest Research Institute, Greece
T. Zagkas and T. Tsitsoni
Aristotle University of Thessaloniki, Department of Forestry and Natural Environment

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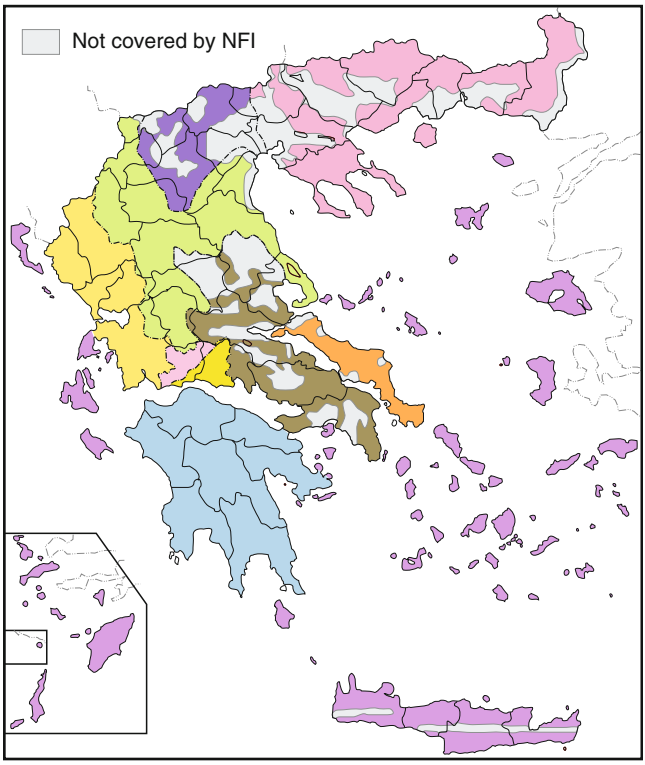

Fig. 15.1 The inventory regions and the areas not covered for the NFI

7. Western Macedonia
8. Eastern Central Greece
9. Euboea
10. Aegean, Ionian islands, Crete

The first region was inventoried in 1965, and the inventory subsequently expanded to the other regions. In 1985, the first phase of the inventory, consisting of interpretation of aerial photographs and the field measurements, was completed. In 1991, the entire NFI was completed, and the results were reported in a handbook titled, "Results of the First National Forest Inventory" (in Greek) (Table 15.1). The results of this inventory indicated that the area occupied by forests was approximately 19% of the country (Table 15.2) with approximately half of the country covered by forest and other wooded land. A characteristic feature of these forests is uneven-aged stands with trees belonging to all diameter classes.

The forest regions, or eco-regions according to the inventory, are shown in Fig. 15.2. Most forest land belongs to the state (Table 15.3), contrary to the situation today in most other European Union countries. The forest tree species composition is 38.4% conifers (mainly fir and pines) with the rest, 61.6%, broadleaved (mainly oak, beech and maquis). Coppice comprises 48% of the forests, 34.7% are high forests and

Table 15.1 A brief summary for the Greek NFI

Inventory	Year of publication	Citation	Language	Dissemination
First National Forest Inventory	1991	Ministry of Agriculture General Secretariat of Forests and Natural Environment (1992)	Greek	Printed

Table 15.2 Division of land by land use

Category	Acreage (1,000 ha)	Percent
Forest land	2,512	19.0
Partially forest land	3,242	24.6
Phryganic land	277	2.1
Alpine areas	440	3.3
Grasslands	1,756	13.3
Water (ponds, swamp)	273	2.1
Barren land	734	5.6
Agricultural land	3,964	30.0
Total	13,198	100.0

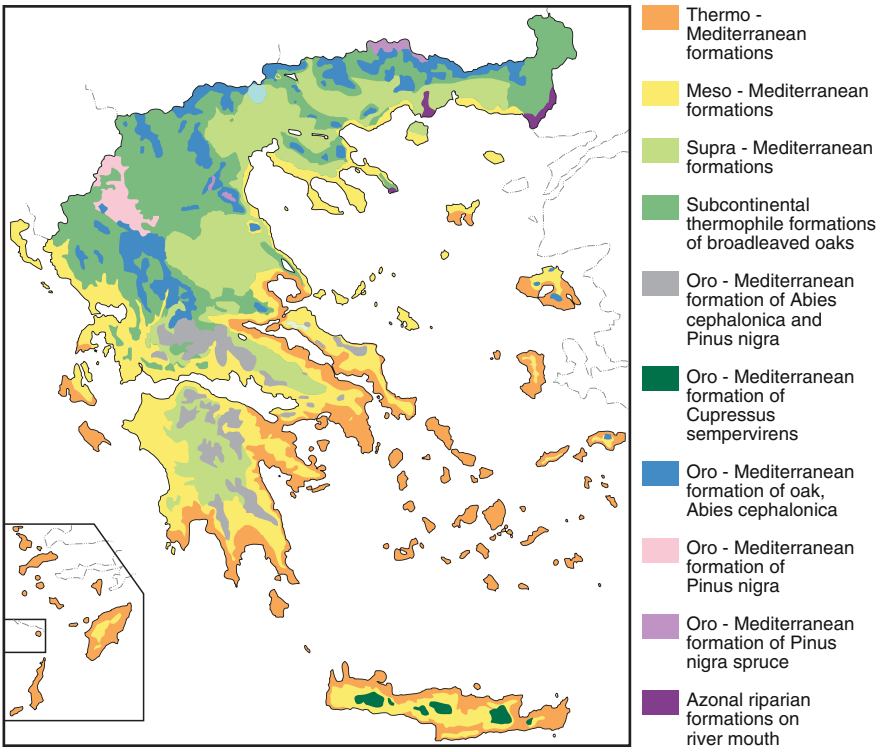

Fig. 15.2 Vegetation map of the forest regions in Greece

Table 15.3 Distribution of forests by ownership category

Ownership	Acreage (1,000 ha)	Percent
State	1,644	65.5
Community	302	12.0
Monastery	110	4.4
Charity institution	11	0.4
Co-operative	246	9.7
Private	200	8.0
Total	2,513	100.0

17.3% are composite. Annual production exceeds 4.0 million cubic metre of wood volume (1.85 m^3/ha per year) of which only a part, 2.7 million cubic metre, is cut. Total standing volume is approximately 158 million cubic metre. Two additional factors characterize Greek ecosystems. First, the ecosystems are heterogeneous, unstable, and vulnerable, as it is commonly the case in Mediterranean countries. Second, an authorized land registry is lacking.

15.2 General Use of the Results

The purpose of the NFI was to improve Greece's forests and soil resources. For each inventory region, data that were collected and recorded included:

1. Soil morphology and watershed network
2. Rocks – soil data
3. Climatic data
4. Vegetation data
5. Land use of the non-forested areas
6. Distribution of forests

The users of the results are the Hellenic Forest Service and the Hellenic Statistical Service. The usefulness of the results is uncertain because of the large gap between the time of assessment and the publications. Thus, the report can be used only as a general indication of forest conditions in Greece.

15.3 Current Estimates

The basic area and volume estimates are given in Tables 15.4a and b.

If we added to the forest growing stock, the volume of other wooded land of about 2.8 million cubic metre as well as the volume of about 2.7 million cubic metre of dead wood, the standing volume would be approximately 158 million cubic metre. The growing stock of Greek forests of approximately 45.2 m^3/ha is relatively low compared to the main growing stock of other European countries. However, there are many forest complexes that are well-organized, that have been managed for a long time, and that support stands with mean growing stock volume ranging from 350

Table 15.4a Basic area estimates based on the NFI

Quantity	Estimate (1,000 ha)	Share %	Description	SE[a] (1,000 ha)
Forest land	2,512	19	1. Ten percent crown cover with minimum height of trees of 5 m at maturity (in situ); areas of approximately 0.5 ha or strips with widths of 30 m (with tree canopy cover of 10%); areas not used for any purpose other than production of wood 2. Areas from which the trees were harvested 3. Reforestated areas 4. Maquis	
Other wooded land	3,960	30	Land which has some forest characteristics but is not forest as defined above. It includes open woodland and shrub, shrub and brushland, whether or not used for pasture or range	
Other land uses	6,724	51.0	All other lands	
Total land area	12,890	100		–[b]
Area covered by NFI				
1. Forests				
1.1. Industrial forests	3,360	25.4		
1.2 Non-industrial forests	3,154	23.9		
2. Other lands	4,863	36.9		
3. Out of the Inventory	1,819	13.8		
According to the management type				
High forest	872	34.7		
Coppice forest	1,206	48.0		
Coppice forest with standards	434	17.3		

[a]Standard error.

[b]Assumed to be error free.

NFI coverage categories:

Industrial forests: areas characterized by high trees and produced merchantable wood. Another definition is the next one: areas which are capable to produce 1 m3 of wood per hectare every year. *Non-industrial forests*: areas with multibrushed dwarf trees and bushes, which for the time being cannot produce merchantable wood products but they have value for grazing and for protection. *Non-forest lands*: areas not classified as forest lands. *Range lands*: non-forest land used for grazing. *Crop lands*: non-forest lands which are used for crops. *Bare lands*: non-forest lands without any vegetation in more than 50%. *Urban, residential and industrial lands*: non-forest lands which are used for industry, residential areas, etc. *Water*: rivers, lakes, swamps.

NFI tree species:

Fir, Aleppo pine, Calabrian pine, Black pine, Scots pine, Spruce, Chestnut, Oak, Plane

Table 15.4b Basic volume estimates based on the NFI

Quantity	Estimate (million cubic metre)	Description
Volume of industrial forests	152	
Merchantable volume	138	Net volume of trees with $dbh \geq 5$ cm, between the stump height and the point where the stem top is 5 cm or the point where there is distortion.
Saw timber volume	139	Net volume of trees with $dbh \geq 30$ cm, between the stump height and the point where the top is 20 cm or the point where there is a distortion.
Stem top volume	14	Net volume of trees with $dbh \geq 5$ cm between the top of the merchantable wood and the upper edge of the tree.
Desirable trees	60	Trees with merchantable value; trees that adapt well to a forest environment; trees that have no distortion or other damages, good shape and health.
Acceptable trees	59	Trees with merchantable value; trees that adapt well to a forest environment; trees whose merchantable wood has not been distorted more than 50%, and have quite good shape and health.
Poor trees	21	Trees with less merchantable value; trees that do not adapt well to a forest environment; trees whose merchantable wood has been distorted more than 50%.
Rejected trees	12	Trees with no merchantable value.
Regeneration		Tree with $dbh < 5$ cm.
Net annual growth	3.8	The difference between gross annual growth and mean annual mortality.
Annual mortality	0.3	The annual loss of volume due to natural causes.
Annual increment of growing stock of trees per hectare on forest land	4.11	

Table 15.5 Growing stock increment for the main forest species

	Annual net increment over bark volume (1,000 m^3)	Percentage increment of growing stock (%)	Annual net increment/ha (m^3/ha)
Coniferous			
Fir	798	1.68	1.47
Spruce	29	3.08	10.35
Pine	1,090	3.10	1.24
Broadleaved			
Beech	931	3.06	2.77
Oak	695	2.62	0.47

to 400 m^3/ha. The main growing stock of the total forests has decreased significantly, because a high percentage of forests are coppice or have been over-thinned due mainly to human actions. Increment estimates are reported in Tables 15.5 and 15.6.

Table 15.6 Growing stock increment on forests

	Annual net increment overbark volume (1,000 m^3)	Percentage increment of growing stock (%)	Annual net increment/ ha (m^3/ha)
Coniferous	1,918	2.26	1.34
Broadleaved	1,895	2.84	0.98
Total	3,813	2.51	1.14

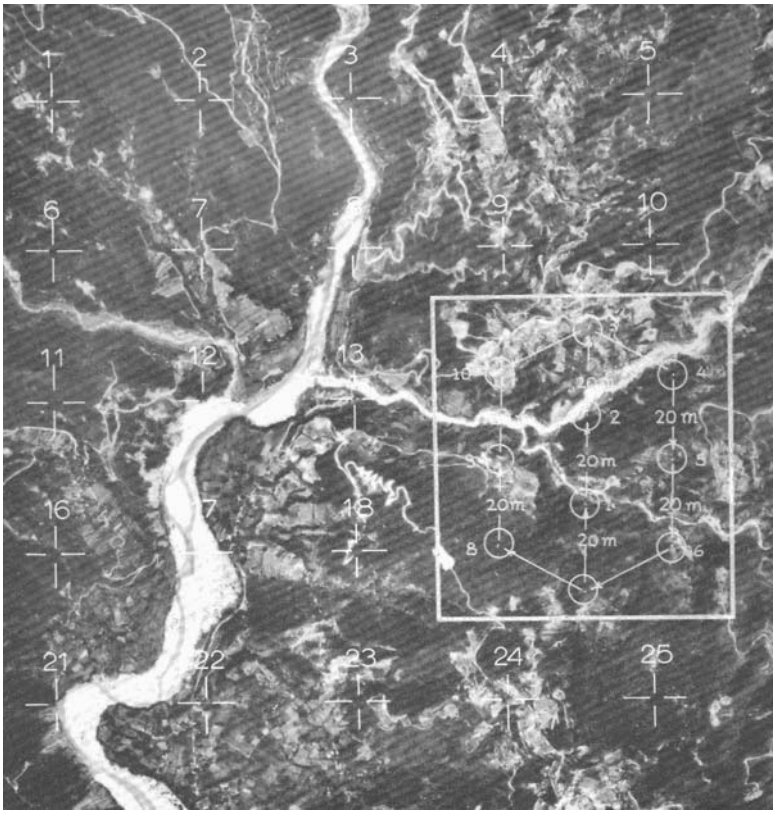

Fig. 15.3 Aerial photograph with 25 photo plots and an example of a field plot

15.4 Sampling Design

The source data for the inventory was panchromatic black and white aerial photographs at scales of 1:30,000 (mainly), 1:20,000 and 1:42,000 from different years. In each aerial photograph, 25 photo-plots were selected (Fig. 15.3), measured and classified according to their land use, forest types, closure density, tree height, slope, and degree of erosion. The field plots were located using the azimuth and the distance from characteristic points on the aerial photographs that were easy to

recognize. Photo interpretation of 95,220 photo-plots was used as the basis for the stratification into non-forest, forest without volume, and forest with volume strata. A random process was used to select 2,744 field plots from among the photo-plots. In each region the ratio of field plots to photo-plots in each stratum was as follows: 1:35 for the non-forest stratum, 1:50 for the forest without volume stratum, and 1:15 for the forest with volume stratum. The interpretation of a random sample of photo-plots was verified in the field. For each field plot, ten trees were measured using a systematic orientation scheme (Fig. 15.3): point No. 1 was 10 m south of the centre of the field plot, and the remaining nine points were determined according to the first point. These ten sample points were separated by a distance of 20 m and covered an area of 0.5 ha (Fig. 15.4). Trees were selected on each sample point using a metric angle corresponding to 10 m^2/ha. For each tree, the measured variables were basal area, diameter at breast height, total height, merchantable height, non-merchantable height, Pressler's height, radial increment and bark

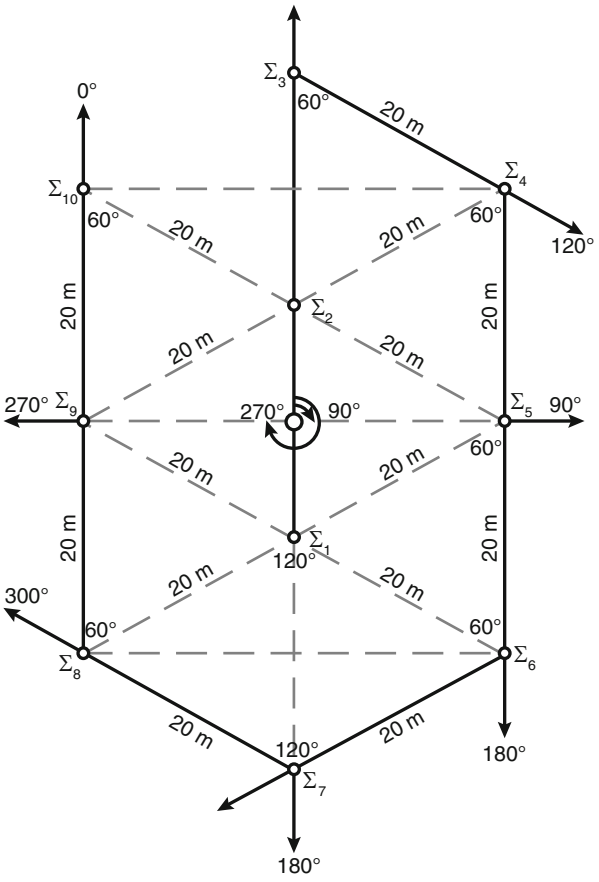

Fig. 15.4 The locations of ten sample points in NFI

thickness. Also, the tree species was identified, and the tree quality, degree of damage, and percentage of the healthy merchantable volume were estimated.

15.5 Estimation Techniques

15.5.1 Area Estimation

Areas were estimated by counting dots from a network of dots on 1:50,000 maps:

$$Area\,(ha) = A_i = A \sum \frac{M_i}{M} \tag{15.1}$$

where M_i is the number of photo-plots in the survey area by stratum (A_i), M is the number of photo-plots in the survey area and A the total land area.

15.5.2 Volume Estimation

Volumes were estimated using the general volume formula,

$$V = \sum \frac{U\,\pi\,(0.5\,dbh)^2\,H\,F\,A}{\pi R^2 N} \tag{15.2}$$

where U is the area of the land unit (m^2), π = 3.14, dbh is the diameter at breast height (m), H is the tree height (m), F is the form factor for the tree, R is the maximum distance from the point to the tree (m), and N is total number of field plots in the area surveyed. Based on the general formula, the following were estimated: net volume per hectare including limbs, net volume per hectare for the main stem inside bark, net volume per hectare for merchantable stem and net volume per hectare for saw timber volume.

15.5.3 Increment

Growth was estimated using the general growth formula,

$$G = \sum (H\,F\,A/N)\,P_V \tag{15.3}$$

where G is volume of annual growth for the survey area (m^3), and P_v is the annual growth.

15.5.4 Error Estimation

The following errors are estimated for the calculations of forest area, industrial forests and growth:

- Total forest area: ±0.2%
- Merchantable volume of industrial forests: ±2.6%
- Growth of industrial forests: ±3.1%

15.6 Current and Future Prospects

No new NFI is being planned and no NFI work is underway in Greece, because the people and the whole Service that conducted the existing inventory were recently transferred to another department.

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