About the IUFRO's XXth world congress excursion objects in Estonia

EXPERIMENTAL AREA OF RAE BOG. By Jaak Pikk

The forest land of Estonian Republic forms about 50% of mainland. Approximately two- thirds of forests suffer from temporary or permanent excessive moisture. Intensive paludification process of forest lands and decrease of stand productivity on large areas are caused by humid climate. Annual quantity of precipitations exceeds heavily the amount of evaporation. It is the reason that forest improvement questions are important in our country.

First of all about forest drainage.Our forest drainage history is 160 years old. By the way during the last half century the area of forest stands has more than doubled and the growing stock on it has increased 2.4 times. This result was caused by afforestation agricultural lands but also from the forest drainage. About half million hectares of forest land has been drained. Drainage has increased annual timber increment of forests 800000 m^3. Right here I can mark that great area of ditch-networks are established during the last 15 years. Their response to stand growth was lasting short time. Mean of ditch density is 72 m per ha, volume of dig up ground – 182 m^3/ha.

For nearer future we have not planned to establish new forest drainage networks on natural peatlands. We have large areas of peatlands where the forest drainage is economically useless. About 417000 ha of peatlands formed nature protection areas and other environmental protection objects. They will stay undrained.

Forty five years ago around Tallinn there the percentage of forests was low. At that time there was started the project of afforestation of these areas which are unsuitable for agricultural use, including treeless raised-bogs. At first an experimental area was set up on Rae bog, with the aim of investigating the possibilities of afforestation of treeless bogs where heather and sphagnums dominated in the plant cover. In addition cotton-grass and other swamp plants and some stunted pine trees were growing there. The thicness of the peat layer was up to 4 m, at which more than half of the peat layer consist oligotrophic peat. Ash content of the peat soil was on an average 3%, N – 0.7%, P_2O5 – 0.07%, K_2O – 0.07%, CaO – 0.4%, pH KCl – 3.0 and volume of weight per unit 0.07

The peat-bog was drained in 1950. 1,4 m deep ditches were dug with a distance of 80 m between then. Supplimentary ditches were dug in 1960. The first experimental plantations were made in 1953 and 1958.

Pine (*Pinus sylvestris*), spruce (*Picea abies*) and birch (*Betula pendula* and *B. pubescens*) have been cultivated by the way of planting and sowing. Some of the sample plots were fertilized with nitrogen, phosphorous, potassium and oil-shale ash in various combinations. The yield of some sample plots in the current year is about 240 m^3/ha. Now a productive forest is growing and would begin performing useful functions. Than the better growing forest, all the greater its sanitary importance and recreative value. The peat-bog is also noticeably richer in bird-life now. As a result of afforestation of the treeless bog, the food for wild animals has become richer. The afforested Rae bog is very interesting area (1080 ha) for walks, picking mushrooms and other pastimes and particular object for forest research work.

The Rae experimental area was set up with the aim of investigating the possibilities of afforestation of numerous

treeless raised bog in the vicinity of Tallinn. In centre of researches were questions of ditch density, the right choice of leading tree species, soil preparing for forest cultures, the density and method of cultivation (planting and sowing), the influence of fertilization with oil-shale ash, nitrogen, phosphorous and potassium to tree growth, plant cover and processes of forest soil genesis.

We got good preliminary results of growing Christmas trees on this bog and same time was clear that afforestation oligotrophic peat bogs in green zone of towns is possible. The oligotrophic peat-bog is the best area for research tree growing processis and for experimental works because the soil contitions is very homogeneous.

Experiments:

1. Pine cultures 1953. Plantig and seeding spots (patches) 2.5 x 2.5 m

This observe, that everyone of patshes with size 2,5 m and 2,5 m has 16 spots for planting or seeding. On this experiment for first we observe comparisons between planting and seeding. The height growth of planted pines was better than the height growth of seeded pines. Essentially big difference occur in growing stock. Growing stock of 42-years old planted pine stand is 257 m^3 per ha . At the same time growing stock of seeded stand 131 m^3 per ha, so nearly twice lower.

For second, the application of oil-shale ash 30 tons per ha has positive response to height growth of pines only shot period. Today the mean height of trees are practically similar. On this case the growing stocks are similar too and we have not possibility to advise to use the oil-shale ash for fertilization.

For third we can compare experiments where to oil-shale ash the mineral fertilizers (nitrogen and phosphorous) was added. Nitrogen fertilizer was applyed for many time. The height growth of fertilized pines are not bigger than of pines growing on unfertilized sample plots.

If we compare the yield of wood, it is clearly bigger on fertilized stand 330 m^3 per ha and on unfertilized soil 259 m^3 per ha. By the way in our conditions on most fertile mineral soil the growing stock of same age stands are 340 m^3 per ha. Question may arise only of the quality of the wood. Dominate of boughs are on fertilized sample plot conspicuously bigger than on unfertilized stand.

2. Pine cultures 1953. Planting and seeding spots 0.4 x 0.4 m

40-50 years ago in Soviet Union academician Lõssenko. was sure that a competition and truggle exsist only between different speacies, but does not exsist between the same kind of tree speacies. Growing together the same kind of plant species are helping each other and supporting the growth of one-two leaders, there are no truggle for existence between pine seedlings. "The bigger is the number of seedlings growing together the better is the results " said Lisenko.

Our experiment was established for checking the valid of opinion of Lisenko. We established experiment with pines on spots 0.4 x 0.4m. We planted seadlings normally (one plant per spot) and with great density (3-4 seedlings together in bunch per spot); seeded normally (about 20 pine seeds per spot) and with great density (100 seeds per spot).

Sowing with normal density the growth increment of pines was really a little worse than on sample plot where 100 seeds per seeding spot are sowed. Volume of stand was in case with normal sowing 133 m^3 per ha and with dense seeding 135m^3/ ha. The difference is unimportant.

Experiment with planting of seedlings normal way and with bunch way saw the fluctuations of height growth. Volume is essentially greater in stand established on normal way. Our experiments are not bore the theory of Lisenko.

3. Pine cultures 1958. Fertilized.

In use mineral fertilizers another group of questions are arising. We spoke that using fertilizers stand volume growth increment will increase essential, but every time it is not true.

On this experiment pine culture was fertilized once with phosphorous and 5 times with nitrogen. The height growth of the stand has been similar in fertilized and in unfertilized pine culture. After fertilization with nitrogen alternation of tree species has begun. Birch is a nitrogen favouring tree species grows more quikly than pine. If we use repeatedly nitrogen fertilizers natural seeding of birches will break in the culture. If the birches have not been cut down, they have begun to kill pines. Arisen pine-birch mixed stand has not so big growing stock than pure pine stand, fertilized only by oil-shale ash. There are growing a little amount of birches.

4. Birch plantation 1958.

Birch plantation was established with natural regenerated plants, height of the seedlings was 20-40 cm. Before cultivation the sample plot was fertilized by oil-shale ash (10 tons per ha). This sample plot was fertilized 9 time with nitrogen, 2 time with phosphorous and once with potassium.

The fertilization has good response to height growth of birches. In normal growth contitions the silver birch (*Betula pendula*) and the downy birch (*Betula pubescens*) have similar growth intensity during first 15-18 years. After that the volume and height increment of *Betula pendula* is essentially better than of *Betula pubescens*.

In our example plot the growing stock of two birch species is equal. It is so therefore that the number of *Betula pubescens* per ha is 4477 and number of *B. pendula* only 341. So about volume of unfertilized birch stand we can not speak because it is very low.

5. Spruce cultures 1958. Planting. Fertilized.

The spruce cultures with high density are fertilized many times. 8000 plants per ha of spruces were planted. We saw for first that than more we have given the fertilizers all the better the spruces have grown. Today we may be convinced that in stand where abundantly nitrogen was applied the variation parametres of trees is increased. Number of trees with small diametre is great. The greater is variation of trees in stand having same density and height the smaller is growing stock.

On this experimental area crop up such kind of questions as why are the stands too dense, why the dead trees are not cut out, why the sample plots are not fertilized during last 15 years.

Refertilization is not needed, because the growth increment of the stand is good enough. The naturale circling of nutrient elements from organic material has arisen. If we shall bear off the felled trees, we take off lot of nutrient elements. There is a probleme with thinning of stands because after thinning can appear serious moose damages.

KOLJAKU-OANDU RESERVE IN LAHEMAA NATIONAL PARK. By Tõnu Terasmaa

A second excursion object was the Koljaku-Oandu reserve what is located at the north-eastern part of the Lahemaa National Park in the forest district of Sagadi. The reserve is east-west orientated and about 5.7 km long covering 899 ha (1.4% of the total territory of the national park which is 64,910 ha).

The reserv is geomorphologically unique in Baltic countries as it cover the most expressive part of different geomorphological formations of the Littorina Sea and the Ancylus Lake, the forerunners of the Baltic Sea. Different geomorphological development of the reserve has caused the terraced character of the territory and the gradual fall of height towards the North direction. Within the whole reserve there are numerous coastal landforms from the different development stages of the Baltic sea.

As regards a diversity of natural forests, the most widespread are pine stands (45.5%), followed by spruce stands (33.8%), birch stands (15.2%) and black alder stands (5.5.%). The total volume of growing stock is 196,000m3. The average age of pine stands and spruce stands is 74 and 77 years respectively. Also a comparatively high mean age have birch stands (53 years) and black alder stands (62 years). Therefore all the forests in the reserve are relatively old – mean age is 71 years. Despite the comparatively high age, the density of the stands remains relatively high under Estonian conditions – on the average 0.81. The average quality class of the stand crop is 2.5, as regards spruce stands and pine stands – 1.7 and 3.1 respectively.

Nowadays the reserve can be characterized by a progressive process of becoming swampy. The reason are the plenty of springs which depart from the basis of terraces. Old ditches having minimal slope and east-west direction practically do not function any more. They were built already in the second half of the previous century.

The changes observed in recent years in the forest fund of the reserve can also be explained by the process of swamping. The relative importance of alder stands has been continuously growing. At the same time there are changes towards the reconstitution of a monolithic forest massive. Pure stands are being substitute with mixed stands, forests with felling areas in them are reforming their new initial borders in accordance with the changes of their growth conditions. As a result of forest becoming older the stand density is decreasing. The quality of the stand, however, has constantly been growing.. Since the establishment of the reserve in 1971 the total volume of dead stand crop has doubled. It is obvious that after some time the stands of the Koljaku-Oandu reserv looks like a real primeval forest.