Chapter 36
The Republic of Macedonia

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36.1 Forest Inventory in the Republic of Macedonia

36.1.1 History and Objectives

Following the chain of past historical, economic and political events that occurred within the region, a truly organised and functional forest management planning system and forest inventory was initiated in the Republic of Macedonia after the Second World War. Prior to 1941, 18 forest management plans were completed covering an area of 86,020 ha (Grujoski 1959) which was about 14 % of the total forest area. In 1946, the government of the Socialist Federal Republic of Yugoslavia adopted the Provisional Manual for Forest Inventory. The main goal was to establish as fast as possible the status of forest resources that remained following uncontrolled exploitation during the war (Meshtrović 1978), and to create a structure for future forest management (Klepac 1947). Those instructions, contained in the Provisional Manual, prescribe the use of a standardised forest inventory in all states of the federation, completed for forest management units, forest management district and forest management provinces. The result was an extensive inventory of all forest resources within the federation. Although the aim was for the inventory to begin quickly, the task was performed with some delay and it took two years to complete (1949/50) mainly due to the lack of skilled and trained

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professionals. In 1946, in the Republic of Macedonia there were only 14 forest engineers (Tasic 1959). The results from this inventory were reported in the Statistical Yearbook (SYb) in 1954 (State Statistical Office 1954). Since this 1949/50 inventory, only two assessments of forest resources have been completed, one in 1961 and one in 1979. The results from these inventories were published in the SYb in 1964 and 1982, respectively. The data collected in these inventories were gathered through Forest Management Plans and questionnaires, a method that has been continued by the state's statistical office for the yearly updates.

36.1.2 Sampling Methods and Periodicity

The assessments of forest resources have been conducted to provide information that satisfies forest policy requirements for the benefit of society. To date the three inventories that have been completed were based on self-registered questionnaires using data from Forest Management Plans (FMP), cadastres, local administrations and hunting associations. The periodicity of inventories was never officially prescribed. The surveys have not been probability based statistical inventories. The Federal Statistical Office (Statistical Office of the Socialist Federal Republic of Yugoslavia) prescribed a Methodology for Forest Inventory whereby only the stand variables were included (State Statistical Office 1963, 1982). With these inventories standing stock was determined either by the balance method or the estimation method. The balance method has been applied in managed forests (forests under FMP), where the standing stock is evaluated during the management inventory. In non-managed forests, an estimation method was applied, which used data from neighbouring managed forests. Where no such neighbouring data were available an estimate of standing stock was made using temporary sample plots established in the stand or using growth tables.

The periodicity and methodology of the forest management inventories (MI) which are made for the revision on the FMP are defined by Rulebook for contents of the Forest Management Plans (Ministry of agriculture, forestry and water economy 1971, 1975, 1998). FMP are revised every 10 years and a management inventory is conducted in the year preceding. Every year about 10 % of the forest area is inventoried. Management inventories are completed on a management unit level using temporary sample plots. Prior to the introduction of the 1971 Rulebook describing the contents of the Forest Management Plans, general guidelines for forest management on the whole territory of Yugoslav Federation were applied whereby the basic management unit was forest management district. The periodicity of 20 years was prescribed and the MI was completed using temporary sample plots (Meshtrovic̀ 1978; Ivanovski 1997).

The most recent Forest Law (2009) included a requirement to undertake a National Forest Inventory (NFI), but it did not define the periodicity between assessment dates. To date the NFI has not begun and the methodology describing its implementation remains to be prepared.

36.1.3   Data Collection

The input data in the three large forest surveys 1949/50, 1961 and 1979, as well as those used today for updating the statistical data on forest resources are collected within the framework of the forest MI. In uneven-aged high forests and in even-aged mature stands, sample plots have to cover between 5 and 10 % of the stand area and in even-aged younger stands and coppice stands, the sample should cover between 3 and 5 %. During the MIs, the stand characteristics are assessed on temporary sample strips or circular plots. The field assessor selects the most suitable plot type.

With the MI, three categories of variables are evaluated: tree, stand and site.

Trees variables are measured or estimated on temporary sample plots, with a diameter at breast height (dbh) threshold of 10 cm in high forests and 5 cm in coppice forests. The variables relate only to the living trees and they are:

- Tree species
- Diameter at breast height (dbh), where the dbh is assessed in 5 cm diameter classes; Tree height measured on a sub-set of tally trees selected in different diameter classes and stand locations
- Forked tree (below or above breast height)
- Stem damage (mechanical, pathological, insect)
- Stem quality (straight, curved on one side, twisted).

Stand variables describe the forest stands based on previous assessments and data collected on sample plots. They include:

- Management form (high forest, coppice, even-aged, uneven-aged)
- Stand age: the classes are 20 years and 10 years wide for high even-aged and coppice forests, respectively. If a stand consists of compartments larger than 1 ha in size and with an age difference of more than one age class, the stand is partitioned into sub-units
- Stand structure: layers (one or two layers stand), their coverage (in percent), and development stage (five phases)
- Stand stability: including damage, urgency and type of silvicultural treatment. Plant community (forest association) with an assessment of the occurrence and abundance of wooden, bush and herb species
- Composition: pure and mixed forests
- Regeneration: development stage and quantity
- Harvesting: species, quantity and assortment by year.

Site conditions are gathered in order to describe the factors that influence tree growth and stand development. Some variables are estimated in the field, others are derived from various external data sources. The following variables are included in this group:

- Altitude above sea level (m): minimum, maximum value
- Exposition: eight direction classes

- Slope: 5 categories (flat—up to 5°, slightly inclined—6 to 10°, medium inclined —11 to 20°, steep—21 to 30° and very steep more than 31°)
- Soil quality: type, depth, moisture, depth of mull horizon
- Non decomposed organic material: depth in cm
- Erosion: occurrence, type of erosion (superficial or line), place/location.

Although data about site conditions are gathered in the MI the data has not been used for the National Forest inventory or the yearly updates. A probability based inventory has recently been carried out in the National Park "Mavrovo" during 2009 and 2010 (Trajkov et al. 2011). During this inventory, 3542 permanent circular sample plots were established on a 300 × 300 m grid, where sample plots in neighbouring grid rows were displaced by half of the grid width (150 m). The size of the sample plots varies between 100 and 1256 m^2, with respective circle radii from 5.64 to 20 m. The size of the plots selected depends on the tree density in the stand, where the intention is to include at least 30 trees per plot. For the forest regeneration, 4 circular plots with a radius of 1 m each were established in each sample plot. The minimum dbh thresholds were 10 cm in high forests and 5 cm in coppice forests. In addition, dead standing trees were also measured; in contrast to MIs where this requirement is not prescribed in the regulations.

36.1.4   Data Processing, Reporting and Use of Results

Based on the MI field data, as well as data available from other sources (e.g. geological surface), every stand is described with its surface area, site conditions and stand variables, both in a narrative and numerical form. The stand area is obtained from topographic maps with a scale of 1:25,000. The volume of the stand is calculated by tree species and diameter classes. For this, the number of trees by tree species and diameter class is multiplied by the respective average single tree tariff volume, which is obtained from local or national volume tables. The number of trees per hectare is obtained from the number of trees in all sample plots in the stand and the ratio with the total area of the stand and the total area of the sample plot located in the stand. The volume of the stand is estimated using appropriate growth tables. Input parameters for these tables are tree species, age and height i.e. site condition. Due to the lack of national growth tables, tables from the neighboring countries are usually used.

The average dbh of a stand is the dbh of the mean basal area tree in the stand, and the stand's average tree height is a weighted arithmetic mean of tree heights, where the weights are the basal areas of the trees (Lorey's height). Wood increment is estimated using the percentage of increment calculated by Schneider's formula (Klepac 1963). Increment is usually established for groups of stands with the same characteristics and with similar site conditions. The stand density is expressed as a volume density, i.e. the ratio between the measured volume and the normal volume of the stand obtained from growth tables (species, age, site condition). According to the proportion of different tree species in the total growing stock, stands are

classified as pure or mixed. A pure stand is considered one in which more than 90 % of total growing stock is from one species. These stand characteristics are then used to compile estimates for the whole forest area under a management plan.

The data about forest area, harvesting and other activities in forests as well as the utilisation of wood and non-wood goods and benefits from forests, are recorded in the questionnaire by the forest managers. These questionnaires are submitted to the State's statistical office which were published in SYb prior to 2001 and since then have been published in the Statistical Review of Forestry. The report which presents the forest inventory data from 1979 (SYb 1982) includes information on forest area, growing stock, increment, ownership, tree species, type of management, stand age classes for even-aged forests, dbh classes for uneven-aged forests, purpose, afforestation and reforestation, forest damage (forest fire, insect infestation, disease, illegal cutting), hunting statistics, harvesting techniques and forest roads, etc. The annual statistic reviews from 2001 to date give relatively poor information on wood resources. In terms of the status of the forests, the annual statistical reviews present only the area of the forest by tree species and the rest refers to the works performed in the forests, e.g. planting, harvesting, employment, damage, etc.

The MI data serve different purposes (scientific papers, master and doctoral thesis, etc.) at varying spatial scales, and several reports on the state of managed forests have been published (Ivanovski et al. 1990; Nestorovski 2012). These reports on the state of managed forests comprise information about forest area, growing stock and increment, for the whole country and is broken down into forest management units, provinces and regions, the type of forest management and the type of forests (even-aged and uneven-aged forests, high forests and coppice forests), as well as the annual allowable cut.

36.2 Land Use and Forest Resources

36.2.1 Classification of Land and Forests

36.2.1.1 General Land Classification

Since there is no recent data from a national forest inventory available in the Republic of Macedonia, a general hierarchical system of land use is presented in this report. This land use information is derived from the Spatial Plan of the Republic of Macedonia for the period 2002–2020 (Eremeeva et al. 2004), adopted in 2004. In this plan, the territory of the state is divided into productive (2,241,000 ha) and non-productive (330,000 ha) land (Table 36.1). The productive land is then divided into agricultural and forest land with 1.244 million and 997,000 ha, respectively. Data about forests are based on data from State Statistical Office (SYb 2001) and classifies forests into high and coppice, managed and unmanaged. According to the most recent forest law, a Forest is defined as a piece of land of a minimum size of 200 m^2 where tree species and shrubs are present, as

Table 36.1 Land use classes according to the Spatial Plan of the Republic of Macedonia for the period 2002–2020 (Eremeeva et al. 2004)

Class name		Description	Area (1000 ha)	Area (%)	Correspondence to FRA classes (FAO 2004)
Productive land	Forest land (stocked forest land)	All categories forest	997	38.8	Forest, OWL, OlwTc
	Agricultural land	Cropland, fallow land, fast growing tree plantations, grassland with small groups of trees less than 0.02 ha, riparian forest vegetation outside the forest, orchards and vineyards, grassland, grazing land	1244	48.4	OL, OWL, OwlTc
Non- productive land		Natural land: water bodies, reed beds, bogs, heath lands, rocks, areas of gravel and debris, landslides, other natural lands, Built-up land: industry and commerce, mining, traffic and transport, disposal sites, tourist facilities, dwellings and parking sites, gardens and parks, buildings Other land: Inaccessible and unproductive non-forest land	330	12.8	Other land, other land with tree cover
Total land area			2571	100	

well as bare land in the neighbourhood or in the middle of the forest, forest nurseries, forest roads, seed plantations, wind shelters belts, fire breaks in forests, and forests in protected areas. The category Forest does not include small groups of trees on an area of less than 200 m^2, boundary trees on agricultural land, fast growing tree plantations, vegetation near river beds outside forest, recreational parks in inhabited areas.

36.2.1.2 Forest Classification by Use

Due to the fact that the main and most reliable source of information about forests is forest management plans, any classification of forests starts with the division between managed and non-managed forests. The total stocked forest land in 2012 amounted to 988.8 thousand ha (Ministry of Agriculture, Forestry and Water Economy 2012) of which 902 thousand ha were managed, i.e. for which forest management plans are prepared (Table 36.2). According to the most recent Law on forestry, further classifications of forests have been established according to use, management system, species, and stand characteristics.

Table 36.2 Forest classes by use within managed forest land according to the Forest Management Plans (Ministry of Agriculture, Forestry and Water Economy 2012)

Class name	Description		Area (1000 ha)	
Managed Forest land	Productive forests – high forests – coppice forests – shrub-lad	Forests that priority function is wood production	Forests available for wood supply without restriction	841	
	Protective forests – high forests – coppice forests – shrub-land	Forests with protective or other function and with yield	Forests available for wood supply with restriction in regards of the choice of the cutting system		
	Forests with special purposes			10	
	Forests in protected areas	National parks, Natural monuments	Forests without yield	5	51
			Forests available for wood supply with restriction in regards of the cutting system	46	
	Total stocked (covered) area				902
	Temporary or permanent Unstocked parts of the forests	Unstocked due to – Forest management (e.g. forest roads, timber yards) – Natural reasons			182
	Total managed forest land				1084

   According to the purpose or the services provided, forests are divided into productive (economic) forests, protective forests, forests with special purpose (forest gaming reservations, park forests, memorial forests, forests for seedling production, scientific forests, etc.) and forests within protected areas. Productive forests are areas where the primary function is wood production which are available for wood supply. Parts of the forest (stands) with protective function (mostly forest around water bodies) in the context of the management units are distinguished as separate management classes. The primary function of these forests is protection but they are also used for wood supply, in a restrictive manner. According to the forests census from 1979 the surface area of such forests amounted to 17,617 ha. Forests on the protected land is partly managed which is allowed according to the Nature Protection Act. These areas are divided into management zones. The parts of the forest which are in the zone of sustainable development with some restrictions are considered available for wood supply.

36.2.1.3   Classification by Ownership Categories

The forest ownership in the Republic of Macedonia is divided into three main categories: private, state and religious communities. State owned forests are mostly

managed by the public enterprise *Makedonski shumi* and other state owned insti-
tutions (national parks, reservations, etc.). Private forests are small, with less than
30 ha per owner on average. There is no obligation for owners with less than 30 ha
to prepare management plan, as they are managed by special criteria prepared by
the Ministry of Agriculture, Forestry and Water Economy (MAFW). Large forests
over 30 ha have to complete a forest management plan. The total number of private
forest parcels is around 220,000 so that the average size of the parcels in Macedonia
is 0.45 ha. (Trendafilov et al. 2008). The number of large private forests estate is
relatively small. Over 90 % of the forests are state owned, and only about 10 %
have other type of ownership (Table 36.3). The increase of the area of private
forests is not a result of afforestation, but is a result of the process of restitution of
forest properties that has occurred since 1998.

36.2.1.4   Forest Management and Cutting System

The forests in the Republic of Macedonia are managed under even-aged and
uneven-aged silvicultural systems. According to the last forest inventory from 1979
(Dimitrov 1983), the total covered forest area amounted 906 thousand ha of which
745 thousand ha have been managed and 161 thousand ha non-managed forests or
forests without management plans. The largest part of the managed forests are coppice
forests, occupying 63.2 % (Table 36.4). The proportions of high forests within
managed forests are 20.4 % for uneven-aged and 8.6 % for even-aged forests,
respectively. The remaining 7.8 % are other categories of forests. Total coppice for-
ests as managed and unmanaged occupies 61.6 % of the forest area. However when
the area of "other categories of forests" is added, which are also of vegetative origin
(9.4 %), the total cover of coppice forests raises to almost 71 % of the forest area.
A separate category called "other" includes bushes, shrubs, maquis or pseudo-maquis
and low productive forests. This other category has a total area of 85,000 ha.

   According to the latest update of forest management plans (FMP's) in 2012
managed forests cover an area of 902,000 ha of which high forests (uneven-aged
and even-aged) cover an area of 276,000 ha, coppice with standards an area of
3000 ha, coppice forests an area of 561,000 ha, artificial established stands up to
age of 20 years an area of 8000 ha, and other categories of forest an area of
54,000 ha.

Table 36.3 Forest area according to ownership categories (Dimitrov 1983; State Statistical Office
2012)

Ownership category	Area (1000 ha)	
	NFI 1979	Statistics 2012
State forests	816.6	888.5
Private forests (including forests owned by religious communities)	89.0	100.3
Total forest area	905.6	988.8

Table 36.4 Forest management system according to the census from 1979 and Forest Management Plans, state 2012 (Dimitrov 1983; Ministry of Agriculture, Forestry and Water Economy 2012)

Management system	Census 1979				FMP's State 2012	
	Total forests		Managed forests			
	1000 ha	%	1000 ha	%	1000 ha	%
High forests	263	29.0	216	29.0	276	30.6
Even-aged	96	10.6	64	8.6	Not available	
Uneven-aged	167	18.4	152	20.4		
Coppice with standards	Not separated				3	0.3
Coppice forests	558	61.6	471	63.2	561	62.2
Artificial forests (up to 20 years)	Not separated				8	0.9
Other (shrubs, maquis, etc.)	85	9.4	58	7.8	54	6.0
Total	906	100	745	100	902	100

36.2.1.5 Legal and Other Restriction for Wood Use

Forests in the Republic of Macedonia have to be managed according to the Forestry Law and other Acts regulating in this area. They ensure the sustainable management of forests by specifying limits on rotation age in even-aged forests and on the diameters of trees to be cut in uneven-aged forests. Harvesting in pre-mature stands is restricted by prescriptions on the intensity of tending activities. The regulations also contain specifications for protective forests (land and water protection areas) and forests in protected areas, specifically with regard to sustainable forest management. The availability of wood resources is also restricted to forests with special purposes such as military training areas, research, forests in protected areas, etc. Certain restrictions are present from environmental policy initiatives such as the promotion of habitat preservation.

An important point regarding the availability of wood resources are the low productivity forests such as shrubs with an area of 54,000 ha. These forests have an extremely low growing stock of 12 m^3/ha on average, and largely remain unmanaged. Other restrictions on wood resource availability, particularly in winter, are the long distances from productive forests to customers. Steep slopes combined with a poor network of forest roads and other infrastructure also restrict wood resource availability.

36.2.1.6 Further Classification of Forests

Forests are also categorised by other variables, such as tree species composition. The dominant tree species in Macedonian forests are different oak species (*Quercus* spp.) with a share of 29.3 % of the total forest area, followed by the European beech (*Fagus sylvatica* L.) with a share of 23.2 %. Coniferous forests occupy 7.3 % of the

forest area and the dominant coniferous species is black pine (*Pinus nigra* Arn.) with a share of 4.8 % of the total forest area and 65 % of coniferous forests. In this classification, degraded forest stands occupy 44,800 ha or 4.5 % of the forest area (Table 36.5). Degraded forests are characterised by their poor quality and lack of vitality, which is the result of adverse impacts, such as biotic, abiotic and anthropogenic factors. They are mainly natural mixed broadleaved stands.

In the 1979 inventory the structure of even-aged forests was detailed in 20 year age classes for high forests and 10 year age classes for coppice forests. In uneven-aged forests, the structure was shown in diameter classes 10–30 cm, 31–50 cm and above 51 cm, but for today's needs, these classes do not have a practical relevance.

36.2.2 Standing Stock Wood Resources and Their Use

Standing stock and increment is calculated as the above-ground over bark volume of trees with a dbh above the minimum threshold including stump, stem and branches with a minimum top diameter of 2 or 3 cm depending on the volume table. The management inventory does not provide the amount of biomass, nor is the volume of standing dead trees assessed. Therefore, the volumes given below refer to growing trees. The increment is calculated as a percentage of the volume as explained in Sect. 36.1.4. The volume of drain includes only the volume of living trees that are removed by logging. The amount of harvest, such as cutting inside and

Table 36.5 Forest area by species according to statistical review (State Statistical Office 2012)

Tree species	Area (1000 ha)	Area (%)
Broad-leaved species	574.6	58.1
Fagus sylvatica	229.7	23.2
Quercus spp.	290.0	29.3
Castanea sativa	2.7	0.3
Other hard broad-leaved species	48.7	4.9
Other soft broad-leaved species	3.5	0.4
Coniferous species	72.2	7.3
Picea abies	1.1	0.1
Abies alba	5.7	0.6
Pinus nigra	47.5	4.8
Pinus sylvestris	9.9	1.0
Pinus peuce	4.3	0.4
Other conifers	3.7	0.4
Mixed forests	297.2	30.1
Degraded forests	44.8	4.5
Total Forest Area	988.8	100

outside forests, cutting by state and private forests and the amount of illegal cutting, and the amount of harvest by assortment of state forests, are detailed in the statistical review *Forestry 2012* (State Statistical Office 2012).

According to the forest management plans, the total growing stock in the Republic of Macedonia in 2012 was 88.67 million m^3 and the annual increment 1.785 million m^3 (Table 36.6). The volume of trees cut in forests with different cutting system (clear cut—meaning cut on coppice forests, regeneration cut and selective cut) was 744,000 m^3, volume of harvested trees outside the forests 34,800 m^3 and the volume cut illegally was 26,000 m^3. Over the last decade, the

Table 36.6 The volume of standing stock and increment on forest (*Source* actual forest management plans state 2012) and the amount of cut timber volume (State Statistical Office 2012)

Tree Species	Standing (growing) stock	Increment (1000 m^3)	Harvested timber volume (1000 m^3)				
			In pure stands	In mixed stands	Outside forest	Illegal cut	Total
	Million m^3		Within forest				
Fagus sylvatica	51.65	841	353	29	35	26	805
Quercus petraea	12.29	283	289				
Quercus frainetto	4.88	121					
Quercus pubescens	2.85	76					
Carpinus orientalis	1.02	33	6				
Ostria carpinifolia	0.55	14					
Quercus coccifera	0.05	2					
Other broad-leaves	3.89	97					
Total broad-leaves	77.17	1467	648	29			
Pinus sylvestris	2.19	50	28	18			
Pinus nigra	5.75	182	13				
Abies alba	1.84	37	7				
Picea abies	0.03	1	+[a]				
Pinus peuce	0.36	8	nd				
Other conifers	1.32	40	1				
Total-Conifers	11.49	318	49	18			
Total	88.67	1785	697	47	35	26	805

[a]Harvested symbolic amount (70 m^3)

volume cut illegally has drastically increased. In 2008, the volume cut illegally was estimated to be 7164 m^3. Assessment of the harvest volume from trees outside of forest and illegally cut is estimated from periodic reports to forest managers and forestry inspectors.

36.2.2.1   Tree Species and Their Commercial Use

European beech (*Fagus sylvatica* L.) is the most economically important species in the Republic of Macedonia. In 2012 European beech occupied 58 % of the total growing stock, 47 % of the total volume increment and 51 % of the annual yield (Table 36.6). Conifer species represent 13 % of the total growing stock, 18 % of the annual increment and 9 % of the annual yield. The large difference between growing stock and increment in the conifer forests, and the amount of harvested wood is due to the large amount of young forests which are the result of important afforestation during the 1970s and 1980s where black pine (*Pinus nigra*) was the most predominant species planted (Dimitrov 1992; Trajkov et al. 2006). Some species such as spruce (*Picea abies*) and Macedonian pine (*Pinus peuce*) have only symbolic significance. These species are taken into account here, because spruce is at the southern border of its natural extent and Macedonian pine is a relict species.

36.3   Assessment of Wood Resources

36.3.1   Forests Available for Wood Supply

Legal restrictions on wood supply are mostly directed towards assuring the sustainable management of forests in Macedonia. In the productive forests, those restrictions are directed towards environmental and soil protection. There is also an obligation to harvest less than the annual increment, to harvest mature stands and to ensure silvicultural activities enhance the conditions of young and pre-mature stands. In the protective forests as well as in the forests in the protected areas where sustainable management is accomplished, there are also legal restrictions on the choice of the silvicultural system, such as no clear cutting. In the core zone of the protected areas silvicultural operations are completely forbidden.

Other restrictions on wood supply concerns the availability of harvesting technology and forest accessibility. Technological restrictions evidently exist as old machinery are used in harvesting wood. Due to the lack of investment in machinery, chain saws are used for tree felling, while old adapted agricultural tractors and specialised forestry tractors from the 1980s are used for skidding. Horses are also still used for skidding. Old forest roads with acute bends and limited quality allow only the use of trucks that have low capacity.

Accessibility restrictions are due to the low road density of forests as well as terrain conditions, which involve steep slopes that restrict the use of heavy duty machinery. The average road density of Macedonian forests is 10.55 m per ha (Trajanov and Nestorovski 2008), even if forest roads and public roads that pass through the forests are included in the calculation. Skidding distances to the forest roads are too long and making this operation very expensive.

36.3.2 Assessment and Assortment of Wood Quality

The wood assortment classes, quality and dimensions are regulated by the Macedonian standard for wood (MKS), that include different classes for round-wood, sawnwood, firewood and waste. The assortments are based on minimum length and diameters of logs, as well as certain quality characteristics or faults. The roundwood is divided into sawn veneer logs, peeled-veneer logs, sawn logs and other combined logs, as well as industrial roundwood. Other categories are small roundwood, firewood, pulpwood, and wood for special purposes, (dictated by the customer) resonance wood or wood for xylography. Veneer logs are the most valuable assortment, with best quality and minimum of 2 m length and 30 cm diameter. Sawn logs are divided into three classes I (best quality), II and III (lowest quality). The quality specifications differ between conifers and broadleaved species. According to the 2012 forest statistical data, harvested timber volume in state's forest is 558,800 m^3 (Table 36.7). The difference from the total volume harvested of 744,000 m^3 is the result of harvested wood in the private forests which is about 10 % and for which there are no data about assortment and the waste that remains after filling in the forests.

Table 36.7 Assortment of cropped timber volume in state forests (State Statistical Office 2012)

Assortment of cropped timber	Volume (1000 m^3)	Volume (%)
Logs, coniferous (m^3)	35.9	6.4
Mining wood, coniferous	6	1.1
Other long coniferous wood	10.6	1.9
Stack coniferous wood	1	0.2
Fuel wood, coniferous	3.4	0.6
Logs, broad-leaved	64.9	11.6
Mining wood, broad-leaved	0.2	–
Other long broad-leaved wood	0.2	–
Stack broad-leaved wood	–	–
Fuel wood, broad-leaved	436	78.1
Other wood in the rough, including chopped wooden poles and stakes	0.6	0.1
Total wood in the rough	558.8	100.0

The assessment of wood quality and assortments is also done during the MI. Trees to be felled are also marked at this time. During the MI and for the formulation of management plans the wood volume is divided into four classes: technical wood, chemical processing wood, firewood, and waste wood after logging. The assessment carried out with assortment tables and through expert judgement. Assortments of standing wood are produced at the management unit level.

During the marking of trees for harvesting, stem quality is assessed using three quality classes:

- 1 Stem is upright, full-bodied, free of knots, continuously without faults from stump to top
- + Stem is upright, full-bodied, some knots, no continuity from stump to top, with a higher amount of faults
- 0 stem crooked, with knots, no round stem, no dimensions, and significant faults.

The assessment also includes other parameters related to stem quality (height of the living crown base, upper stem diameter and other variables). During the marking of trees for harvesting the following attributes are also assessed: dbh under bark, stem length, tree height and tree species.

36.3.3 Assessment of Change

As explained in previous sections, no large scale forest inventory has been made in the Republic of Macedonia since 1979. During the FMP revision, changes in forest area, growing stock and increment on Forest Management Unit level are analysed. Changes are calculated as the difference between two successive estimations of these variables. The Statistical Office annually presents forest area statistics, which are based on changes observed in approximately 10 % of forests assessed annually by the MI. The data are collected through regular statistical enquiries. Data on forest operations are collected throughout the year based on accounting records. Questionnaires are completed by PE "*Makedonski śumi*" (Macedonian forests) or its branches, as well as the head of the national parks and other entities which manage forests. The estimation of change at a particular spatial level or about all forests in the country, are made by comparing information from statistical reviews for some years or by summarising data from management plans in a particular region.

Information presented in the annual SYb are mainly systematic data about: the forest operations performed to harvest timber, the value of services performed in forestry, afforestation, reforestation, care and amelioration, energy consumption in forestry, mechanisation, road infrastructure, forest damage, forest area, game population and the number of game shot. Due to a lack of data on growing stock and increment in the statistics, data from management plans is used to assess change.

36.3.4   *Other Wooded Land and Trees Outside Forests*

Information about other wooded land and trees outside the forest such as groups of trees on areas smaller than 200 m^2, boundary trees around the agricultural land, protective belts, parks, etc., are currently not available. A particular problem is the cutting of boundary trees around agricultural land for which a definition is missing. The only source of information about these boundary trees in the category of trees outside forests is produced by Statistics based on the reports issued by the PE Macedonian Forests as they also issue approvals for cutting trees in these areas.

References

Dimitrov B (1983) Состојба на шумите и шумскиот фонд во СР Македонија (in Macedonian). English edition: Dimitrov B (1983) State of forests and forest found in the SR Macedonia. J For 3–4:41–51

Dimitrov B (1992) Општествено економско значење на пошумувањата воопшто и на голините во Република Македонија, (in Macedonian). English edition: Dimitrov B (1992) Socio-economic importance of forestation in general and on the bare land in Republic of Macedonia. In Proceedings of the state's counselling on management of bare lands, Veles, P 105–112

Eremeeva V, Vasilevič B, Penev P, Vlchevski R, Trpchevska D, Tonič Z, Moslovac A, Petrovska A, Kirovski B, Georgieva S, Jankov B, Kalajdjiski S, Manasova S, Lozanovski B (2004) Просторен план на Република Македонија 2002–2020, стр. 128 (in Macedonian). English edition: Spatial plan of the Republic of Macedonia 2002–2020. Ministry of Environment and Physical Planning, Skopje, p 198

Grujoski B (1959) Општ развиток на шумарството во НР Македонија (1944–1959) (in Macedonian). English edition: Grujoski B (1959) General development of the forestry in the PR Macedonia (1944–1959). J For 7–28

Ivanovski C (1997) Уредување на шумите I (In Macedonian). English edition: Ivanovski C (1997) Forest management I, BIGOSS. Skopje

Ivanovski C, Ristevski P, Trajkov P (1990) Просторна разместеност на шумите во СР Македонија (In Macedonian). English edition: Ivanovski C (1990) Spatial distribution of forests in SR Macedonia. For Rev 1–12:35–52

Klepac D (1947) Inventarizacija šuma u planskoj privredi. (in Croatian). English edition: Klepac D (1947) Forest inventory in the planned economy. J For 3:65–71

Klepac D (1963) Rast I prirast šumskih vrsta drveća I sastojina (in Croatian). English edition: Klepac D (1963) Growth and increment of forest's trees species and stands. Publishing house of knowledge, Zagreb

Meštrovič Š (1978) Pravilnik o izradi šumskoprivrednih osnova, osnova gospodarenja I programa za unapređenje šuma u svetlosti šumarske znanosti (in Croatian). English edition: Meštrovič Š (1978) Rulebook on drafting the forest management plans and programs for forest improvement in the light of forestry science. J For 8–10:352–364

Ministry of Agriculture, Forestry and Water Economy (1971) Правилник заизработка на шумскостопански основи и програми за унапредување на шумите и за евидентирање на извршените работи во шумите (in Macedonian). English edition: Rulebook for contents of the Forest Management Plans. Skopje

Ministry of Agriculture, Forestry and Water Economy (1975) Правилник заизработка на шумскостопански основи и програми за унапредување на шумите и за евидентирање на

извршените рабори во шумите (in Macedonian). English edition: Rulebook for contents of the Forest Management Plans. Skopje

Ministry of Agriculture, Forestry and Water Economy (1998) Правилник за содржината на Посебните планови за стопанисување со шуми, Посебните планови за одгледување на шумитесо посебна намена и Годишните изведбени планови (in Macedonian). English edition: Rulebook for contents of the Forest Management Plans. Skopje

Ministry of Agriculture, Forestry and Water Economy (2012) АктуелниПосебни планови за стопанисување со шуми и Посебни планови за одгледување и заштита на шуми со посебна намена (in Macedionian). English edition: Actual Forest Management Plans, state 2012. Skopje

Nestorovski LJ (2012) Analysis of the energetic potential of forests in Republic of Macedonia. In Proceedings of 19th European biomass conference, Berlin 2012, P 345–348

State Statistical Office (1954) Статистички годишник (in Macedonian). English edition: Statistical Yearbook. Skopje. http://www.stat.gov.mk. Accessed 1 Mar 2016

State Statistical Office (1963) Статистички годишник (in Macedonian). English edition: Statistical Yearbook. Skopje. http://www.stat.gov.mk. Accessed 1 Mar 2016

State Statistical Office (1982) Статистички годишник (in Macedonian). English edition: Statistical Yearbook. Skopje. http://www.stat.gov.mk. Accessed 1 Mar 2016

State Statistical Office (2012) Шумарство (in Macedonian) English edition: Review forestry. Skopje, P 30. http://www.stat.gov.mk. Accessed 1 Mar 2016

Tasič B (1959) Уредување на шумите во периодот од 1945 до 1959 година (in Macedonian). English editon: Tasic B (1959) Forest management in the period 1945–1959. J For (jubilee edn) P 29–36

Trajanov Z, Nestorovski LJ (2008) Optimal density of the road network in Republic of Macedonia, FAO/ECE/IUFRO seminar on infrastructure and transport in sustainably managed forest, Slovenian forest institute, Portoroz

Trajkov P, Ts Zlatanov, Kolevska DD, Trajanov Z (2006) Развој на вештачки подигнатите насади од црн бор во топлото континентално и ладното континентално подрачје во Македонија, (in Macedonian). English edition: Developement of black pine artificial stands in warm continental and cold continental regions in Macedonia. For Rev 16:99–106

Trajkov P, Nestorovski Lj, Trajanov Z, Savič N, Nedev D, Trajkov G, Razmoski B, Kovalevski G, Siljanovski A, Postolov V (2011) Заштита на животната средина, економски развој и промоција на екотуризмот во Националниот парк Маврово, дел: Шумите воНационалниот парк Маврово English edition: Environmental protection, economic development and promotion of eco/sustainable turism in NP Mavrovo, part: Forst on the National Parc Mavrovo. Final report, Skopje 2011, funded by the Government of the Republic of Italy and National Parc Mavrovo, implemented by OXFAM Italia

Trendafilov A, Rizovska Atanasovska J, Simovski B (2008) Analyses of private forestry in Macedonia and its role in the National Forest Strategy process, p. 35, PROFOR, http://www. profor.info/sites/profor.info/files/Annex%206%20-%20SQA%20Macedonia_E.pdf. Accessed 1 Mar 2016