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The total area of forest fund in the Republic of Lithuania is about 2.17 mln. ha, including forest lands – 2.13 mln. ha and forested land – 2.05 mln. ha (98.0 and 94.5% respectively). In total, forests cover 32.6% of the country's area. The average growing stock volume is around 240 m<sup>3</sup>/ha (mature forest stands have near 315 m<sup>3</sup>/ha). The gross annual increment is 17.8 mln. m<sup>3</sup> and gross annual increment per 1 ha – 8.5 m<sup>3</sup>. The forests of Lithuania are functionally divided into four groups. Currently 49.6% of forest land are owned by the state enterprises (42 state forest enterprises), 38.9% managed by private forest owners (registered 247.7 thousand private owners). Around 11.6% of all forest lands of Lithuania are reserved for privatization. The Lithuanian Institute of Forest Inventory and Forest Management is responsible for the inventory of forests that is managed by the state enterprises. Private forestry specialists who deal with forest inventory should have forestry education and to be registered by the State Forest Service (on a competitive basis). They usually prepare and provide forest inventory projects for private forest owners. At present, there are about 100 such forest inventory specialists. In addition, every 5 years the nation-wide forest inventory is carried out.

**Key words:** forestry of Lithuania, forest fund, groups of forests, forest ownership, forest management inventory, methods of forest measurements.

**Introduction.** Lithuania performs a basic forest management, based on forest inventory of plots of the designed objects. At the same time, the national forest inventory is implemented in the country. Assessment is required for all forest lands, regardless of the form of ownership. Basic forest management is carried out both by the state enterprise employees and private specialists with forest education and work experience (selection in any cases on a competitive basis).

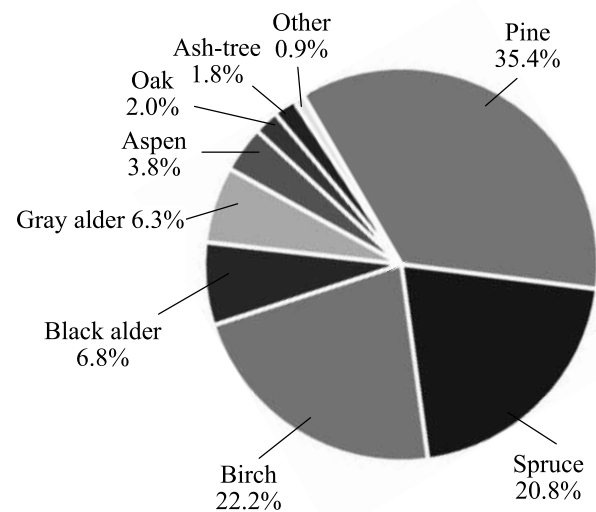
Currently, forest cover in Lithuania is 32.6%. It should be noted that Lithuania plans to increase the share of forest land to 35% due to the involvement of the forest fund and unexploited agricultural land by 2020. The total area of the forest lands in Lithuania is 2.17 mln. ha, 2.05 mln. ha are wooded [1, 2]. The Table shows the comparative characteristics of the total area of forests and reserves in the Republic of Lithuania and the Republic of Belarus [1–4].

**Comparative characteristics of the total area of forests and forests reserve in the Republic of Lithuania and the Republic of Belarus**

Indicator	Unit of measurement	Lithuania	The Republic of Belarus
Total forest area		2.17 / 100	9.48 / 100
Including forest land	mln. ha / %	2.13 / 98.0	8.65 / 91.3
Including wooded-land		2.05 / 94.5	8.16 / 86.1
The total reserve of plantations		510.2 / 100	1,692.7 / 100
Including mature and over mature	mln. m <sup>3</sup> / %	122.8 / 24.1	248.1 / 14.7

Thus, the share of forest land (in relative terms) in Lithuania, according to the forest inventory is by 6.7% more in comparison with the similar data records in Belarus, the proportion of land covered by forests by – 8.4%. Moreover, in Lithuania the share of the reserve of mature and over mature stands (a quarter in the total stock) is significant. Based on statistical data, 0.7 ha of forest and 150 m<sup>3</sup> of timber account for one person in Lithuania. The average growing reserve of Lithuania is 240 m<sup>3</sup>/ha (mature stands – 315 m<sup>3</sup>/ha). The total annual increase is about 17.8 mln. m<sup>3</sup>, about 8.5 m<sup>3</sup>/ha [1, 2, 4].

**Main part.** In Lithuania, the proportion of pine is 35.4%, spruce – 20.8%, birch – 22.2%, oak – only 2.0%, aspen – 3.8% of the forest fund, ash – 1.8% (Figure) [1, 2].



The species composition the forests in Lithuania

The age structure of the Lithuanian forests is as follows: young forests occupy 26.5%, medium – 38.5%, mature – 13.0%, and ripe – 21.9% [1, 2].

Lithuanian forests are divided into four groups on the basis of their functions [1, 2, 4]:

- 1) forest reserves (1.1%);
- 2) special purpose forests (12.0%). This category is divided into two subgroups:
  - a) forests of protecting ecosystems (8.2%);
  - b) recreational forests (3.8%);
- 3) protection forests (15.2%);
- 4) commercial forests (71.7%).

Currently, 49.6%, or 1.077 mln. ha of forest land belongs to the state-owned enterprises (in total, 42 forest enterprises (SFE)), 38.9%, or 844,000 ha, belong to private forest owners (total registered 247,700 private forest owners, on average, each private individual is in possession of 3.27 ha of forest). 252,000 ha, or 11.6% of all forest land in Lithuania are reserved for privatization [1, 2].

Forest management in Lithuania is the basis for the development of projects for the organization and development of forestry. In Lithuania, the Lithuanian Institute of forest inventory and forest management fulfills the preparation of the project for the state forestries. Private specialists in forestry, registered in the State Forest Service, usually conduct training projects for private forest owners.

Currently there are about 100 such specialists.

Forest management of forestry enterprises is carried out every 10 years, while small enterprises are inventoried every 20 years [1, 4].

In addition, the national forest inventory is performed every 5 years. To do this, the entire country is divided into the squares network with increments of 5×5 km, “measurement points” (numbered from 1 to 5 (taxation year)) are laid inside the squares. 4 accounting platforms are laid in these points which identify the key indicators of the productivity of the stand, forest growth, reserve of felled trees and dead wood, the quality control of felling, reforestation, natural forest growth are also performed [4].

In the forestry of Lithuania the following methods of taxation of forest stands are available [1, 4].

*The visual taxation.* It identifies the key indicators of growing in the typical areas without the use of measuring equipment (by eye).

The stock of the growing tree stand is calculated by the following formula:

$$M = M_n \cdot S, \quad (1)$$

where  $M_n$  – normal growing stock,  $m^3$ ;  $S$  – the relative completeness of the stand.

*The visual valuation using measurement instruments.* The typical areas of accounting trees of

three dominant species in each tier the diameter, height, and the average age of the trees are determined are subject to measurement. The diameter, height and age of other species are estimated by eye based on the measurement data of trees predominant tree species. V. Bitterlich’s device enables us to measure the sum of the stand sectional areas from the center sites.

The stock of the growing tree stand is calculated by the formula

$$M = \sum G \cdot HF, \quad (2)$$

where  $\sum G$  – sum of the stand sectional areas,  $m^2$ ;  $HF$  – height factor (species height) of the stand, m.

*A selective tool taxation.* When using this method, the growing stock of the stand is based on the measurement data of the trees with the help of special tools. Measurements are made on circular sample plots.

The amount of cross-sectional area in the data areas is determined using V. Bitterlich’s instrument for measuring completeness.

In order to establish the average diameter of the dominant tree species at each circular site the diameters of five trees that are closest to the center of the circular area are subject to measurement. The height of the two nearby trees is measured in this case.

To evaluate the taxation indicators of the related tree species it is necessary to measure the diameter of such a large number of trees of the wood species, which corresponds to its coefficient of participation in the composition. This amount is distributed evenly across the circular platform. To measure the average diameter of the trees for the wood to be selected, the height of half of these trees is measured.

The age of the dominant tree species is determined on each circular area. For other species at least 2–3 trees are selected (for each species), the age of which is defined.

The resulting data are used to determine the reserve of each timber element per hectare by the formula (2).

*Enumeration taxation on circular areas of constant radius.* When making inventory of the forest stand they use circular sites of 500  $m^2$  by area (12.616 m radius). All trees with a diameter of more 6 cm at breast height are subject to taxation. The following tree index is determined by enumeration: species, tier, state (or increasing losses), as well as the diameter at breast height.

The height and age of a few fallen trees are also determined. The height of 2–5 trees of the dominant tree species and 1–3 trees of each accompanying species is measured at each site. The age of every second tree is determined (as measured by its height).

The volume of each tree is calculated based on the formula:

$$v = \pi \cdot \frac{d^2}{4} \cdot h \cdot f, \quad (3)$$

where  $d$  – tree diameter, cm;  $h$  – tree height, m;  $f$  – the number of species of a tree trunk.

The number of species is determined by the formula depending on the height and diameter:

$$f = 0.34138 + \frac{0.91231}{h} + \frac{0.13122 \cdot h}{d} - \frac{0.19231 \cdot h}{d^2}. \quad (4)$$

**Conclusion.** A distinctive feature of the forest fund of the Republic of Lithuania is the high share of private forests. In general, the country's forests are divided into four groups according to their functions. Based on the proportion of the forests, Lithuania can be attributed to the forest countries (forest cover is 32.6%). The country has accumulated considerable experience in forest management and silviculture.

The forest fund is characterized by good performance: total reserve – 510.2 mln. m<sup>3</sup>; annual growth – 17.8 mln. m<sup>3</sup> (8.5 m<sup>3</sup>/ha); the average reserve of plantations – 240 m<sup>3</sup>, and mature –

315 m<sup>3</sup>; the proportion of the total stock of mature forests – 24.1%.

In Lithuania, the coniferous forest stands occupy a large portion (56%) of the forested land. Softwood stands occupy about 40% of the forest land, and hardwood stands – only 4%. The age structure of the Lithuanian forests is not optimal, dominated (by area) by middle-aged plantations (38.5%), the proportion of mature is 21.9% and young forests occupy 26.5% of the Lithuanian forest fund.

Lithuanian Institute of forest inventory and forest management performs forest management of the state forests enterprises in Lithuania, and private forest management can be performed (on a tender basis) by private forest experts (about 100).

There are the following taxation methods of the forest stand: the visual valuation, valuation by eye using measurement instruments, instrumental selective taxation, enumerative taxation on circular areas of constant radius.

National selective forest inventory is carried out in Lithuania, the data of which are the basis for the formation of reliable forest statistics, the development of forest taxation, silvicultural regulations, strategic plans of forest management and wood consumption forecasts.

#### References

1. Tebera A. Forest productivity. Kaunas, KMAIK, 2013. 268 p.
2. Lithuanian statistical yearbook of forestry. Vilnius, Directorate General of State Forests, 2013. 325 p.
3. *Ministerstvo lesnogo khozyaystva Respubliki Belarus* [Ministry of forestry of the Republic of Belarus]. Available at: <http://www.mlh.by/> (accessed 28.01.2015).
4. Kuliesis A. Forest management. Kaunas, KMAIK, 2013. 216 p.

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