Dynamics of Basal Area Increment on Sample Trees in Selected Stands of Scots Pine in the Niepołomice Forest Near Krakow

by
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Abstract

In the Niepołomice Forest were established two experimental areas to study the impact of industrial air pollutants on the dynamics of the basal area increments (= BAI) during a period of 25 years. The diameter breast high (= DBH), the height and the thickness of bark were measured of all trees. The diameter increments were measured in five yearly periods on wood cores of more than twenty samples. Depending on this the average periodic basal area increments ($\overline{BAI}$) were calculated for the samples together as well as grouped in four DBH classes. It seems to be right that air pollutants are the antropeic ecological factors with a special activity. At first are eleminate the most weaker trees from the stands and then obliterate the normal differentiation on the rest living trees. Impact of air pollutants seems to be an acceleration factor in processes of senescenting of stands.

Introduction

In conclusion to Prof. Knabe's work, which was presented at IUFRO Symposion, Essen, Western Germany, appointed the two important problems in world forestry research. The future of the forest ecosystems in large industrial and industrialised regions this is determined by resolution of them. The first is the protection of the forest areas against the air pollution in all this localities, which are still without these badly impacts. The second one is to show the people generally what is really the endagering the living forests surrounding industry establishments and how much ist the financial loss indeed. The wastes are uncountable at all without the measuring method.

The scientists who are engaged now in problems of growth and increments of trees and stands growing in industrial regions are Dr. J.Pollanschütz, Wien,Austria and Dr. B.Vinš, Zbraslav, Tschekoslovakia, as well as Dr.J.Greszta,Krakow, Poland, Dr. J.Olszowski and Dr. S. Godzik,Zabreze,Poland. The other authors who didn't publish their works yet in the IUFRO materials, but who are engaged in the problems of lowering increment in forests under the impact of industrial fumes are Prof.E.Bjorkman, Stockholm, Sweden and Ass. Prof. Dr. B. Ruthkowski, Krakow, Poland.

The negative symptoms of industrial air pollutions in Niepołomice Forest were first noticed in the years 1961 - 1970. Needles of Scots Pine were turning yellow and became shorter, tree crowns by and by looser and many dead standing trees in stands appeared. Appearance these symptoms of threat to the natural environment of Niepołomice Forest gave the author reason to start researches on the changes of increment in Scots Pine stands the most endangered by air pollutants.

In those investigations was appointed to establish the changeability in basal area increment on samples chosen like a proper indicator in differentiations of strenght in living processes on poisoned trees.

M e t h o d

It was adopted 25 yearly period of investigations as a proper time to show everyelse changes in dynamics of increments depending on impact of industrial fumes. In Niepołomice Forest there were established two comparable experimental areas. Area No. 1 was situated near by the West boundary of forest the area No. 2 deeper of the forest about 10 km to the East from the first. On both areas there were 90 years old Scots Pine stands of second stand quality classes. The area No.1 presented the pre-dominant in this part of habitat - the fresh mixed forest (Querco - Carpinetum) the area No.2 - on the habitat of humid mixed forest (Querco - Pinetum).

It was carried out the measurements of DBH, height and the thickness of the bark of all the trees. The trees were assigned to the biological classes of Kraft (2). Using method of Draudt (1) there were chosen 10 percent of trees in proportion to the number of trees calculated in DBH degrees. These trees as samples were bored with the Pressler increment borer in DBH in four directions in accordance to the four quarters of the globe. On the wood cores there was measures the thickness of bark and the DBH increment of 5 yearly periods. There were calculated mean value of bark thickness and mean DBH increment of each bored tree. Then there were calculated the DBH of samples given on the end of every increment periods also values of periodic basal area increments (= BAI).

Because in the age over 65 years the high increment of Scots Pine is early going down it was possible to take BAI like a proper indicator in processes of growth of trees. The BAI which is depending on value of the DBH and DBH increment too, is more proper in using by valuation of intensity of processes of growth of tree than the DBH increment itself. It isn't the same if the DBH increment will be realised on a thin or a thick tree.

R e s u l t s a n d D i s c u s s i o n

On the figure 1 there are given the BAI - average for all samples. On the experimental area No. 1 the average BAI (=$\overline{\text{BAI}}$) in the time of last 25 years are a little bigger, and they reach the value equal to the value established at the beginning of research in the last 5 yearly period. Therefore on the experimental area No. 2 the $\overline{\text{BAI}}$ of trees is consequent going down in time. It may be established that the currency of the process is normal. On the area No.1 the $\overline{\text{BAI}}$ on samples in the period of 25 years is 0.0310 sq.m. and on the area No.2 0.0298sq.m Both those effects are similar. It is interessting if the participation in the $\overline{\text{BAI}}$ of different groups of samples on the both experimental areas is similar.

On the figure 2 there are presented the $\overline{\text{BAI}}$ separate for samples divided in four DBH classes. In the first class there are the trees thinnerthan 20 cm before 25 years, in the second - DBH 20.1 to 30.0 cm, in the third - DBH 30.1 to 40.0 cm and in the fourth class there are trees thicker than 40.0 cm - 25 years ago. On the area No.1 periodic - 5 yearly $\overline{\text{BAI}}$ on samples from the sesond DBH class increases like on all samples - presented on the figure 1. The $\overline{\text{BAI}}$ on samples from the third DBH class never, in any period don't come over the first, start value however the $\overline{\text{BAI}}$ on the thickest samples increase during the whole 25 yearly period of time. The processes are quite different of the $\overline{\text{BAI}}$ on samples from the different DBH classes on the area No.2. The $\overline{\text{BAI}}$ on the samples from the first and the second classes of DBH in every from 5 yearly increment periods are bigger than the start value, but on the samples from the third and the fourth DBH classes - vice versa. It is good to appoint that on the area No.1 there are the most $\overline{\text{BAI}}$ on the samples from the third DBH class, and on the area No.2 are the same on samples from the fourth DBH class.

It seems to be that all above given differences in the dynamics of $\overline{\text{BAI}}$ on samples may be explained depending on another character in impact of industrial fumes based on different situations of experimental areas. On the area No.1 endagered more than 20 years ago by influences from air polluting aerosoles still dead trees are observes, behind in different period intensity. This is the case of relative rising in light factors. It is the cause that in currency of time the $\overline{\text{BAI}}$ on sample trees from the second and the fourth classes become bigger, as they are still at the same level on the samples from the third class. The $\overline{\text{BAI}}$ on the same time period isn't going up. On the experimental area No.2 - situated deep in Niepłomice Forest dead trees doesn't occur as quickly when impact of fumes endagers most the highest trees. Those are the samples from the third and the fourth DBH classes. It means that natural decreasing of the $\overline{\text{BAI}}$ can be therefore accelerated by air pollution. Thinner trees which have shadow living conditions can in the same time increase the $\overline{\text{BAI}}$.

C o n c l u s i o n s

It seems to be right that chronic impact of fumes is the new anthropeic ecological factor with a special activity. First it causes quick elimination the most weaker trees from the

the stands which was appointed like an abnormal phenomenon presented as appearing of dead trees and then it becomes ob literated the increment differentiation on the rest living trees. It leads then to gradual stagnancy in their growth. Particular limitation those two periods in time in which fumes are acting is difficult or even impossible. Above mentioned conclusion isn't quite proofed not heavy effects in this elaboration. But it seems to be interesting to investigate further the problem on ecology of forest surrounding industrial regions. Next studies of these problems are continued by author.

A c k n o w l e d g e m e n t

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L i t e r a t u r e   c i t e d

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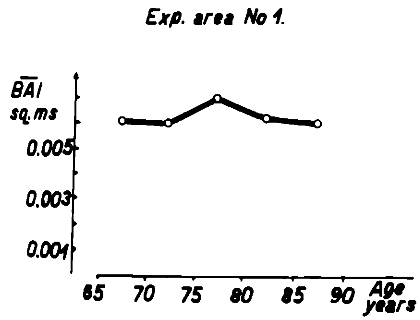
Periodic average basal area increments

Figure 1.



Periodic average basal area increments

Figure 2.