

# What the members of IUFRO post-congress excursion have seen in Lithuania

After visiting Latvia the quests arrived in the northernmost part of Lithuania and have been welcomed by the representatives of the Lithuanian forest community.

Lithuania is located in the geographical center of Europe. It covers 65,300 km<sup>2</sup> with a population of 3.7 million. The climate is transitional between maritime and continental, and is comparatively mild. The average annual temperature is +6.1C<sup>o</sup>, and precipitation 662 mm. The terrain in Lithuania is flat and somewhat hilly. Podzolic and sod podzolic forest soils are predominant. In ancient times the territory was densely covered with forests. The total phytomass (~300 t ha<sup>-1</sup>) and the annual increment (~12 t ha<sup>-1</sup>) reached their maximum during the Atlantic chronozone when broad-leaved forests prevailed. Deforestation in Lithuania occurred during the latest millennium, but ceased in the middle of this century when (1950-1990) about 0.5 million ha of new forest plantations were established.

Starting point of Post-Congress excursion in Lithuania was the **extensive Biržai forest** (18,000 ha) as the southernmost forest belonging to the mixed forest taiga subzone. The terrain here is flat with an elevation of about 56 m. The soil has been formed by melt water from the Valdaj glacier. Loam and sandy-loam soils prevail. In the Biržai forest, mixed stands of *Picea abies*, *Populus tremula*, *Betula pendula*, *Alnus glutinosa* and *Fraxinus excelsior* are dominant.

The attention of the quests was concentrated on the biodiversity in large terrain and on how to keep it in time. Clear, narrow stripe and shelterwood cutting using conventional machinery and technologies really enabled foresters to protect undergrowth and achieve natural regeneration on about 70% of the cutovers. As it was shown in the Latveliai county, mixed spruce (50%), birch (20%), aspen (20%), alder (10%) stand of the *mixtoherbosa* type with undergrowth of ash (80%) and spruce (20%) has been removed by clear cutting in 1986. Currently a

nine-year old mixed stand from spruce (20%), aspen (40%), alder (10%), ash (20%), birch (10%) has been established. The number of a total of 35,000 trees ha<sup>-1</sup>, including 6,000 spruces and ashes grow in it. A thinning of low intensity was carried out in 1995 in order to improve the situation for spruce, ash and birch. It was clearly seen that mixed two storeyed stand in 6-7 decades will reach the shape and productivity of mother stands which were cut 10 years ago.

The most exciting discussions were about **thinnings and shelterwood cuttings** applied for achieving the maximum increment in mixed spruce-deciduous stands. As it was explained by prof. L. Kairiūkštis, in the Lithuanian Forest Research Institute the principles of the formation of maximally productive stands are elucidated and the optimum regime of tending felling determined. This is based on the principles of optimizing the tree crown dimensions, the number of trees per ha and the spatial stand structure. It has enabled foresters to decrease the albedo, and increase utilization of the solar energy and productivity of individual trees. The models and thinning programme standards for pure and mixed stands of all native species have been created on the above basis.

Thinnings and shelterwood cuttings in aspen-spruce stands have been demonstrated in the Latveliai county (soil and site type Gleyic Luvi Soils *oxalidos*). A thirty four year-old aspen stand with spruce in the second storey after several thinnings of low intensity in 1969 was thinned according to the standard by removing 62 m<sup>3</sup> ha<sup>-1</sup> and leaving 875 in the first and 1,040 trees in the second storey. At the age of 39 years another thinning was performed removing 104 m<sup>3</sup> ha<sup>-1</sup>. The first storey has been removed by a two-stage-shelterwood cutting 143+370 m<sup>3</sup> ha<sup>-1</sup>. Consequently, over the 61 year rotation 900 m<sup>3</sup> ha<sup>-1</sup> were obtained and a new spruce stand of 134 m<sup>3</sup> ha<sup>-1</sup> formed. The average wood increment was 14.7 m<sup>3</sup> ha<sup>-1</sup>; in certain periods the increment was 22-23 m<sup>3</sup> ha<sup>-1</sup>.

On a corresponding site and soil type thinnings and shelterwood cuttings in birch-spruce stands were applied in county Tamosiunai. A thirty five year-old birch-spruce stand, after two thinnings of low intensity was thinned according to the standards of maximum growth by removing 96 m<sup>3</sup> ha<sup>-1</sup>. Another thinning was performed when the stand was 40 years old by removing 77 m<sup>3</sup> ha<sup>-1</sup>. Finally, at the age of 59 years a shelterwood cutting was used to remove the birch storey of 325 m<sup>3</sup> ha<sup>-1</sup>. Consequently, the average stand increment of 11.0 m<sup>3</sup> ha<sup>-1</sup> and total stand productivity of 649 m<sup>3</sup> ha<sup>-1</sup> have been achieved, and a spruce stand of a new generation with 121 m<sup>3</sup> ha<sup>-1</sup> established.

Spruce **thinning of different intensity** also deserved great attention. A mixed birch-aspen-spruce stand on Gleyic Podzol soil of the *oxalidosum-myrtillus* type developed on a cutover in 1944 by natural regeneration (country Latveliai). It was decided to grow the stand in 3 different ways: (1) as a pure spruce stand (2) as a birch-spruce stand and (3) as an aspen-spruce stand.

The conclusion has been made by the members of Post-Congress excursion (dr. von Fürstenberg P.) that pure spruce stand 253 m<sup>3</sup> ha<sup>-1</sup> at present stage (53 years old) is prevailing in commercial value, but the value according to the total productivity (573 m<sup>3</sup> ha<sup>-1</sup> and biodiversity and sustainability of forest will prevail when mixed aspen-spruce-birch stand is formed.

For the participants the **survey of forest drainage and road construction** work in the Biržai forest enterprise was of great interest. Forester in-chief A. Nareckas explained that during 1950-1980 about 18,000 ha in the Biržai Forest enterprise have been drained. At the same time 650 km of forest roads were constructed. The forest roads are 12-26 m wide depending on the local conditions. In Biržai, as well as in other forest enterprises characterised by wet forest land, the road network is coordinated with one of drainage ditches. The earth removed from the ditches is used for road bed construction at the side of the ditch, thus making the road construction cheaper by 30-40%. Each year about 12 km of ditches are dug and about 40 km of road have been surfaced with gravel.

Head of the enterprise R. Gaudiešius describes the Biržai Forest enterprise and sawmilling. The total area of wood and wooded lands is 57,000 ha. The total growing stock is 5.31 million m<sup>3</sup> and mean growing stock 187 m<sup>3</sup> ha<sup>-1</sup>. The current annual increment is 220,000 m<sup>3</sup> and mean annual increment 6.7 m<sup>3</sup> ha<sup>-1</sup>. The annual removal by clear felling is 90,000 m<sup>3</sup>, the yield obtained by thinnings and silvicultural operations totals 50,000 m<sup>3</sup>. The mean annual yield is 4.1 m<sup>3</sup> ha<sup>-1</sup>. Clear cutting and about 50% of the thinnings are performed by the workers of the enterprise. The remaining thinnings are carried out by private wood-cutters. About 50% of the harvesting is done in assortments, and the remaining as whole stems.

The Forest enterprise is divided into 11 districts and 30 forest guards. The total staff is about 490, of which 121 are trained in forestry. The enterprise has a wood processing unit (3 saw mills) designed according to the output of the final products. Palette board production from small dimension wood is the main product of the wood processing unit (8,000 m<sup>3</sup> year). A total of 3,000 m<sup>3</sup> of saw boards are produced yearly from conifer and deciduous logs. The enterprise produces large amounts (30,000 m<sup>3</sup>) of fuelwood and wood chips. The number of sawmill workers is about 100.

The IUFRO Congress quest visited also the **Biržai castle** and historical museum. Here in the 16th century a brick castle and residence for Lithuanian Duke Radvila was constructed beside lake Širvėna. During the Swedish War in 1657 the castle was destroyed and rebuilt in 1662-69. However, during the Great Northern War the castle was again destroyed – the town has lost its previous importance. Currently the main building of the old castle is used as the local museum. After reception in castle the quests were taken to city Kaunas.

Next day the IUFRO group visited the **Dubrava experimental forest enterprise** and Lithuanian Forest Research Institute. The forest enterprise was established in 1957 as the main experimental base for the Lithuanian Forest Research Institute (LFRI). The forest of 18,400 ha consists of three main tracts. Pine is dominant (39%), then follows spruce (32%), birch (11%), black alder (8%), as well as some ash and oak. The average age of the stands is 53 years, the growing stock  $252 \text{ m}^3 \text{ ha}^{-1}$  and current annual increment  $7.5 \text{ m}^3 \text{ ha}^{-1}$ . The Enterprise has a nursery, arboretum, cone shelling plant, seed store, wood terminal, sawmill and machinery repair shop. The enterprise has 260 employees (50 with a professional education), including 4 forestry doctors. Every year about 40–45,000  $\text{m}^3$  of timber are cut, an area of 100 ha reforested, 300–500 ha of young stands are tended, and about 4,000  $\text{m}^3$  of sawn timber produced.

More than 300 of the main experimental plots of the LFRI have been set in the forests of the enterprise. Experimental plantations from various species composition, density and tree distribution, containing 30 tree and 35 shrub species, have been established in the area of 800 ha of forest. Seed orchards of pine, spruce, larch, oak and other species on an area of 39 ha, and 28 ha of pine, spruce and larch clonal archives have been established. Thinning and unclear cutting systems have been designed to achieve the highest stand productivity. Continuous forest inventory has been introduced.

Head of the enterprise hab. dr. A. Kuliešis showed the **experiments in mixed plantations** in the Vaišvydava county. Plantations were established in 1959–1960 and have been subjected to a thinning of low intensity only at the age of 25–30 years. The best results over the first 37 years were obtained in stands with enough space for selfthinning at a young age. Lime appears to be a good pioneer tree for oak if its density is regulated in time. Stand volume is  $323 \text{ m}^3 \text{ ha}^{-1}$  at the age of 37 years.

The participants examined the **Norway spruce and larch orchard** with great interest. In Lithuania tree breeding activities were initiated as early as the 1960's. The seed orchard of Norway spruce (3.8 ha) at Dubrava was established. The spacing was  $8 \times 8 \text{ m}$ . A quadratic clone mixing design was used. During the first year of growth in the seed orchard, the spaces between the rows were followed and agricultural crops grown there. As it was explained by dr. A. Pliūra the first seed yield was obtained at the age of 15 years. The measures used to force seed formation did not prove to be efficient. In 1989, the seed yield was  $20 \text{ kg ha}^{-1}$ , in 1992  $9 \text{ kg ha}^{-1}$  and in 1993  $61 \text{ kg ha}^{-1}$ .

Also the Larch seed orchard used for producing hybrid seeds established in 1964–66 was shown. The scions for grafting were taken from plus trees of European, Polish, Japanese and hybrid larch. Already during the third year after planting, the grafts of Japanese larch began producing seed. In 1974, a heavy seed crop was produced. The heterosis hybrids which are produced in the seed orchard are of high quality. They reach the height of 8–9 m at the age of 8 years.

Later the quests went to the **Virgin forest** where folk performers met them singing national songs, and dancing folk dances. The most productive pine-spruce stand here was established in 1861. The height was 30 m., and the diameter – 39 cm. Over the last 25 years rather stable growing stock was in both – the first ( $646\text{--}664 \text{ m}^3 \text{ ha}^{-1}$ ) and the second ( $71\text{--}80 \text{ m}^3 \text{ ha}^{-1}$ ) storeys of the stand, the current annual increment is  $5\text{--}7 \text{ m}^3 \text{ ha}^{-1}$  per year and mortality  $4.5\text{--}5.0 \text{ m}^3 \text{ ha}^{-1}$  per year.

Discussions on **Continuous forest inventory** (CFI) in the Dubrava forest also took place. The main goal of such forest inventory, as hab.dr. A. Kuliešis explained, is to estimate the total growth and its balance, the growing stock, its structure and dynamics, as well as the efficiency of silvicultural measures. CFI on a permanent sample plot basis was started in 1976. The growing stock in the enterprise increased over 15 years by  $5.4 \text{ m}^3 \text{ ha}^{-1}$  per year (58% of the total increment). A total of  $2.5 \text{ m}^3 \text{ ha}^{-1}$  (27%) was felled annually by intermediate cutting and  $1.3 \text{ m}^3 \text{ ha}^{-1}$  (15%) were lost due to mortality.

The **spacing experience of Spruce**. In order to investigate the laws of the growth of trees entering coenosis and subsequent intraspecific relations, spruce (*Picea abies*, Karsten) plantations in 1957 were planted at a regular spacing with a density of 100,000; 50,000; 25,000; 12,500; 6,250; 3,200; 1,900;  $820 \text{ ha}^{-1}$ . The data of annual biometric measurement during crown closure have revealed that there is a critical boundary for crown closure at which the onset of negative interaction between the trees is noted: at first a slight increase and then a pronounced (>10%) decrease in tree increment. Following crown closure and during subsequent growth, mutual suppression of individuals decreased while the current growth increased. Hence, as prof. L. Kairiūkštis explained the average increment of the trees (H.D) during coenosis formation is described by the typical stress curve. Also the data permit us to conclude that there is enough to plant 2500–1700 spruces per hectare in order to eliminate the negative interaction between the individuals in a young stand.

In the afternoon the group was taken back to Kaunas for sightseeing the old town and national galleries. Really the participants enjoyed the music and pictures of world famous Lithuanian painter and composer M.K. Čiurlionis.

A farewell party in restoran "Metropolis" provided with a broad scale of folk dance, music and national Lithuanian songs was at the same time the concluding summary expressed by the quests what they had seen in the three independent Baltic countries.

For the Lithuanian forest community the visit of prominent IUFRO World Congress delegates was a great honour and full satisfaction, while reading the opinion expressed in letters later received by organizers.

L. Kairiūkštis

### Acknowledgement

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**Prof. Poul V. Ellefson:**... It was with great pleasure that we had the opportunity to view the forest of Lithuania and the

very professional manner in which various forestry programs are being directed toward their continuing vigour and sustainability...

**Prof. Fred Kaiser:**... We have returned to our country filled with great admiration for you and your colleagues what you were able to accomplish...

**Dr. Risvand Jens:**... the excursion in Lithuania was unforgettable...

And so many letters even from Japan prof. Sugihara Hikoich, from Australia prof. Faith Daniel ect.



Discussion in the Misa drained transitional bog.



Genetic reserve of the excellent Scots pine in the Smiltene Forestry District (Latvia): height 39.5 m, age 155 years, volume 550 m<sup>3</sup>/ha.