Bioindikation in belasteten und unbelasteten Gebieten

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Bioindikation in belasteten und unbelasteten Gebieten

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CONTENTS

INTRODUCTION

Collaboration in the field of forest die-back research between the Slovenian and the Austrian scientists started in 1990 (ANONYMOUS 1991) and the present research project, entitled "Bioindikation in unbelasteten und belasteten Gebieten" is the continuation of the cooperation between the research group working at the Karl-Franzens Universitaet in Graz, led by Prof. Dr. D. Grill resp. Doc. Dr. H. Mayrhofer, and the group working at the Institute for forest and Wood Economy in Ljubljana, led by Prof. Dr. F. Batič.

The main subject of the cooperative research is to study the influences of air pollution on the forests using bioindication methods. The first part of the project deals with investigations of biochemical and anatomical structure of Norway spruce needles in order to determine the degree and extent of the influences of pollutant gases from Thermal Power Plant in Šoštanj (North Slovenia) on the surrounding forests. The second part represents a study of epiphytic lichen vegetation as a bioindication systeme for monitoring air pollution. The main study area is situated in the immission zone of the above mentioned power plant, but the research has been conducted also in a few other regions in Slovenia .

The Thermal Power Plant in Šoštanj is situated in the Šalek valley (Šaleška dolina) in central north Slovenia. It has a power of 745 MW and it supplies one third of electric power needs in Slovenia. As it uses locally mined lignite with about 1,4% content of sulphur, the emissions of pollutant gasses from the power plant are very high . Annually the plant emits about 90.000 t of SO2, 11.000 t of NOx and 8.000 t of dust particles (HRČEK et al. 1992). Thermal power plant has been working for over thirty years. Severe damages on forests appeared on acidic soils in 1985, approximatly 15 years after the full installation of the power plant (KOLAR 1989, FERLIN 1991).

The power plant is situated in the bottom of the valley at the altitude of 350 m. Mountains on the western side are rather high and steep, reaching 1550 m, while on the eastern side the mountains are lower, reaching only 900 m. There are no strong winds in the area, but locally upslope and downslope winds predominate. Under certain weather conditions two types of temperature inversions can be formed above the valley. The first occurs usually at 100 m above the valley bottom protecting settlements in the valley from the polluted air. Under anticyclonic conditions another inversion is formed at the altitude between 1100 and 1200 m. Both inversions keep polluted air masses in the rather narrow layer and contribute to the forest decline (HRČEK et al. 1988).

Effects of the emissions from the thermal power plant on the vegetation are well pronounced, especially on the sites in the close vicinity of it. These effects on the forests are described in the first report of the Slovenian - Austrian cooperation (KALAN 1991).
As it is difficult to delimit the extent of the emission area of the Thermal Power Plant in Šoštanj as well as to distinguish between natural and antropogenic factors (e.g. air pollution), which are causing forest decline, several investigations have been carried out in the area in order to solve that problem. The first were dealing with forest die-back inventories (ANONYMOUS 1987, KOLAR 1989) and the reduced forest trees growth (FERLIN 1990). Later, the effects of air pollution on the anatomy and physiology of forest trees have been studied (ŠLIBAR 1990, BATIČ & KRALJ 1991, RIBARIČ- LASNIK 1991, RIBARIČ- LASNIK & BATIČ 1991, KMECL & BATIČ 1992), considering also natural stresses such as climate, soil and biotic agents (LEŠNJAK et al. 1989, SIMONČIČ 1992). The influences of the polluted gasses from the thermal power plant on the nearby forests and on the the vitality of the trees have been proved again. However the delimitation of the emission area of the thermal power plant is still uncertain as the study should consider the part of damages, caused by the thermal power plant, but in connection to natural stress factors, forest management and transboundary transport of air pollutants. In this respect the collaboration with the Austrian colleagues, who helped us with the new methods and their experience in this field of research, is considerable in persuading certain authorities that emission of pollutants from the thermal power plant should be cut down as much as possible inspite of rather great costs needed for installation of cleaning devices.

In addition to the described research interests another aspect of the problem arose. The emission source in Šoštanj is rather close to the Slovene-Austrian border (about 30 km). It would be usefull to determine the pollution emission - imission situation in this area in connection with the problem of local emission centers and transboundary transport of air pollutants.

The additive desulphurisation of the emission gasses from the power plant has been implemented since 1991. There is a possibility to study the changes appearing on the vegetation after taking this measures and, last but not least, it is also interesting to study air pollution effects on vegetation in the climate and soils of Southern Alps in comparison with other areas in Europe.

Brief reports from both parts of the cooperative research project will be given separately.

I. DETERMINATION OF THE INFLUENCE OF AIR POLLUTION ON THE FOREST ECOSYSTEM ON THE BASIS OF STUDY OF STRUCTURE AND PHYSIOLOGY OF PLANT TISSUES AND ORGANS

(Feststellung des Einflusses der Luftverunreinigung auf das Waldoekosystem aufgrund der Struktur und Funktion von Pflanzen geweben und Organen).

1. INTRODUCTION

The analysis of the structure and physiology of plant organs and tissues can explain the mechanisms and causes of damages, which are either directly caused or triggered by air pollution.
The analysis of photosynthetic pigments have been often used for determination of air pollution on plants (JAEGER 1982, SCHUBERT 1985, GRILL et al. 1983, 1988, BERMADINGER et al. 1989, LUETZ 1988, LANGE et al. 1987, KOESTNER et al. 1990, etc.). Photosynthetic pigments can reflect directly the influences of air pollutants (sulphur dioxide, hydrogen fluoride and several photooxydants), or they can indicate disturbances through mineral nutrition (LANGE et al. 1987, MIES & ZOETTL 1985, LICHTENTHALER et al. 1985). Acid air pollutants such as sulphur dioxide and hydrogen fluoride act detrimentally on chlorophylls (JAEGER 1982, GRILL et al. 1983, LUETZ 1988, BERMADINGER et al. 1989, etc.), while photooxydants influence especially concentration and composition of carotenoids (RENNENBERG 1988, BERMADINGER et al. 1989). In order to determine the emission area of the Thermal Power Plant we decided to analyse these pigments in the needles of Norway spruce, grown on chosen sites in the surrounding areas.
Appart from the analysis of photosynthetic pigments as stress indicators in Norway spruce needles we also tested the integrity of needle membranes by measurement of electrical conductivity of needle diffusate and potassium efflux from the needles. These two parameters are often used as stress indicators either for climatic factors (ARONSSON & ELIASSON 1970, ZHANG & WILLISON 1987) or for determination of air pollution influences (FEILER 1985, KELLER 1986, ZWIAZEK & BLAKE 1991).
For better determination of stress in Norway spruce detailed analysis of several biochemical parameters in the needles are necessary. According to the experiences from the group in Graz we decided to analyse the content of thiols and ascorbic acid in the needles and measure the activity of the enzyme peroxidase. It was also decided to analyse complete composition of photosynthetic pigments, with a special attention to carotenoids.
According to topography of the valley, composition of air pollutants and climatological conditions, we expected high sulphur pollution in the valley and especially on the slopes between both temperature inversion zones, and the presence of photooxydants on higher altitudes.

2. MATERIAL AND METHODS

2.1. Material

Norway spruce (*Picea abies* (L.) Karsten) needles, sampled from the sixth whirl from the top of the crown, collected on apparently healthy and vital trees, between 60 and 80 years old, were collected twice in two different profiles laid over the valley using different ways of sampling procedure (Fig.A, Fig.B).

2.1.1. Sampling profile SMREKOVC-VINSKA GORA

The first sampling was carried out in autumn 1990. A pair of the above described spruce trees were felled in a profile laid over the valley (KALAN et al. 1991). The profile contained 62 sampling plots with 50 m of altitudinal difference between each of them (Fig.A, Fig.B). Besides the profile, needles were also sampled in the same way from five research plots, previously established for pedological analysis, which were selected on acid soils in close vicinity of the Thermal Power Plant. The profile and the five plots were chosen according to topography of the valley and climate conditions (temperature inversion zones and predominant wind directions). Needle year classes were separated in the field, put into plastic bags and tranported dayly in a cool box to the laboratory in Ljubljana. There, needles for pigment analysis were deep frozen at -20 o C, while the needles for membrane tests were left in the refrigerator at 5 o C. Sampling was carried out during dry and stable weather in October 1990.

2.1.2. Sampling profile SMREKOVC-ŠOŠTANJ-POHORJE

The second sampling was performed at the begining of September 1991. Apart from the air pollution situation, determined by topography and distance from the thermal power plant, the sampling profile was adjusted to the intensity of forest die-back (regarding more sensitive soils!), so that part of the profile crossed the valley in direction North - South, reaching Pohorje mountains on the North. In this way then following ten sampling plots were chosen:

1. Lajše (altitude 360 m, distance from thermal power plant (TEŠ) 2 km, NW; deep sandy - loamy soils; forest damage class II)
2. Topolščica (altitude 375 m, distance from TEŠ 4,25 km, NW; deep sandy - loamy soils; forest damage class I)
3. Laze (altitude 380 m, distance from TEŠ 9 km, SE; distric cambisol; forest damage class I)
4. Veliki vrh (altitude 470 m, distance from TEŠ 2,75 km, SE; distric cambisol; forest damage class II)

5. Graška gora (altitude 680 m, distance from TEŠ 7,2 km, N; rendzina; forest damage class I)
6. Zavodnje (altitude 750 m, distance from TEŠ 8,25 km, NW; distric cambisol; forest damage class III)
7. Brneško sedlo (altitude 1000 m, distance from TEŠ 21,5 km, NW; distric cambisol; forest damage class II)
8. Kramarica (altitude 1050 m, distance from TEŠ 12,75 km, W; distric cambisol, forest damage class I)
9. Kope (altitude 1480 m, distance from TEŠ 20,2 km, N; distric cambisol; forest damage class II-III)
10. Smerekovc (altitude 1520 m, distance from TEŠ 12,75 km, W; distric ranker; forest damage class I)

Sampling sites 1, 2,and 3 are situated below the lower temperature inversion zone and therefore protected during stable weather from the influences of polluted gasses from the thermal power plant. Sites 4, 5 and 6 are the most polluted, laying on the slopes between the two inversion zones. Site 4 is also very close to chimneys in the downwind direction, site 6 represents the site with very poor soils, exposed to direct air pollution from the plant and to downslope winds which intensify the immission on the site. Sites 8 an 10 are most of the time out of reach from the polluted air because of high altitude and opposite position to the thermal power plant and prevailing wind direction in the area. Sites 7 and 9 are on the ridges of Pohorje mountains, out of the closest immision zone. At the begining air pollution monitoring around thermal power plant, it was supposed that this area was not influenced by the exhaust gases from Šoštanj. By now several signs of forest dieback have been observed on the whole western ridge of Pohorje, from Mislinja to Slovenj Gradec. According to topography and climate conditions the reason for forest dieback in that area is presumably air pollution from Šoštanj.

In the very close vicinity of sites 2, 4, 5 and 6, there are permanent ANAS staticns, which monitor standard climate parameters, dust particles in the air and SO2 concentration. The station on the site no.6 (Zavodnje), where forest dieback in the area began and has been the most extensive, is equiped also with measuring gauges for O3, HF, and NOx. The whole monitoring system belongs to the thermal power plant and is run by the Electrical Institute Milan Vidmar in Ljubljana. All data from these stations are available.

Forest damage classes were determined by local foresters using the ECE prescribed method (KOLAR 1989).

On each of the sampling plots needle samples were collected by climbing from five Norway spruce trees per plot. Sampling procedures were carried out according to the recomendations by the colleagues from Graz, especially for carotenoids, thiols and ascorbic acid analysis (ESTERBAUER & GRILL 1978, GRILL et al. 1979, GRILL & PFEIFHOFER 1985). Analysis were carried out in laboratories in Ljubljana and Velenje.

2.2. Methods

At analysis, carried out in Ljubljana, pigments were determined spectrophotometrically by using 100% acetone extraction method described by ŠESTAK et al. (1971), while calculation of the pigment concentrations followed the method by LICHTENTHALER (1987). Crude acetone extracts from chosen needle samples from the profile 1990 were sent to Graz, where detailed pigment analysis were carried out using HPLC method (BERMADINGER et al. 1989). The detailed pigment analysis and analysis of ascorbic acid, using HPLC method, have not been succesfully introduced yet in laboratory in to the Ljubljana.

Membrane leakage test was made using the method by KELLER (1986).

Analysis of water soluble thiols was carried out by the method of GRILL & ESTERBAUER (1973) and activity of the enzyme peroxidase by the method of KELLER & SCHWAGER (1971). In all needle samples the macronutrients S, Ca, K, and Mg were also anlysed using standard methods.

3. RESULTS AND DISCUSSION

3.1. Results from sampling in 1990 (The SMREKOVC-VINSKA GORA profile)

Some chosen results of the needle pigments and diffusate analysis are shown in figures from 1 to 24. The figures 1 to 10 represent the results of needles analysis for those sampling sites in which detailed analysis of pigments were carried out, appart from spectrophotometric determination of pigments and diffusate analysis. Figures from 11 to 21 represent some chosen measurements of pigments, where chlorophyll concentration in needles began to decrease already in the third or fourth needle year class. All values for pigment and diffusate analysis are averages of the two measurements in the needles from both trees at each sampling site. In figures from 22 to 24 the average values for pigment contents and diffusate analysis for the three years old needles are given according to the altitude of the sampling sites, separated for both sides of the valley.

The pigment contents in Norway spruce needles have been influenced by pollutant gases from the Thermal power plant. As it is demonstrated on the figures from 1 to 21 there is a change in the pattern of pigment concentrations, especialy of chlorophylls. The concentrations of the chlorophylls start to decrease in many samples already in the three year old needles, which is not a normal situation. This change in pattern of chlorophyll concentration was found in samples from the different altitudes from the sampling profile. It was the most obvious in the samples from that part of the profile, which lies within both temperature inversion zones (Fig.11 to 21), but it was also detected in the samples collected on the five research plots, chosen for pedological investigations. The chlorophyll content pattern in the samples collected on the sites which be above the upper inversion zone (above 1100-1200 m of altitude) is as expected. Absolute values of the chlorophylls (chlorophyll a and b) are rather low, but still within the normal ranges for Norway spruce. In the current year needles concentrations of total chlorophylls varied between 1 and 2 mg of chlorophylls per g of needle dry weight, while four years old needles contained between 1.5 and 3 mg of chlorophyll/g D.Wt. dry weight. The ratio between chlorophylls a and b was around 2.5 on the majority of the sampling sites. The concentrations of total carotenoids, determined spectrophotometrically, were between 0.2 and 0.5 mg/g D.Wt. Values of the ratio quotient between chlorophylls and carotenoids were between 4 and 12, in majority of samples from 4.5 to 6. Amounts of carotens (alfa and beta caroten) and xanthophylls (lutein, zeaxanthin, violaxanthin, neoxanthin and antheroxanthin), determined in Graz by the HPLC method, were very low. The reason was probably in the sampling and extraction procedures, which haven't been addapted yet for these kind of analysis.

The results of needle diffusate analysis (pH of diffusate, potassium efflux in mg of K/g D.Wt., and electrical conductivity in mikro S/cm), also shown on figures 1 -10 (c), are rather scattered. After two hours of shaking the measured parameters varied as follos : for pH from 4.41 to 6.81; for conductivity (mS/cm) from 18 to 187; for K efflux (mg K/g D.Wt.) from 39 to 1561. After 24 hours of shaking the same parameters varied within the following values : pH from 3.89 to 5.85; conductivity (mS/cm) from 15 to 664; K efflux (mg K/g D.Wt.) from 20 to 3049 .

As can be concluded from the figures, the results of photosynthetic pigment analysis confirmed the findings of other authors, namely the changed chlorophyll contents in the case of SO2 air pollution (RABE & KREEB 1980, GRILL et al. 1983, BERMADINGER et al. 1990, SIEFERMANN-HARMS 1990). The decrease of the total chlorophyll content and the total carotenoid content started in the three years old needles, but it was also detected in two years old needles (RIBARIČ-LASNIK 1991). When annual pathway of chlorophyll and total carotenoid concentration was followed, unfortunatly only in two needle year classes, the increase of pigments was also detected in the same trees where earlier decrease was well pronounced (RIBARIČ-LASNIK 1991,). The destruction of the chlorophylls, due to SO2 air pollution, is not surprising. The measured one month average of the SO2 immissions in the middle of the western side of the sampling profile (Zavodnje, 850 m of altitude) are between 30 and 60 mikro g SO2/m3 in summer months and between 40 and 100 mikro g SO2/m3 in winter months (HRČEK et all. 1992). Peak concentrations in certain periods are much higher.There is a slight decrease in chlorophyll concentration with increasing altitude of sampling site on the western part of the profile, but the increasing concentrations of chlorophylls were determined in several samples from the most polluted sites on both valley sides within the temperature inversion zones (Fig.22a,b). High pollution with sulphur dioxide in the sampling area was also proved by analysis of total suphur content in spruce needles and epiphytic lichen observations on felled spruces. Except for ten sampling sites at above 1200 m of altitude on the western part of the profile, which were classified to first and second class of sulphur content classes (KALAN 1991), all sites belong to the third and the forth class. The situation is the same with classes of atmospheric purity as determined by epiphytic lichen cover. From all these data it can be concluded that alterations in Norway spruce needles result from direct influences of the polluted air, although decrease in pigment concentrations can also be a consequence of changes in the soil, especially in unsufficient magnesium availability which was proved in one of the pedological research plots (SIMONČIČ 1992), which is also part of the profile. Very high values of the chlorophylls/carotenoids ratio in certain parts of the profile can indicate the presence of photooxydants. This will be confirmed by the detailed analysis of carotenoids. The present results of analysis of these pigments can only be considered as preliminary because sampling and extraction procedure has not been defined yet.

The analysis of diffusates are in agreement with pigment analysis. Samplig sites, where pigment concentrations show changes in pattern, showed also the highest potassium efflux. Peaks of potassium efflux respond also to the high values of diffusate conductivity (Fig.23-24,a,b). This can be considered as the indication of membrane leakyness caused by sulphur dioxide or photooxydants, or some other stress factors.
Numerical data of all sample analysis can be find in the annex to the report.

From the results briefly presented above it can be concluded that the thermal power plant affects the nearby forests. In the years, when climate conditions do not cause large scale and severe drying of trees, the influence of emission gases can be detected on the biochemical level, e.g. in high sulphur content, changes in photosynthetic pigments pattern, membrane leakage, etc. .

3.2. Results of sampling in 1991 (The SMREKOVC-ŠOŠTANJ-POHORJE profile)

The results of sampling in 1991 are presented on figures from 25 to 35, the numerical data of the sample analysis can be found in the annex to the report. Unfortunatly, we have not been able yet to introduce the HPLC method for pigments and ascorbic acid analysis in the laboratory in Ljubljana because of late delivery of the equipement needed. Therefore we present in the report only data of spectrophotometrical analysis of pigments.

3.2.1. Analysis of photosynthetic pigments

The results of pigment analysis are presented on figures from 26 to 35 . Values for total chlorophylls (chl a + b) are between o.56 and 1.28 mg/g D.Wt. for current year needles, and between 1.20 and 2.26 mg/g D.Wt. for four years old needles. Changed age pattern was determined similary as at sampling in 1990. Especially in samples from sites Zavodnje and Veliki vrh, which are the most polluted ones, this tendency is the most pronounced. The concentration of chlorophylls start to decrease already in the third needle year class, and even more in four years old needles. In these two sites also absolute concentrations of chlorophylls are the lowest. Chlorophyll concentration in needles slighlty decreases with altitude which was also found at sampling in 1990. Chlorophylls b and a do not show any special trends according to total chlorophylls. Quotient chl a/chl b is between 2 and 4, but most for data it is around 2.5. The value of that quotient is slighlty lower in sites from lower elevations which might be a sign of greater breakdown of chlorophyll a in the presence of sulphur dioxide.
Values of total carotenoids show the same behaviour as chlorophylls. In current year needles the concentrations are between o.142 and 0.283 mg/g D.Wt., and between 0.223 and 0.471 mg/g D.Wt. in four years old needles. Again, the values are lower in sites from lower elevations and the lowest in the samples from the most polluted sites Zavodnje and Veliki vrh. Values of the quotient between total chlorophylls and carotenoids are between 3.3 and 5.9 on current year needles and between 3.5 and 4.8 in four years old needles. This might indicate a slow decrease of chlorophylls with age of needles in comparison with carotenoids and might reflect aging of needles or maybe also the influence of sulphur pollution.
All pigment data discussed above are related to average values of five trees from each sampling plot. Scattering of data among the trees is rather low, for total chlorophylls the standard deviation acconuts 0.21.

3.2.2. Analysis of peroxidase activity

Activity of the enzyme peroxidase is presented in units of enzyme per g of lyofilised spruce needles. Data are presented on the same figures as for chlorophylls. The activity of the enzyme increases with the age of needles (from 3.81 to 29.20 in current years needles and from 14.67 to 31.40 in four year old needles). Activity is the highest in three year old needles (from 15.19 to 49.55) which coincides with the data for pigments. There are some sites with rather low peroxidase activity, such as the most polluted site Zavodnje, or the site Smrekovc at the highest altitude in the sampling profile, the sites Lajše and Laze, which are situated below the lower temperature inversion and one site on Pohorje.
Generally, data on peroxidase activity are rather scattered, also among the trees from each of the sampling sites. The average standard deviation for all sites accounts 8.12.

3.2.3. Analysis of water soluble thiols

As analysis of samples collected in 1991 were not carried out in time it was not possible to measure thiol content in them. All values determined were too low. Therefore we repeated sampling in the same localities and in the same way in 1992 and data, presented on the same figures as pigments and peroxidase activity are the results of sampling in 1992. Only two needle year classes were analysed. Concentrations of thiols in current year needles are between 0.16 and 0.52 umol/g lyofil. D.Wt., and between 0.21 and 0.41 umol/g lyofil. D.Wt. in two years old needles. The highest values were determined in samples from sites Kramarice and Berneško sedlo, which are both on the altitude of 1000 m. Maximum concentrations (between 0.68 and 0.84 umol/g lyofil. D.Wt.) were found in needles of trees growing on higher altitudes and not at trees from lower lying sites where SO2 pollution is higher. Data of thiol concentration in needles are very homogenous, the average standard deviation of all data is 0.08.

3.2.4. Analysis of total sulphur content in needles

Data of total sulphur content, expressed as a percent of needle dry weight, are presented on Fig.25. Two needle age classes were analysed. Sulphur content was found to be higher in sites in lower elevations such as Veliki vrh, Lajše and Topolščica, which are closer to the thermal power plant. According to sulphur content classes these three sites belong to the class 4, other sites belong to sulphur classes 3 and 2. The results of total sulphur content analysis are similar to those obtained by sampling in profile SMREKOVC-VINSKA GORA in 1990 (KALAN 1991).

4. DISCUSSION

The intention of Norway spruce needles sampling in two profiles over the Šaleška dolina (Valley of Šalek), where the thermal power plant in Šoštanj is situated, was to determine the impacts of polluted gases from the plant on the biochemical and physiological parameters of spruce, in order to delimit the extent of the immission area and also to determine the role of this pollution in forest decline in that part of Slovenia. As forest decline is a consequence of numerous factors, natural and anthropogenic, we decided to analyse those parameters in needles which would help us to fulfill the above mentioned intention.

Analysis of needle pigments in both periods of sampling gave similar results as other researchers had reported from elsewhere in the Alps under similar climate, pollution and topographical situation (LUETZ 1988, BERMADINGER et al. 1989, GRILL & SCARDELLI 1990, BERMADINGER-STABENTHEINER & GRILL 1992). In our situation, the difference is that air pollution in the bottom part of the sampling profile is much higher. In 1991 the average year sulphur dioxide concentration below the lower temperature inversion zone was 0.04 mg/m3. It was measured in Šoštanj, a site very close to our sampling site Lajše, and also the same value was measured in site Topolščica. 98 percentil value for the same localities were 0.38 and 0.28 mg/m3. On the most polluted sites Zavodnje and Veliki vrh, which are both included within the two temperature inversions, the mean year concentration of SO2 accounted 0.05mg/m3 in Zavodnje and 0.08 mg/m3 on Veliki vrh. 98 percentil value for these sites were 0.45 mg/m3 and 0.55 mg/m3 (ČUHALEV et al. 1992). Peak values of sulphur dioxide were much higher. Chlorophyll concentrations show in both sampling periods changes in age pattern from some sites in the most polluted belt of the sampling profile. Concentrations of chlorophylls start to decline already in the third or the fourth year. In the same earlier samplings in the same area a decrease of chlorophylls was determined already in the second year of needle life, especially when sampled during winter or spring, but the same needles contained later, during summer and autumn, the highest amount of pignnets (RIBARIČ-LASNIK 1991). At both samplings we found also a slight decrease of chlorophylls with growing altitude of the sampling site which is consistent with changing light atmosphere and stronger stress in the presence of oxydants (LUETZ 1988, BERMADINGER et al. 1989, GRILL & SCARDELLI 1990, BERMADINGER-STABENTHEINER et al. 1991, etc.). Unfortunatly only in some of the samples collected in a 1990 detailed composition of corotenoids was analysed in laboratory in Graz. Total carotenoids, determined spectrophotometrically, show the same behaviour as chlorophylls,which is in agreement with findings of some other authors (RABE & KREEB 1980, GRILL et al. 1983, KOESTNER 1989).

Results of the measurements of the activity of enzyme peroxidase as a general stress indicator are very scattered and difficult to comment according to other data and sampling site conditions. As this enzyme is known to be an unspecific stress indicator (JAEGER 1982) we are not surprised that we have not found any closer correlation between the activity of the enzyme and the total sulphur content in needles. The enzyme might respond stronger to other stresses like oxydants, drought and patogens. The same results we got when we analysed Norway spruce needles in a profile laid over the city of Ljubljana, where the activity of peroxidase responded more to traffic than to sulphur dioxide air pollution (ROMIH 1990).

Water soluble thiols as biochemical indicators of stress and sulphur dioxide pollution indicators were analysed for the first time in forest die-back investigations in Slovenia. As the method of analysis has just been introduced the results obtained are merely preliminary. As already mentioned the results are very homogenous. Thiol content does not differ much with sampling sites in the profile and, what is more suprising, the sites with the highest total sulphur content do not have the highest thiol content. According to statements in review article given by SMITH et al. (1990) this can be explaine ba the fact that the sulphur dioxide concentrations in these sites are so high, especially during nights, that the sulphur supply exceeds the ability of spruce needles to metabolise it in forming thiols. High total sulphur content, probably mostly anorganic sulphur, determined in these needles, can prove this. The highest values of thiols were measured in needle samples collected on two sites on the altitude of 1000 m, quite remote from the thermal power plant. It must be stated that all needle samples had rather high sulphur content, sulphur content class II was the lowest measured. According to some other investigations (GRILL & SCARDELLI 1990) the concentrations of thiols in our samples are rather high, but quite comparable to others (GRILL & ESTERBAUER 1973).

Biochemical investigations of Norway spruce needles significantly contributed to better understanding of stress situation of trees in polluted enviroment and gave additional data to forest dieback inventories and already earlier existing measurement of sulphur content in needles. When finished, they will help us to understand the origin and pathways of damages which are leading to forest decline and through this it will be easer to delimit the imission area of the Šoštanj thermal power plant.
Further studies are planned regarding samples collected in 1992, still in preparation.

Tätigkeit des Inst. für Pflanzenphysiologie der Karl-Franzens-Univ. Graz AG GRILL-STABENTHEINER

Wie im vorhergehenden Text deutlich und wiederholt hingewiesen, erfolgt die Bearbeitung des Projektes in Form überregionaler Zusammenarbeit.
Diese Zusammenarbeit mit dem Inst. für Forst- und Holzwirtschaft, Laibach (Prof. Batic) und dem Inst. für Pflanzenphysiologie, Graz, verläuft äußerst zufriedenstellend.

Unsere Aufgabe lag im wesentlichen darin, bereits vorliegendes verderbliches Probenmaterial zu analysieren. Die analytischen Methoden zur Bestimmung der Pigmente und der Ascorbinsäure mittels HPLC und der wasserlöslichen Thiole und der Peroxidaseaktivität mittels Spectrophotometer waren die selben, wie sie im Zuge anderer Projekte zur physiologischen Bioindikation an Fichten in Graz angewendet wurden. Die meisten Untersuchungen erfolgten anfangs durch Mitarbeiter unserer AG. Später wurde Frau Mag. Cvetka Ribaric-Lasnik eingeschult, wobei verschiedene Mitarbeiter halfen.

Dazu erfolgten auch längere Aufenthalte von Frau Mag. Cvetka Ribaric-Lasnik am Inst. für Pflanzenphysiologie in Graz:
10.2. - 14.2.1992
17.2. - 20.2.1992
15.6. - 16.6.1992: Homogenisierung (Labormühle) bereits gesammelter und tiefgefrorener Proben als Probenvorbereitung für die weitere Analyse.

Nach der Erlernung der Methoden betrafen mehrere kürzere Aufenthalte von Prof. Batic in Graz bzw. Mag. Ribaric-Lasnik die Klärung spezieller methodischer Probleme und Behebung von Fehlerquellen bei Analysen, aber auch besonders die Interpretation und Diskussion von Ergebnissen. Gezielt wurde auch auf eine Weiterführung dieses Projektes hingearbeitet.

Am 11. Juni 1992 fand in Laibach eine Besprechung bezüglich des Projektes statt (Teilnehmer: Grill, Stabentheiner, Batic, Ribaric-Lasnik). Schwerpunkt waren die Erstellung des Zwischenberichtes und die weitere Projektplanung. Während dieses Besuches in Laibach fand auch eine Besichtigung der zur Verfügung stehenden analytischen Möglichkeiten (HPLC) im Hinblick auf die Verwendbarkeit für das Projekt statt.
Im Anschluß an diese Besprechung erfolgte eine gemeinsame Exkursion in das Probengebiet um Sostanji. Hier konnte vor Ort über die Problemstellung im Rahmen des Projektes diskutiert werden. Im Zuge dieser Exkursion konnte auch das Labor in Velenje, wo ein Teil der Proben aufgearbeitet wird, besucht werden.

Als erste Dokumentation unserer Zusammenarbeit kann die Posterpräsentation von Prof. Batic anläßlich der IUFRO-Tagung in Dresden angegeben werden. vgl. Beilage

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Abstracts

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S. Feller, Institut für Forstbotanik und
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ANALYSES OF AIR POLLUTION INFLUENCE ON NORWAY SPRUCE NEEDLES SAMPLED IN A PROFILE OVER HIGHLY POLLUTED VALLEY IN NORTH SLOVENIA

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On the profile laid over highly polluted valley in North Slovenia Norway spruce needles were sampled in autumn of 1990. In the bottom of valley a termal power plant is installed with annual emission between 100.000 and 120.000 t SO_2 per year. Needles of Norway spruce were sampled from a pair of felled even aged (60 to 80 years) trees at each 50 m of altitude from the valley bottom (300 m) to the tops of both valley sides (1550 m, 900 m). The aim of the study was to determine the emission area of thermal power plant according to topography and meteorological circumstances (temperature inversion zones, wind direction). Apart from determination of health status of trees before felling (defoliation and yellowing class, other signs of damage) needles were analysed on total chlorophyll and carotenoid content, total sulphur and macronutrients content and on membrane lekeage (measurement of electrical conductivity of needle diffusate and potassium efflux). These measurements were carried out in the laboratory of forestry institute in Ljubljana while detail analyses of all photosynthetic pigments were carried out on some chosen samples from the profile in the aceton extracts in the laboratory of the Institut fuer Pflanzenphysiologie, Karl-Fraenzens Universitaet in Graz. The impact of air pollution on biochemistry of Norway spruce needles was proved to be high and very clear. It was manifested in high sulphur content of needles, low photosynthetic pigment content and changed ontogenetic pattern of pigments content and also in membrane desintegration indicated by high potassium efflux and high electrical conductivity of diffusate of damaged needles. These damages were the most severe in the nearest surrounding of the termal power plant and on areas where meteorological conditions, especially temperature inversion caused accumulation of air pollutants. Sulphur dioxide, emmited from the termal power plant is the main cause of damage. This is proved by all above mentioned analyses as also by observations of epiphytic lichen vegetation carried out on the same trees.

II. BIOINDICATION OF AIR POLLUTION BY EPIPHYTIC LICHENS (Bioindikation der Luftverunreinigungen mit epiphytischen Flechten)

1. INTRODUCTION

Epiphytic lichens are well known bioindicators of air pollution (FERRY et al. 1973, HAWKSWORTH & ROSE 1976, NASH III & WIRTH 1988, etc.). In the research of forest die-back they are very usefull as they enable to assess air quality in remote places where there are no possibilities for instalation of air pollutant measuring devices (TUERK 1985). In comparison with forest trees as bioindicators they are not dependent on soils, which is very important in distinguishing processes going on in forest soils and atmosphere. Therefore epiphytic lichens are often used for differential diagnostics of forest decline (GLIEMEROTH 1990).

In Slovenia , epiphytic lichen vegetation has been used as bioindicator of air quality at forest die-back inventories since 1985 (BATIČ & KRALJ 1989, BATIČ 1991, BATIČ 1992). A very simple method of air pollution bioindication by epiphytic lichens has been used, namely mapping of the thalli types (crustose, foliose and fruticose). On each forest die-back inventory plot a cover and frequency of all the above mentioned lichen thalli types were assessed, and an index of atmospheric purity was calculated for the observation plot using data of lichen observation. In this way lichens have been mapped within 4x4 km grid of forest die-back inventories. Cover and abundance of crustose, foliose and fruticose lichens were assessed and an index of atmospheric purity (IAP) was calculated, using special equation (BATIČ 1991). On the polluted sites the value of index is low and lichen vegetation is very poor. The maximum span of the index value is from 0 to 54 for the whole plot (IAP t).
Appart from lichen thalus type mapping there is also a mapping of epiphytic lichen species going on within 16 x 16 km bioindication grid in order to get an overview into lichen flora of Slovenia and to improve the air pollution bioindication method using epiphytic lichens. In cooperation with the group from Graz (Doc. Mayrhofer) we decided to map epiphytic lichen species in a broader emission area of Thermal power plant Šoštanj. There are two main goals of cooperation. At first, lichenologists from Graz have been helping us in determination of lichens, especially microlichens. There is no reference herbarium of lichens in Slovenia which reduces the possibilities for taxonomic work on that plant group. Through cooperation the Austrian colleagues have been helping us to establish a lichen herbarium in Ljubljana as a base for future taxonomic work on that group. Another aim of collaboration is to improve the bioindication method by epiphytic lichens on the species level. Such kind of approach is better defined as the method presently used in forest die-back inventories in Slovenia.

2. MATERIAL AND METHODS

As the whole cooperative project deals mainly with determination of emission area of the Thermal power plant Šoštanj we decided to map the epiphytic lichen flora of Pohorje. The mapping of lichens in the Šalek valley and on the sampling profile has been already carried out. From the forest die-back inventory data we concluded that emissions from the power plant affect also the south-western slopes of Pohorje. Therefore we decided to map exposed and protected sites on Pohorje, especially deeper brook valleys, which are cutting the massive from the northern and the southern side. In order to carry out this mapping there are two diploma works going on, one in Karl-Franzens- Universitaet in Graz (by Marietta KOCH) and one in Ljubljana University (by Barbara KRUHAR).

Appart from the mapping on Pohorje we have planned to investigate lichenologically also some other parts in Slovenia. Such areas were chosen that might be important for the European lichen mapping also. This areas will be within the chosen forest reserves in the Dinaric region and the Triglav National Park.

3. RESULTS AND DISCUSSION

Epiphytic lichen vegetation has been used as bioindicator of air quality in all forest die-back inventories since 1985. In Fig.36 the results of epiphytic lichen vegetation assessment on forest die-back inventory plots in inventory 1991 are presented. The state of epiphytic lichen vegetation is expressed by the values of index of atmospheric purity. Together are presented data for index value regardless the tree species and height of observation. From the mapping can be seen that low values of index indicate the major air pollution centers in Slovenia, one of them is also the thermal power plant in Šoštanj. On the Fig.37 the percentage distribution of forest trees on the inventory plots according to index classes are presented for observations of epiphytic lichens on the most common tree species (sm = Picea abies (L.) Karst., bu = Fagus sylvatica L., hr = all Quercus species) separately for different heights of observation.
The same method of epiphytic lichen mapping was also used in the surroundings of the thermal power plant in Šoštanj in order to help in delimitation of the immission area. Appart from thallus types mapping the species composition was studied and mapping of chosen lichen species was carried out in different ways. Table 2 shows a comparison between thallus types mapping and lichen species mapping on the profile over polluted valley on pairs of Norway spruce trees. Although Norway spruce has rather poor epiphytic composition the results obtained by both methods fit quite well. A detailed presentation of lichens recorded on felled trees in a profile is given in annex to the report (Table 1).

Since the begining of cooperation several collecting excursions have been made into the Pohorje mountains. The intention of that work, carried out by Marietta KOCH is to compare the present species compositions of epiphytic lichens with old records in order to determine the influence of air pollution. Special attention has been paid to epiphytic flora of sycamore (Acer pseudoplatanus), which has normally a very rich lichen flora. In this report the preliminary list of already found species is enclosed (Table 1). Among these there are several, which are new for Slovenia and there are also already some findings of species which are interesting in the broader scale. Other part of lichenological work on Pohorje mountains was carried out by Barbara KRUHAR, a student from Ljubljana, who analysed epiphytic lichen flora of four bioindication plots from Slovenian 16 x 16 km bioindication grid in comparison with some plots in Dinaric Carst and Karavanke. A preliminary list of lichen species from Pohorje and other plots is presented on Table 2 in the appendix of the report.

Besides lichenological investigations on Pohorje we have made some collecting excursion to the Dinaric region of Slovenia, which is floristically unknown and might be important for lichen floristics in Slovenia as also in broader scale. Two profiles have been chosen for epiphytic lichen mapping in that area. The first one was set in the area of Kočevje and the other in the area of Snežnik mountain. One collecting excursion to Kočevska Reka was made already in June 1992 (BATIČ & MAYRHOFER), the rest of collecting in both the above mentioned profiles was carried out by Martin GRUBE at the beginning of October with assistance of staff from the Institute for Forest and Wood Economy in Ljubljana.

As part of cooperation it can be mentioned also the one day introduction into the method of thin layer chromatography of lichen substances in the laboratory of Institut fuer Botanik in Graz. This method might be a usefull tool for better determination of some more problematic taxa.

III. FINAL REMARKS

Comparison of the results of biochemical bioindication on the basis of Norway spruce needle analysis and epiphytic lichen observations in the emission area of the thermal power plant in Šoštanj shows a great degree of consistency. There is the highest degree of correlation between total sulphur content of needles and the state of epiphytic lichen vegetation, especially in the nearest surroundings of the thermal power plant. Sampling sites with high sulphur content in needles exibit in most of cases very poor lichen vegetation. A changed age pattern of photosynthetic pigments in needles has been also determined in the same samples. These findings were determined in samples collected in sites of both profiles (SMREKCVC-VINSKA GORA, SMEREKOVC-ŠOŠTANJ-POHORJE) within both temperature inversions. Very high total sulphur content and drasticaly changed age pattern of photosynthetic pigments were determined especially on the sites in the very surroundings of the thermal power plant. Epiphytic lichen vegetation was extremly poor in these sites, confined mostly to air pollution very tolerant species, namely Scoliciosporum chloroccocum. This species is the most abundant in the area investigated, being very frequent also in sites quite remote from the pollution source.
Analysis of other biochemical parameters in Norway spruce needles (carotenoids, thiols, ascorbic acid, activity of the enzyme peroxidase) also confirm the influence of the polluted air, but additional sampling would be necessary to obtain enough solid results. These analysis would be necessary also in order to delimit the influence caused by natural stresses (drought, frost, radiation, patogens) from antropogenic activity.

Results of sampling in both profiles (1990, 1991) show and confirm very high level of air pollution caused by thermal power plant. This influence is not confined only to valley and nearby slopes but it spreads into much larger area (Pohorje!) what can be seen from the analysed needle samples collected there, and from observations of epiphytic lichens, especially on southward and westward exposed slopes on higher elevations.

For the determination of the extend of emission area of thermal power plant and delimation of contribution of the transboundary air pollution transport some repetitions of sampling would be necessary as also prolongation of the sampling profile in the North-East directions. This would be extremly important in order to assess the effects of the already planned sanation of the emission from the thermal power plant which is expected to be partly completed in two or three years.

Samo additional data will be available also when already started studies will be completed. This results should be the orientation basis for further samplings and observations in this area.

At the end it can be stated that the results of biomonitoring of air pollution by above cited methods not only confirm measurements of pollutants in the air but they contribute important data about the pollution model of the area which is not so simple like it was imagined by metheorologist.

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ILLUSTRATIONS OF THE RESULTS

Fig. A : The position of the both profiles, laid over the Šalek valley, where Norway spruce needles were sampled in 1990 and 1991.

Fig. B : The position of the sampling sites in the profile SMREKOVC-VINSKA GORA (1990 sampling), laid in the east-west direction over the Šalek valley according to the position of the temperature inversion zones.

Fig.1-10 : Analysis of Norway spruce needles sampled in the profile SMREKOVC- VINSKA GORA in 1990
a) pigments determined spectrophotometrically
b) pigments determined by the HPLC method
c) results od needle diffusate analysis.

Fig.11- 21: Examples of photosynthetic pigment content analysis in Norway spruce needles, sampled on the sites of the profile SMREKOVC-VINSKA GORA (1990) between both temperature inversion zones with changed age pattern of piqmnets.

Fig. 22: The presentation of the results of the photosynthetic pigment analysis according to the altitude of sampling sites in the profile SMREKOVC-VINSKA GORA (1990); a) west side of the valley; b) east side of the valley.

Fig. 23: The presentation of the results of needle diffusate analysis after two hours of treatment; a) west side of the valley; b) east side of the valley; sampling profile SMREKOVC-VINSKA GORA, 1990.

Fig. 24: The same as Fig. 23, but after 24 hours of shaking.

Fig. 25: Presentation of the results of needle analysis, sampled in the profile SMREKOVC-ŠOŠTANJ-POHORJE in 1991 according to the sites in the profile; Fig. 25 a - Fig. 25 e present the results for two needle age classes, Fig. 25 f - 25 h present results for four needle age classes.

Fig. 26 - 35 : Presentation of needle analysis of ten sampling sites in the rpofile SMREKOVC-ŠOŠTANJ-POHORJE, sampled in September 1991.

Fig. 36: Lichen map of Slovenia - values of IAP (index of atmospheric purity) on forest die-back inventory plots, data from the inventory 1991.

Fig. 37: Presentation of IAP values, grouped into classes according to tree species and height of lichen observation; forest die-back inventory 1991.

Table 1: List of lichens, found during mapping of lichen flora of Pohorje, diploma work of Marietta KOCH

Table 2: Comparison between list of lichen species, IAP values, total sulphur content in Norway spruce needles and some other parameters on pairs of spruce trees which were felled on the profile SMREKOVC-VINSKA GORA in 1990.

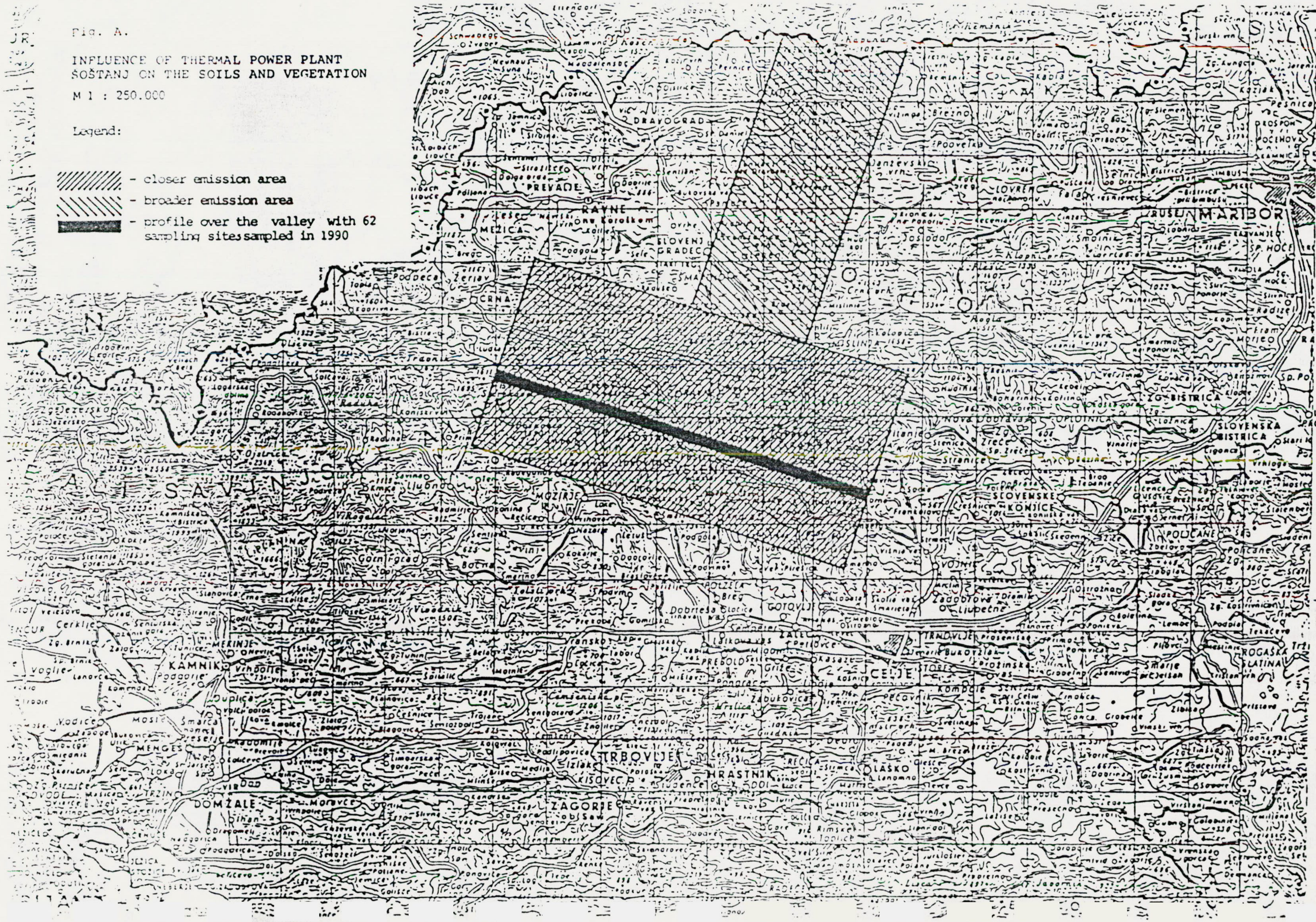


Fig. A.

INFLUENCE OF THERMAL POWER PLANT ŠOŠTANJ ON THE SOILS AND VEGETATION

M 1 : 250.000

Fig. B.

DAS BIOINDIKATIONSPROFIL :

SMREKOVEC - ŠOŠTANJ - VELENJE - VINSKA GORA

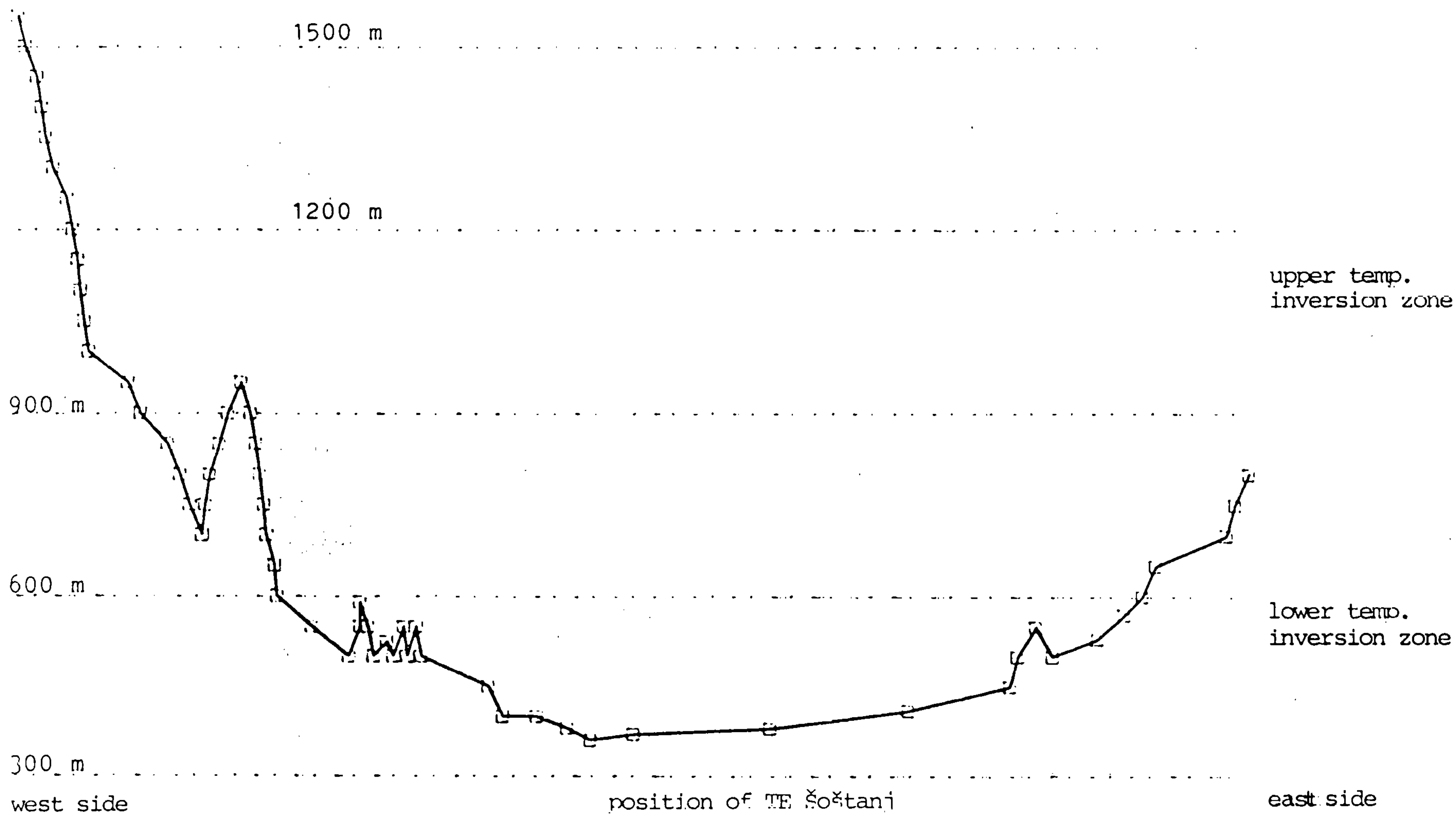


Fig. 1 Sampling site No. 1 in the profile of Smrekovc - Vinska gora

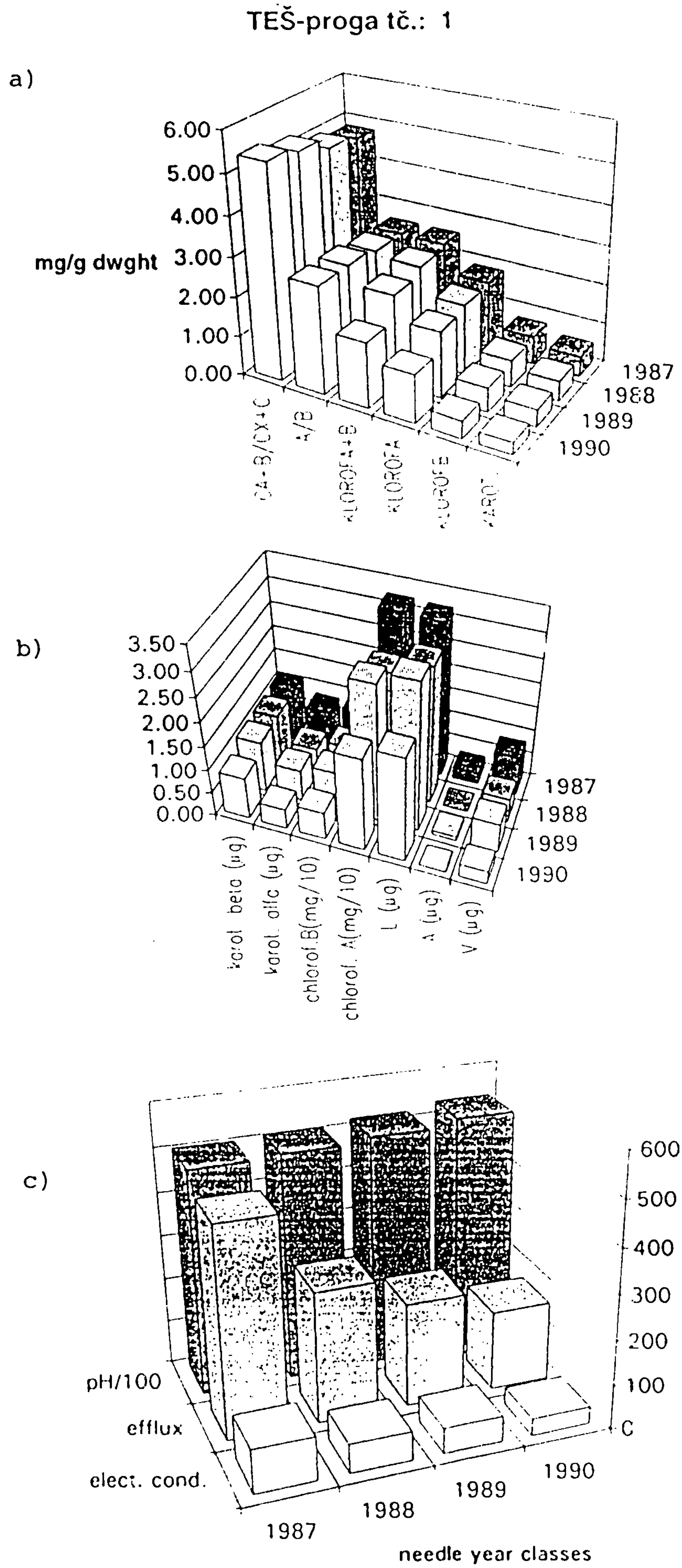
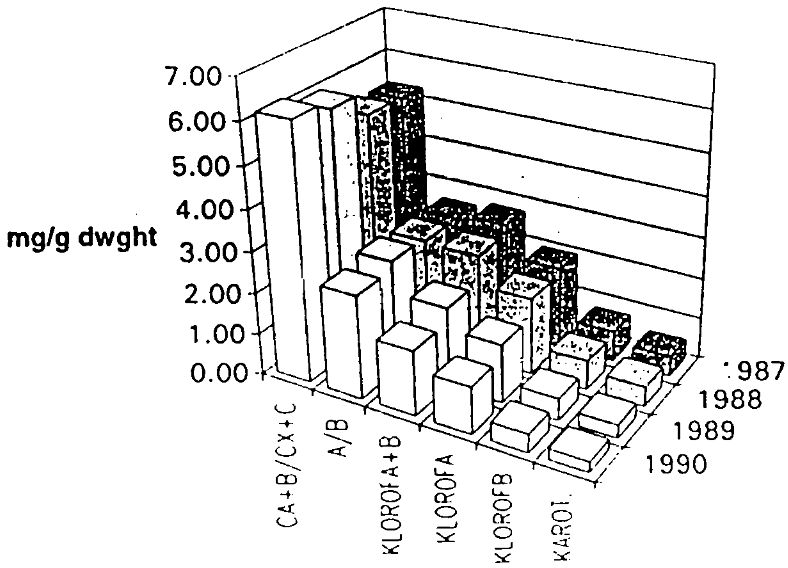


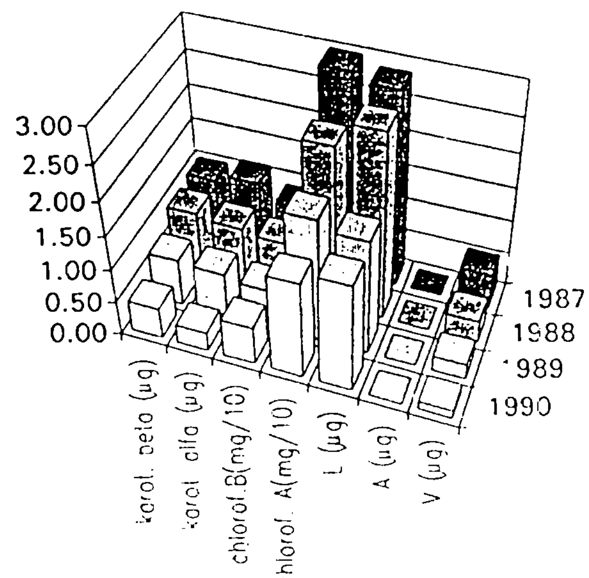
Fig. 2 Sampling site No.6 in the profile of Smrekovc - Vinska gora

TEŠ-proga tč.: 6

a)



b)



c)

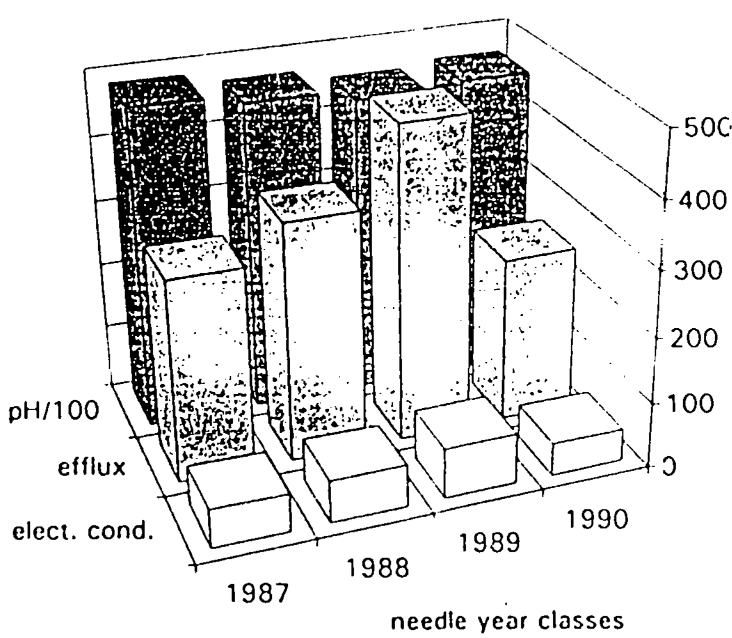
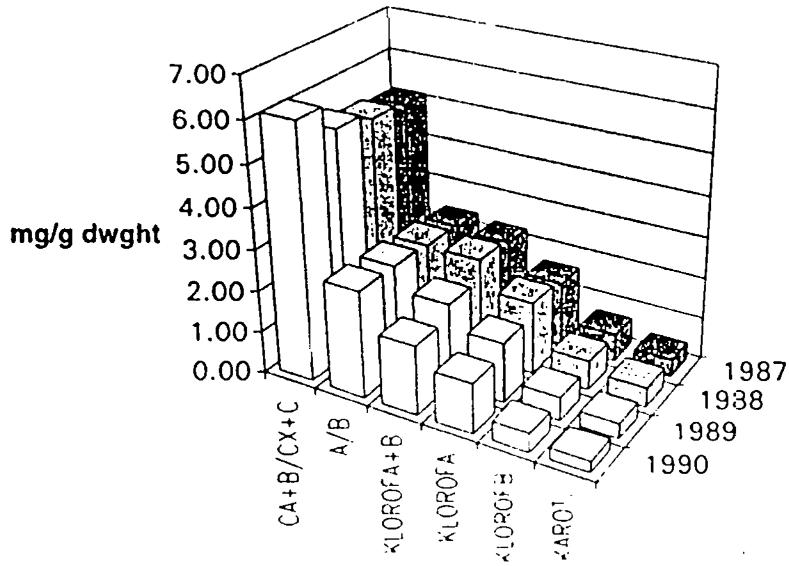


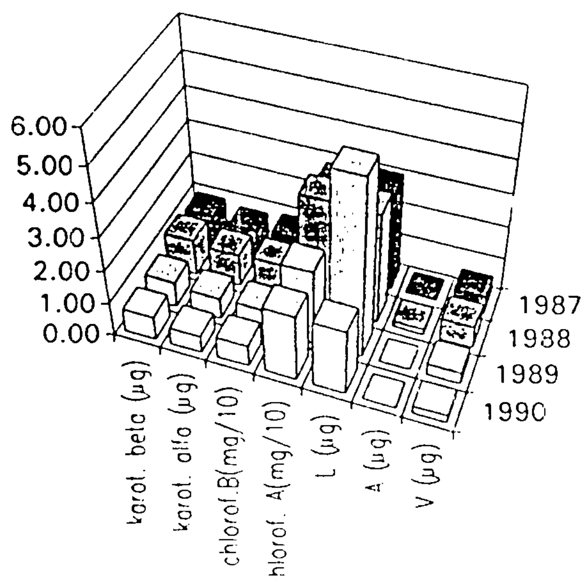
Fig. 3 Sampling site No. 7 in the profile of Smrekovc - Vinska gora

TEŠ-proga tč.: 7

a)



b)



c)

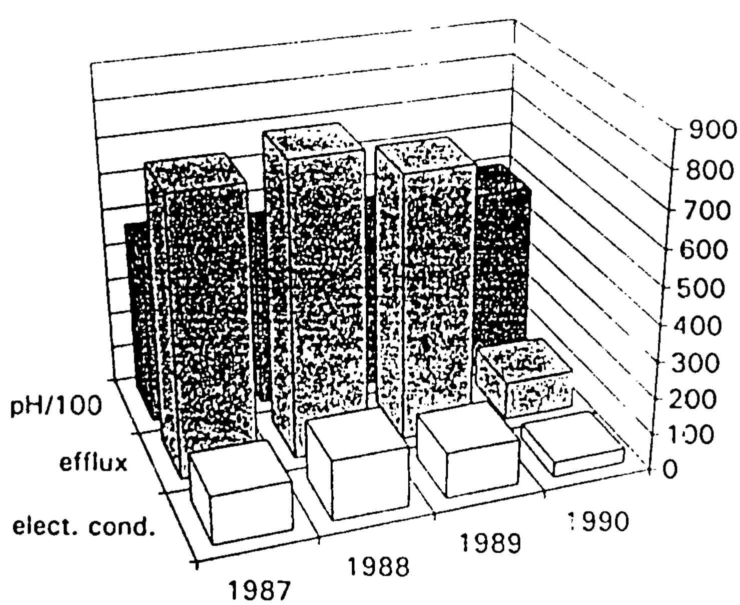


Fig. 4 Sampling site No. 10 in the profile of Smrekovc - Vinska gora

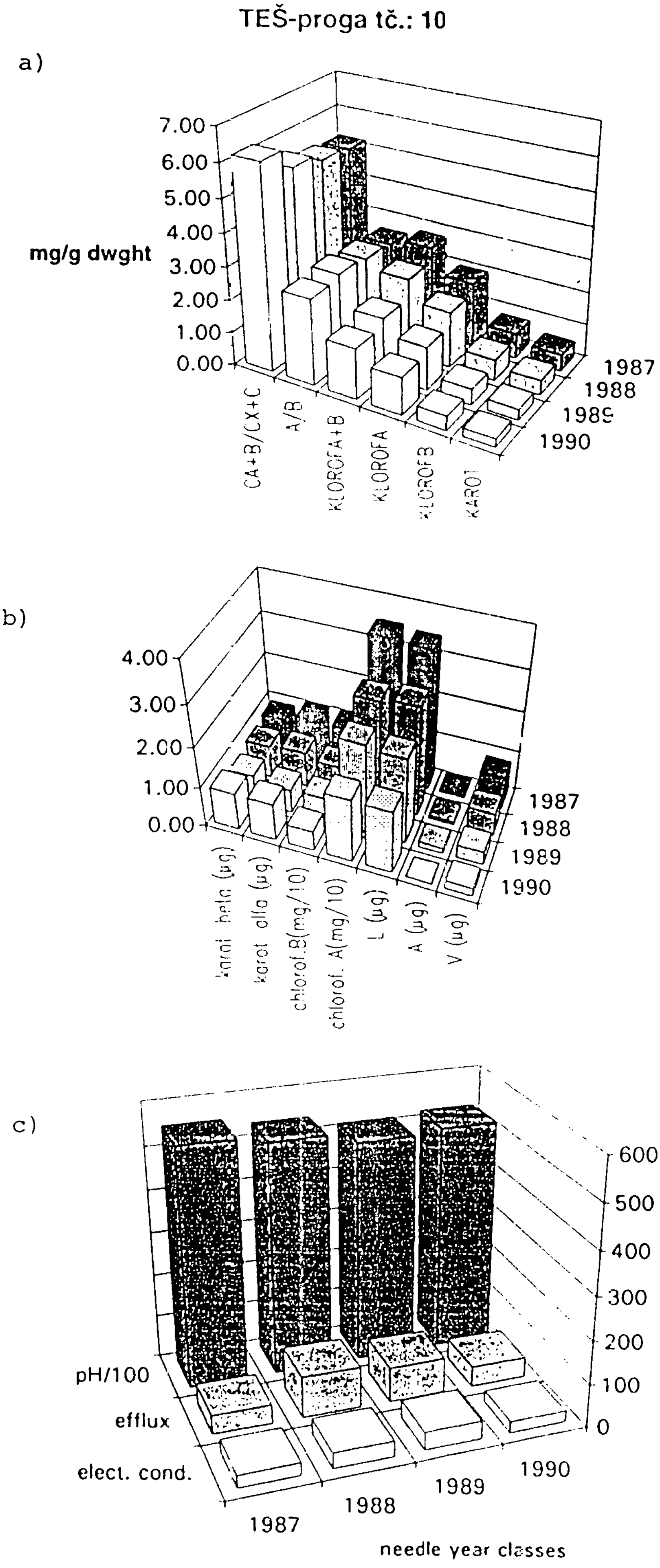
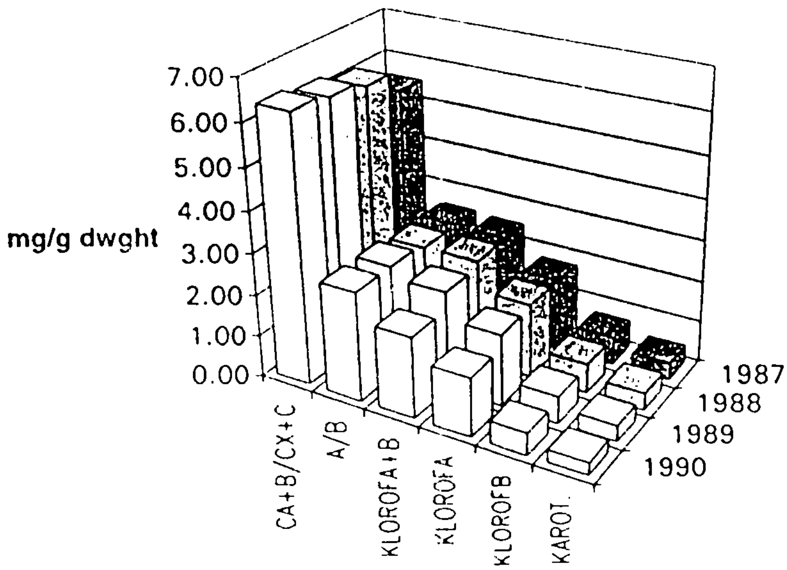


Fig. 5   Sampling site No. 51 in the profile of Smrekovc - Vinska gora

TEŠ-proga tč.: 51

a)



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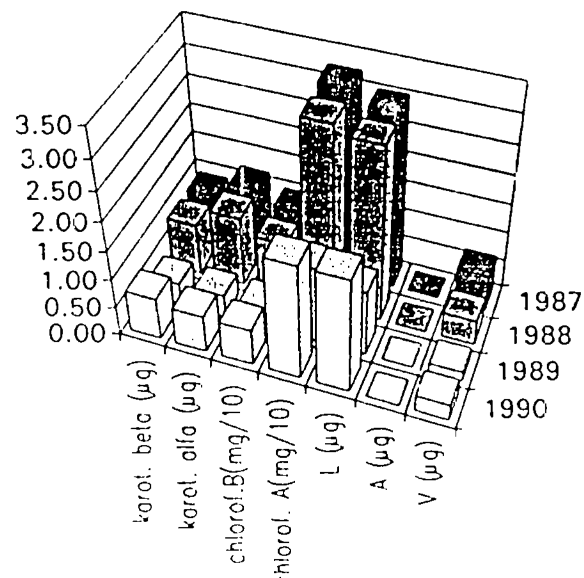


c)

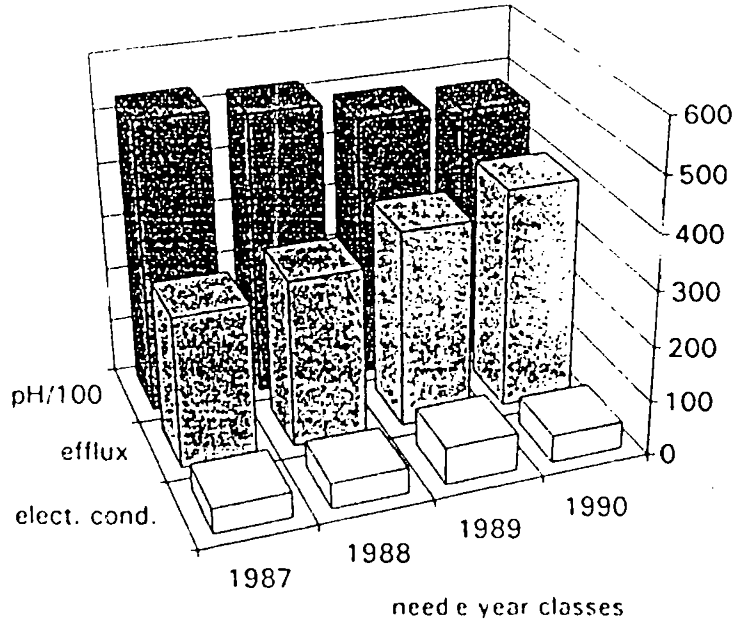


Fig. 6 Sampling site No. 52 in the profile of Smrekovc - Vinska gora

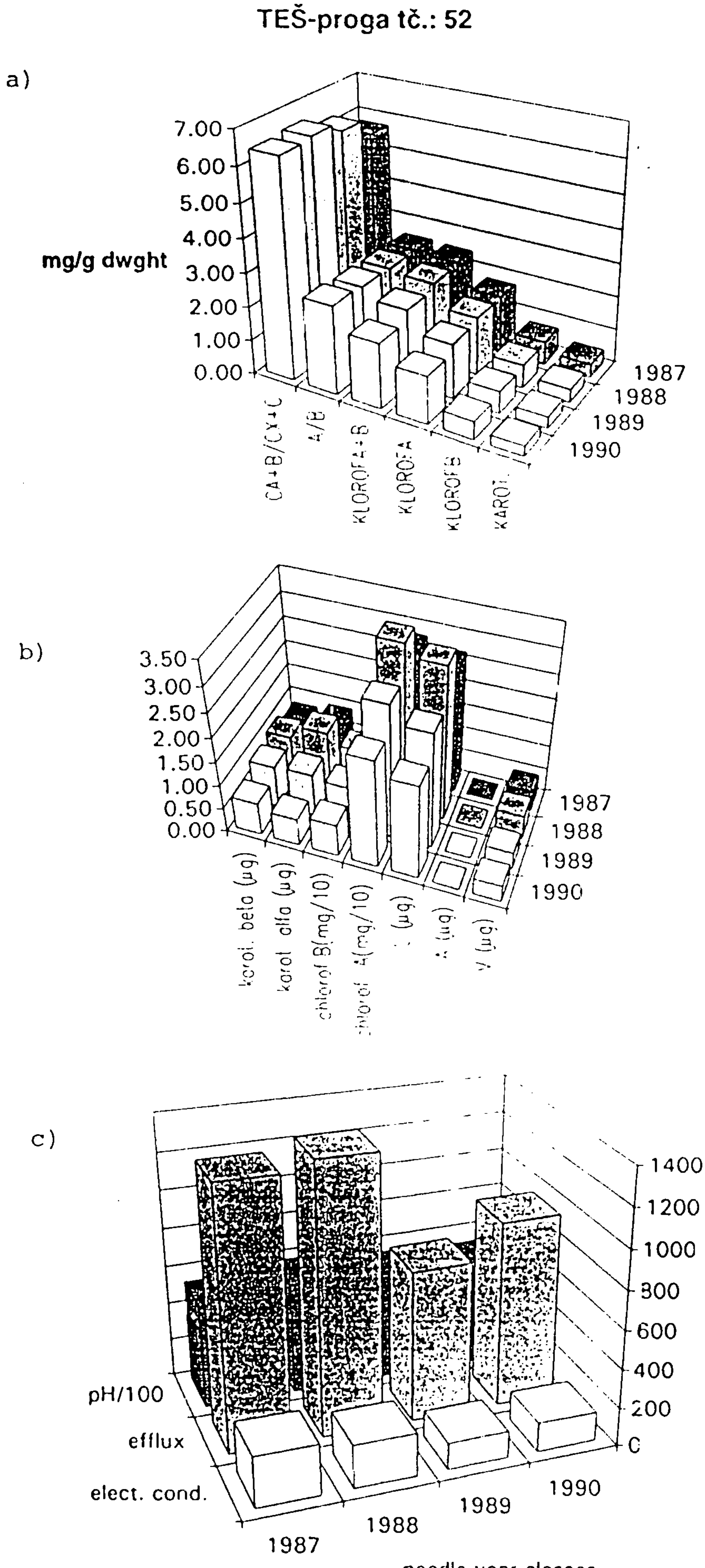


Fig. 7 Sampling site Graška gora in the profile of Smrekovc - Šoštanj - Pohorje (1990-1991)

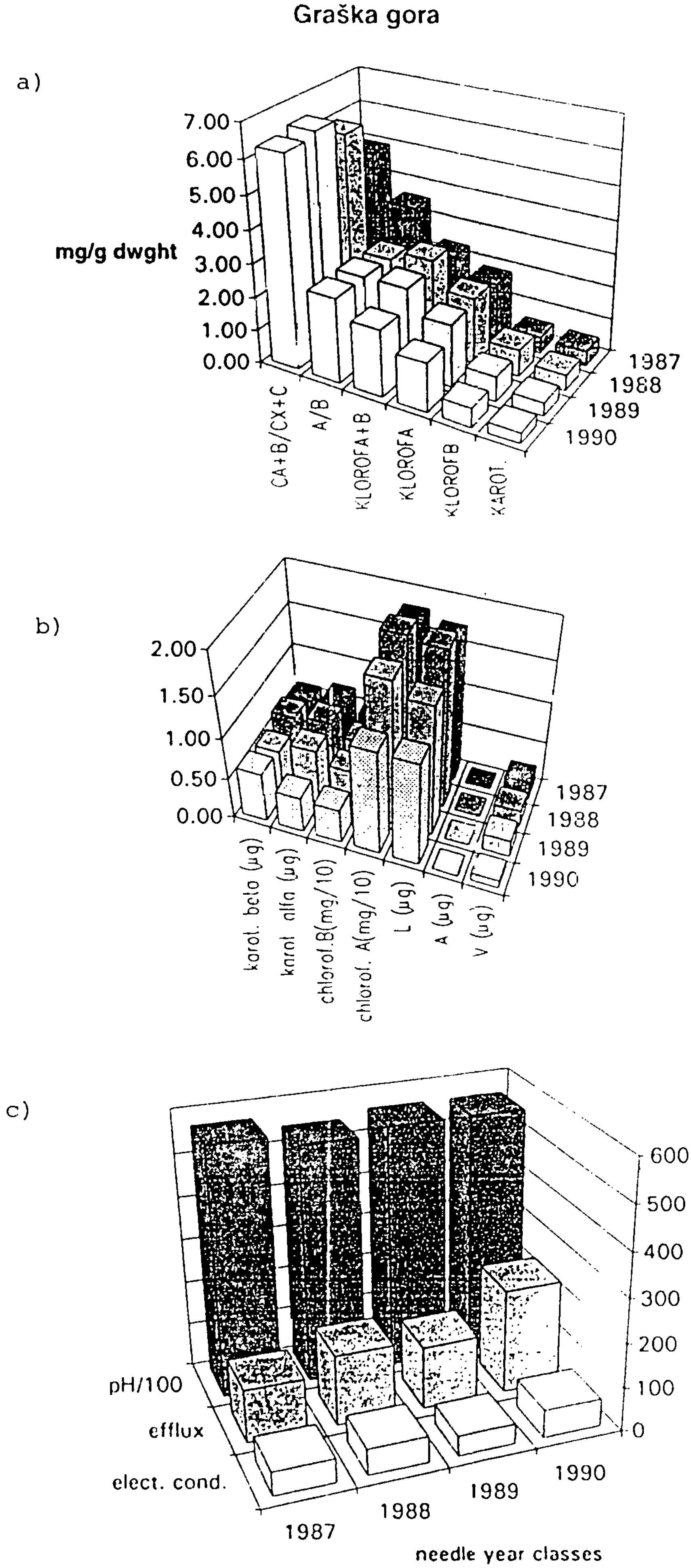
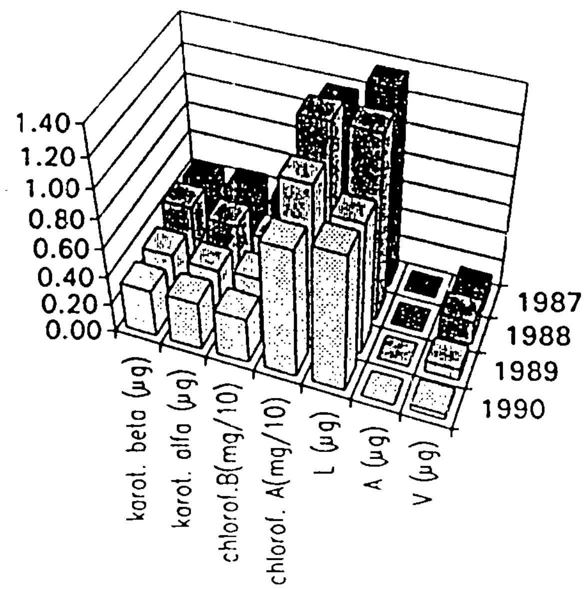


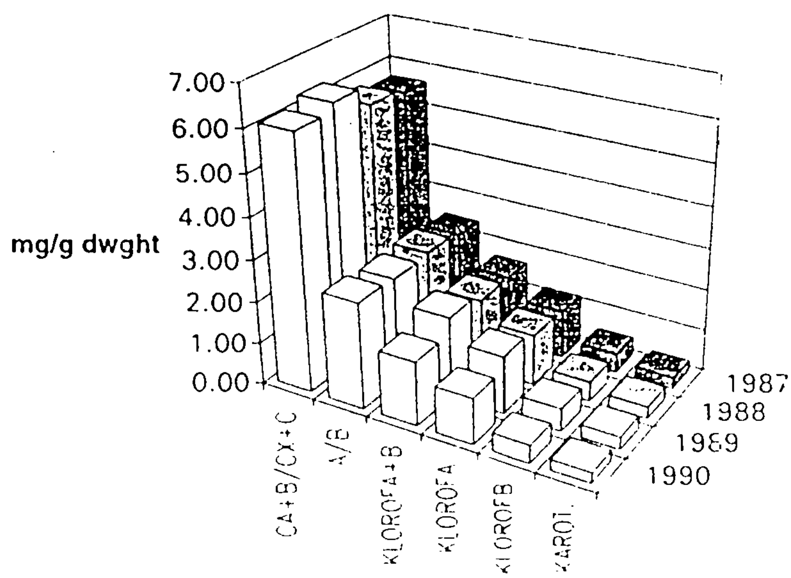
Fig. 8 Sampling site Široko pri Lajšah in both profiles (1990-1991)

Široko pri Lajšah

b)



a)



c)

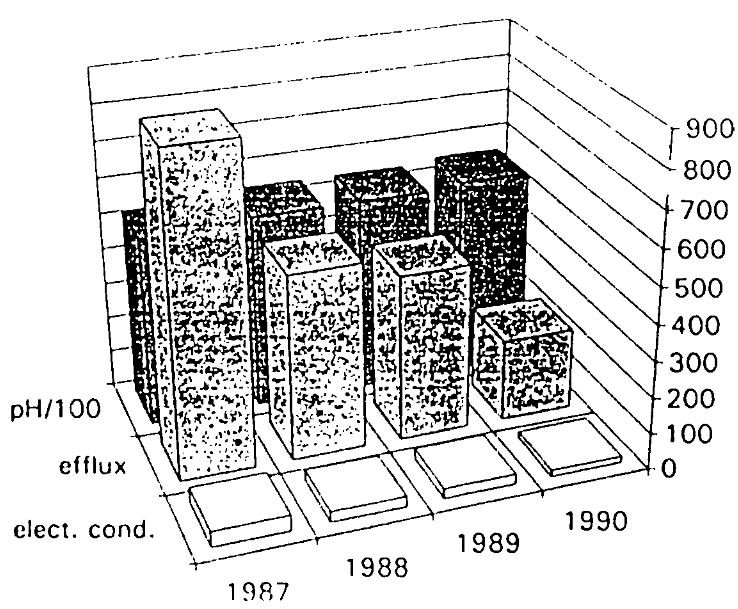
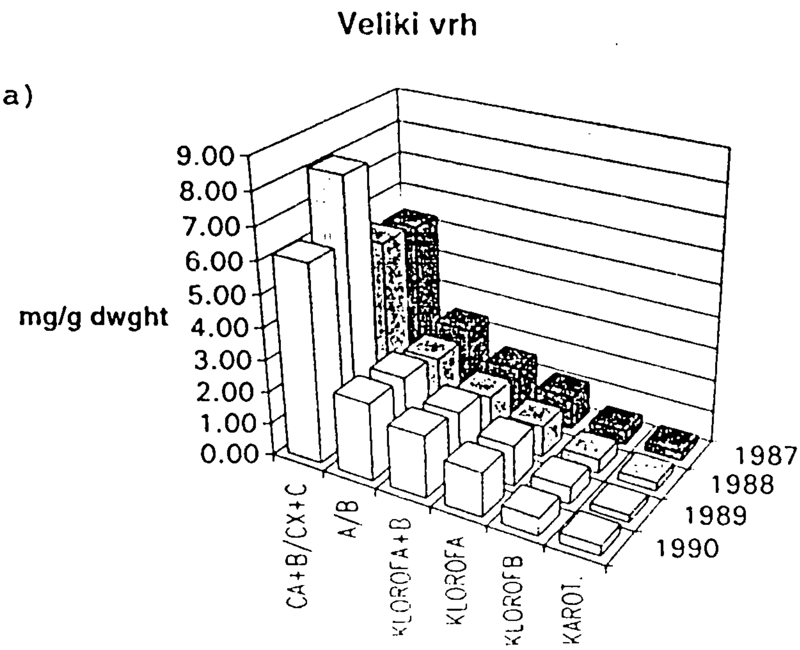


Fig. 9 Sampling site Veliki vrh in both profiles (1990-1991)

a)



b)

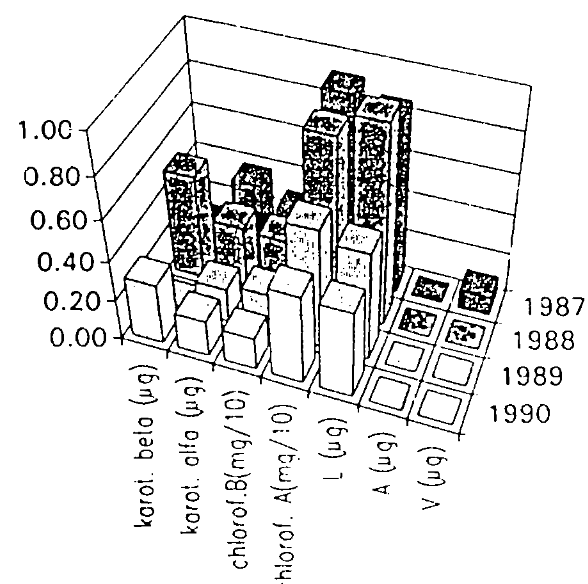
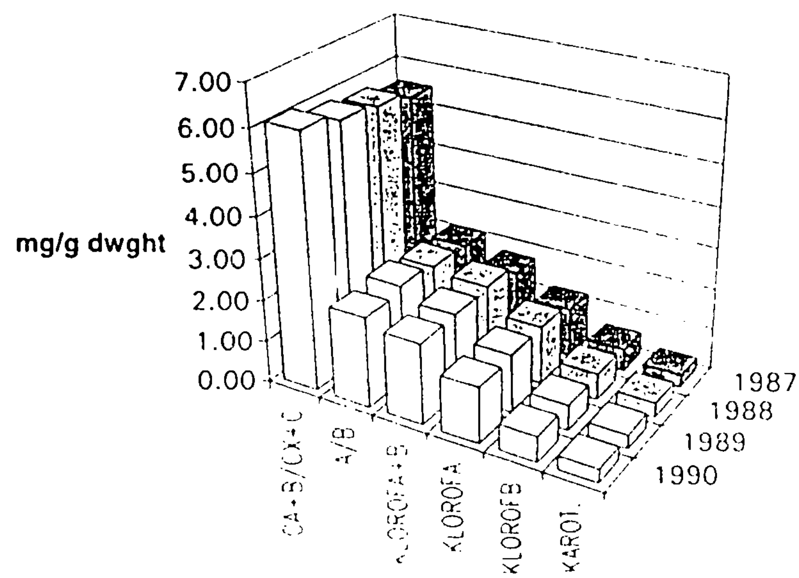


Fig. 10 Sampling site Zavodnje (Prednji vrh) in both profiles (1990-1991)

Zavodnje (Prednji vrh)

a)



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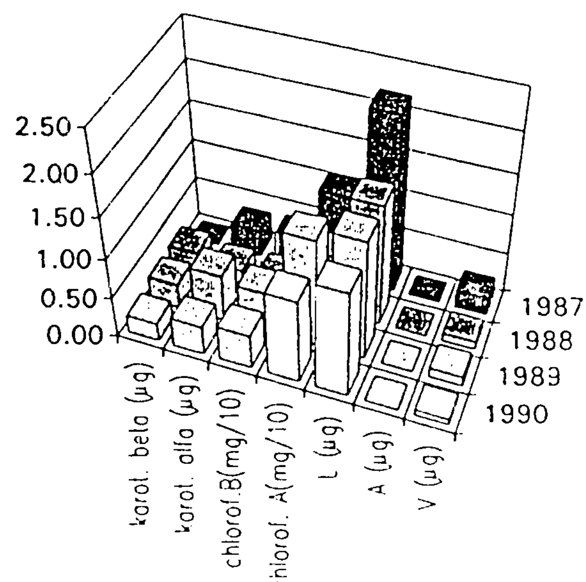


c)

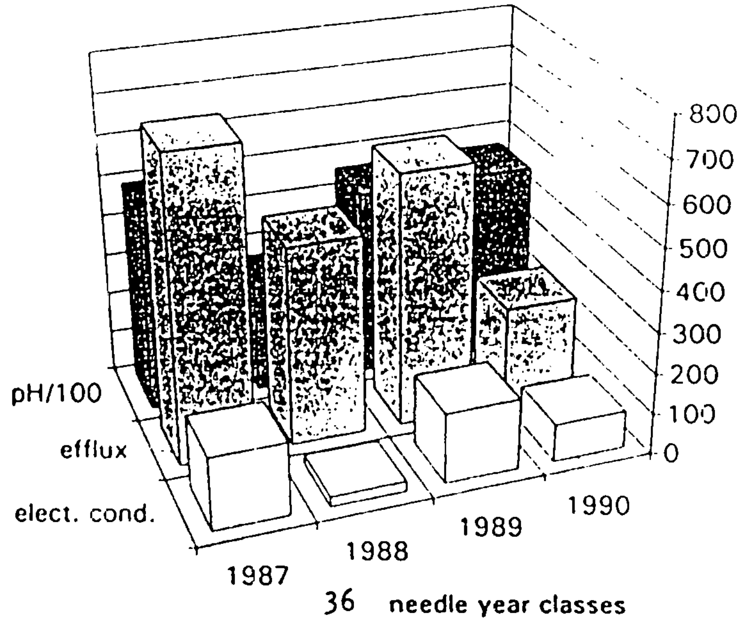


Fig. 11 Sampling site No. 12 in the profile of Smrekovc - Vinska gora

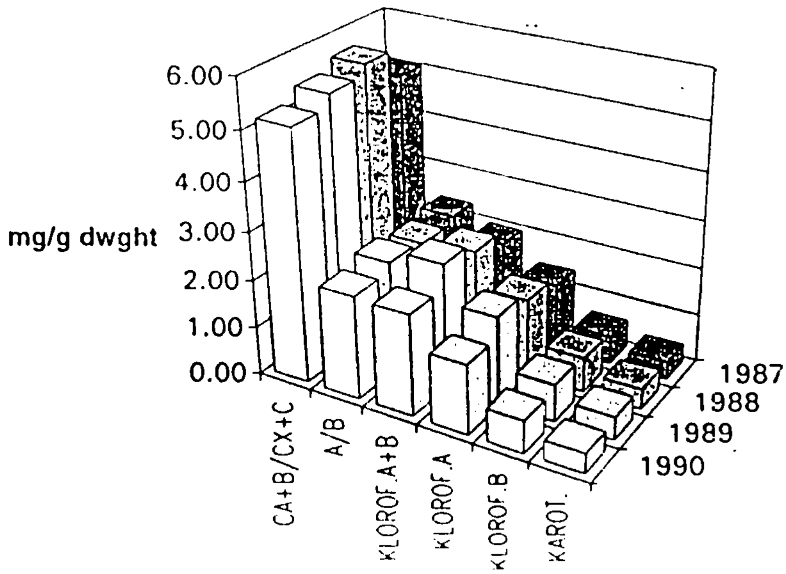


Fig. 12 Sampling site No. 16 in the profile of Smrekovc - Vinska gora

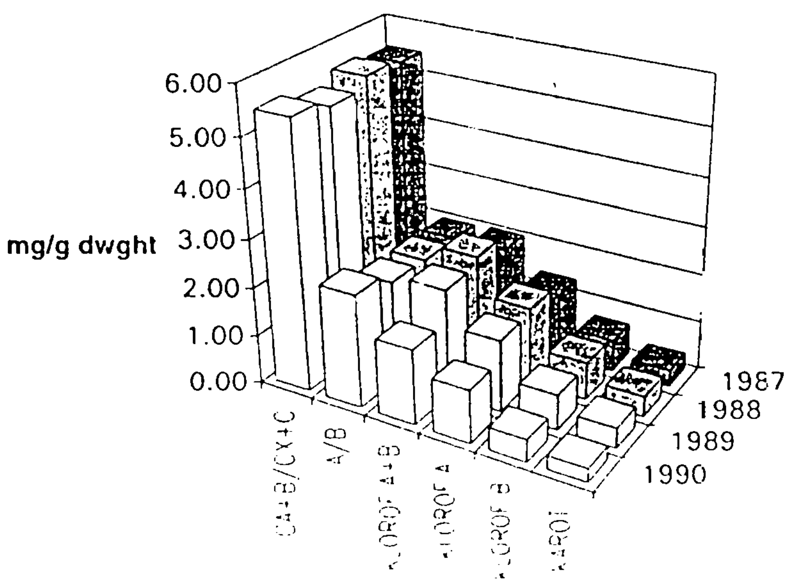


Fig. 13 Sampling site No. 19 in the profile of Smrekovc - Vinska gora

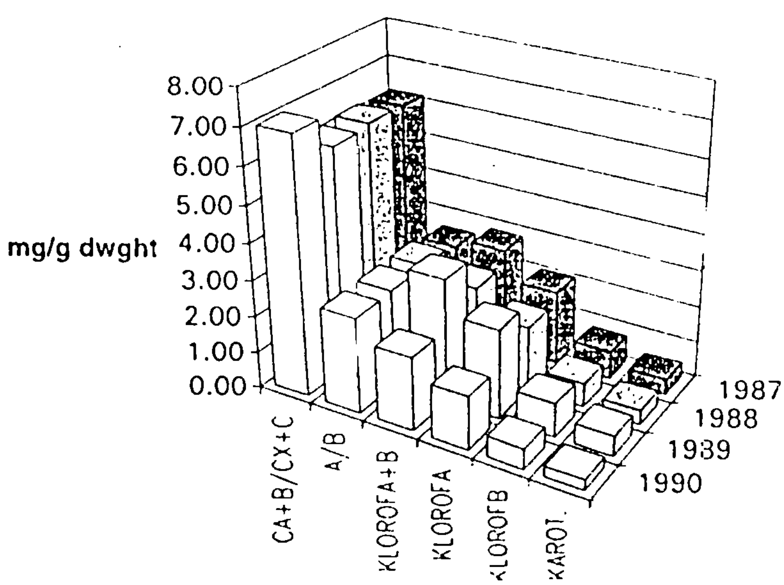


Fig. 14 Sampling site No. 20 in the profile of Smrekovc - Vinska gora

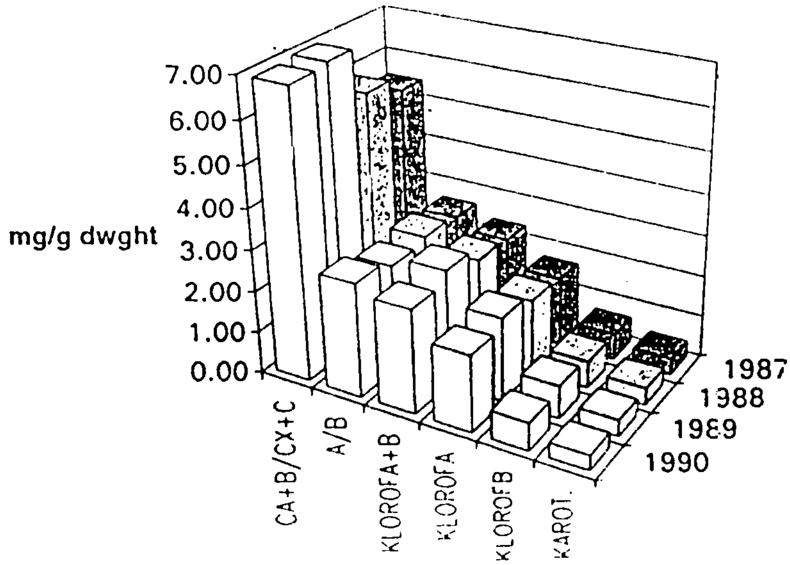


Fig. 15 Sampling site No. 28 in the profile of Smrekovc - Vinska gora

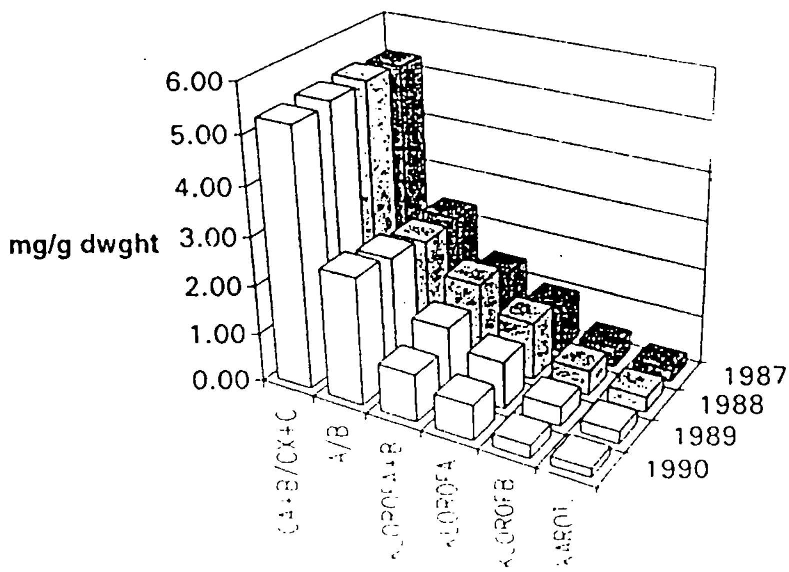


Fig. 16 Sampling site No. 30 in the profile of Smrekovc - Vinska gora

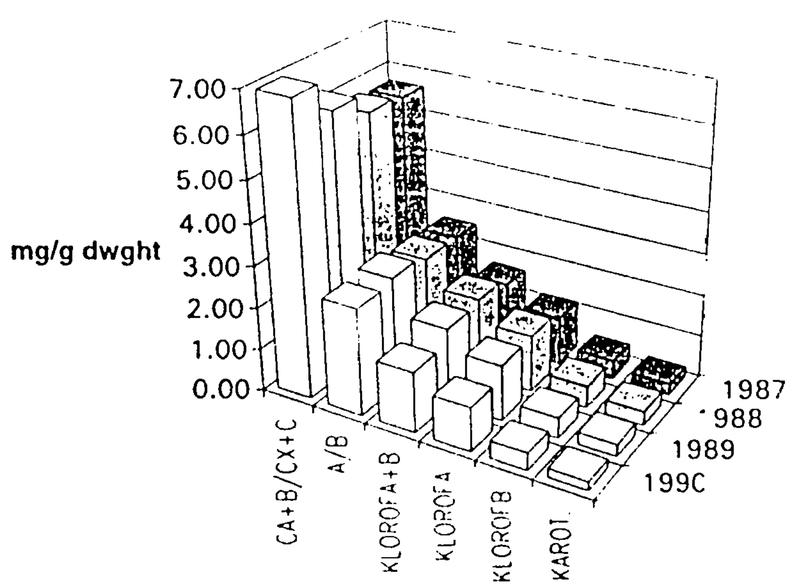


Fig. 17 Sampling site No. 31 in the profile of Smrekovc - Vinska gora

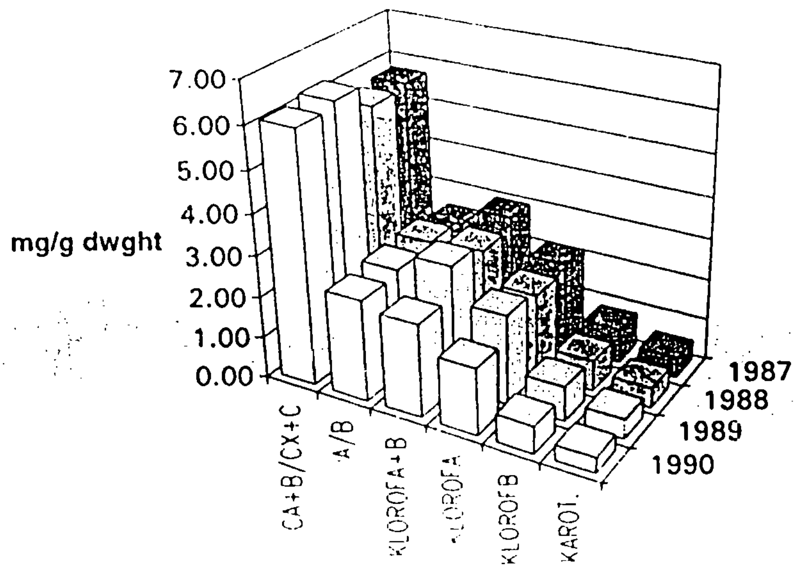


Fig. 18 Sampling site No. 32 in the profile of Smrekovc - Vinska gora

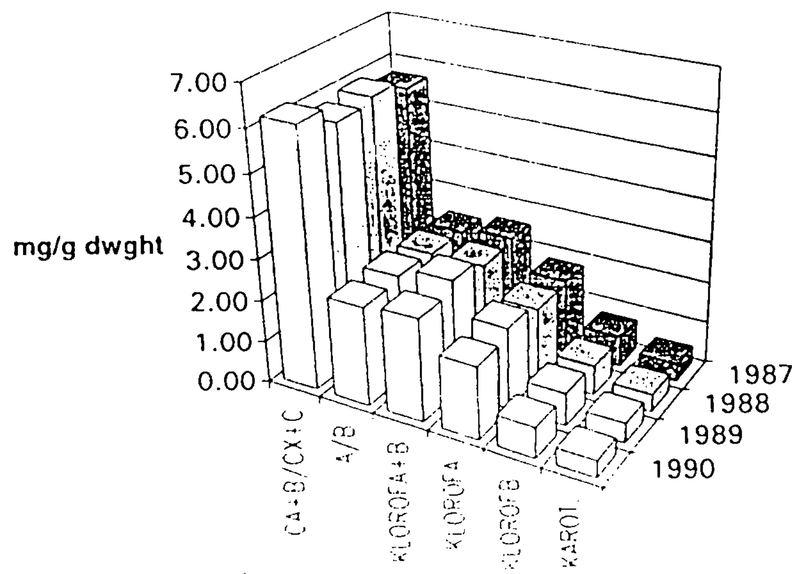


Fig. 19 Sampling site No. 34 in the profile of Smrekovc - Vinska gora

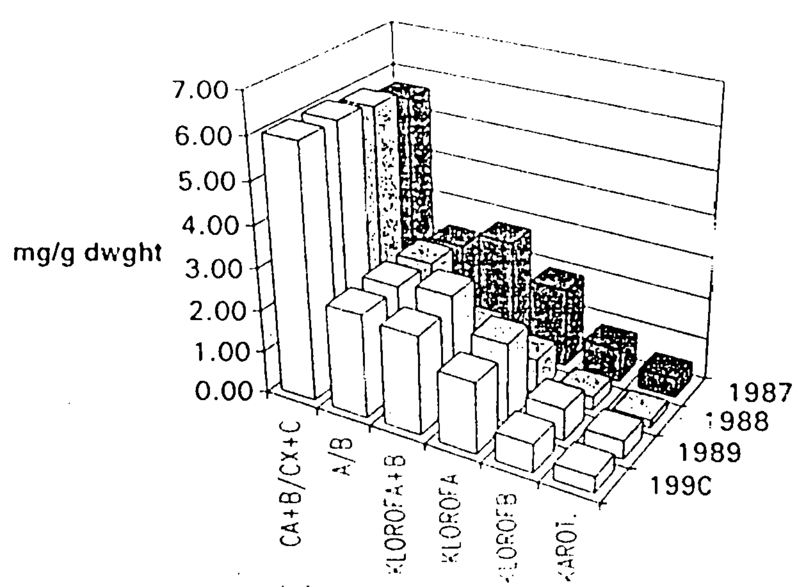


Fig. 20 Sampling site No. 37 in the profile of Smrekovc - Vinska gora

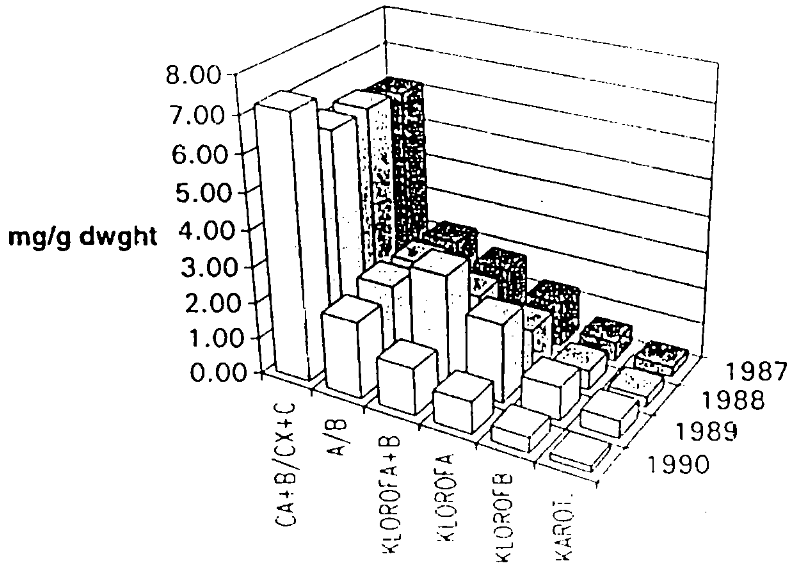


Fig. 21 Sampling site No. 44 in the profile of Smrekovc - Vinska gora

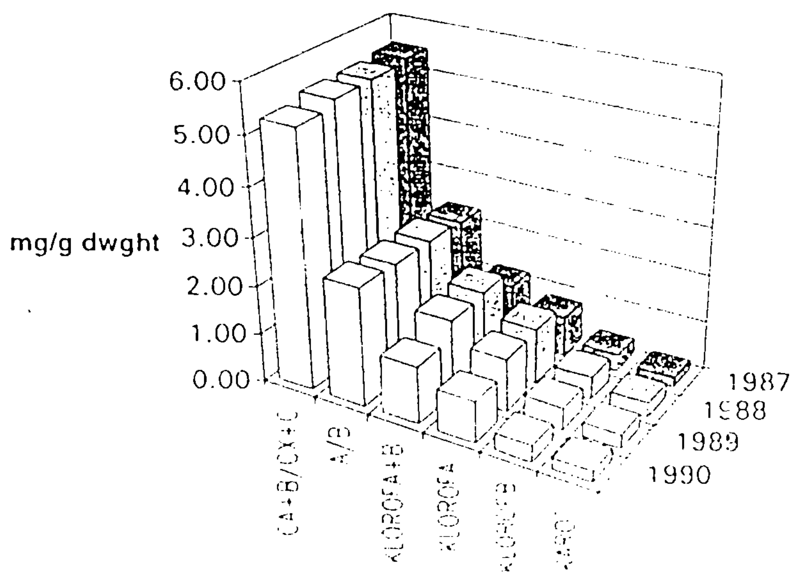
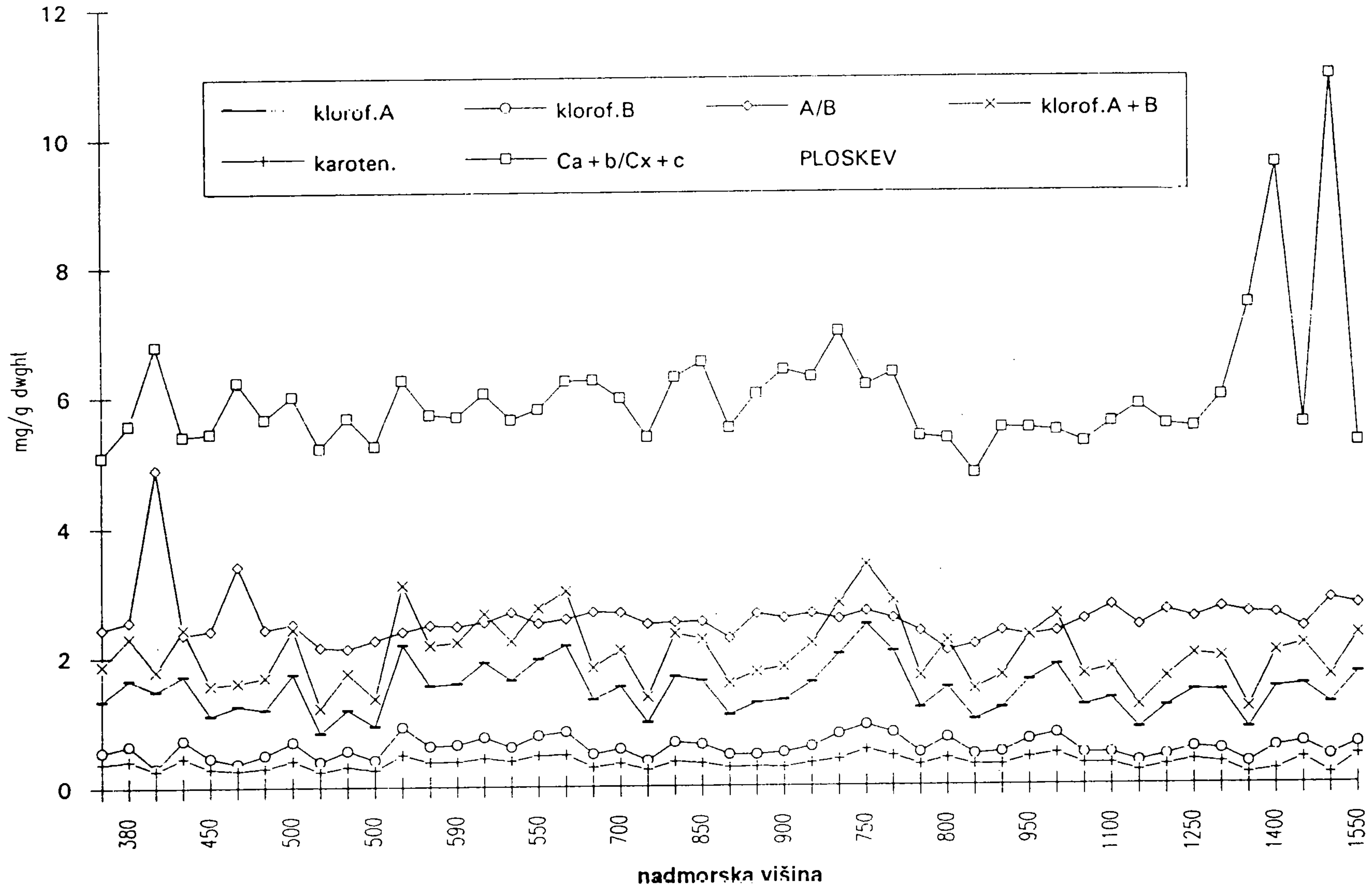
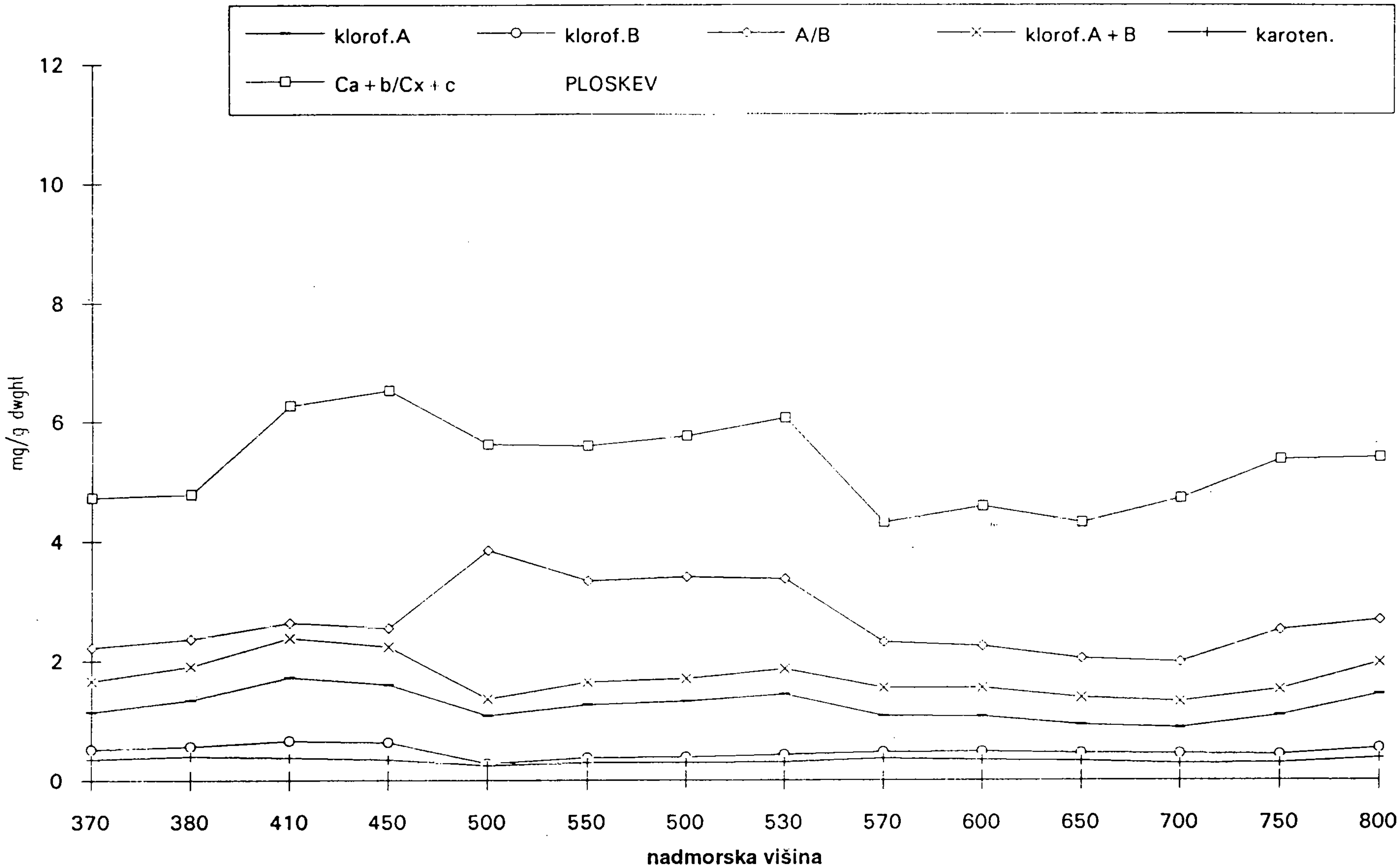


Fig 22.a



mg/g dwght
12
10
8
6
4
2
0
klorof.A
klorof.B
A/B
klorof.A + B
karoten.
Ca + b/Cx + c
PLOSKEV
380
450
500
500
590
550
700
850
900
750
800
950
1100
1250
1400
1550
nadmorska višina

Fig. 22 b



klorof.A
klorof.B
A/B
klorof.A + B
karoten.
Ca + b/Cx + c
PLOSKEV
mg/g dwght
0
2
4
6
8
10
12
370
380
410
450
500
550
500
530
570
600
650
700
750
800
nadmorska višina

Fig. 23 a

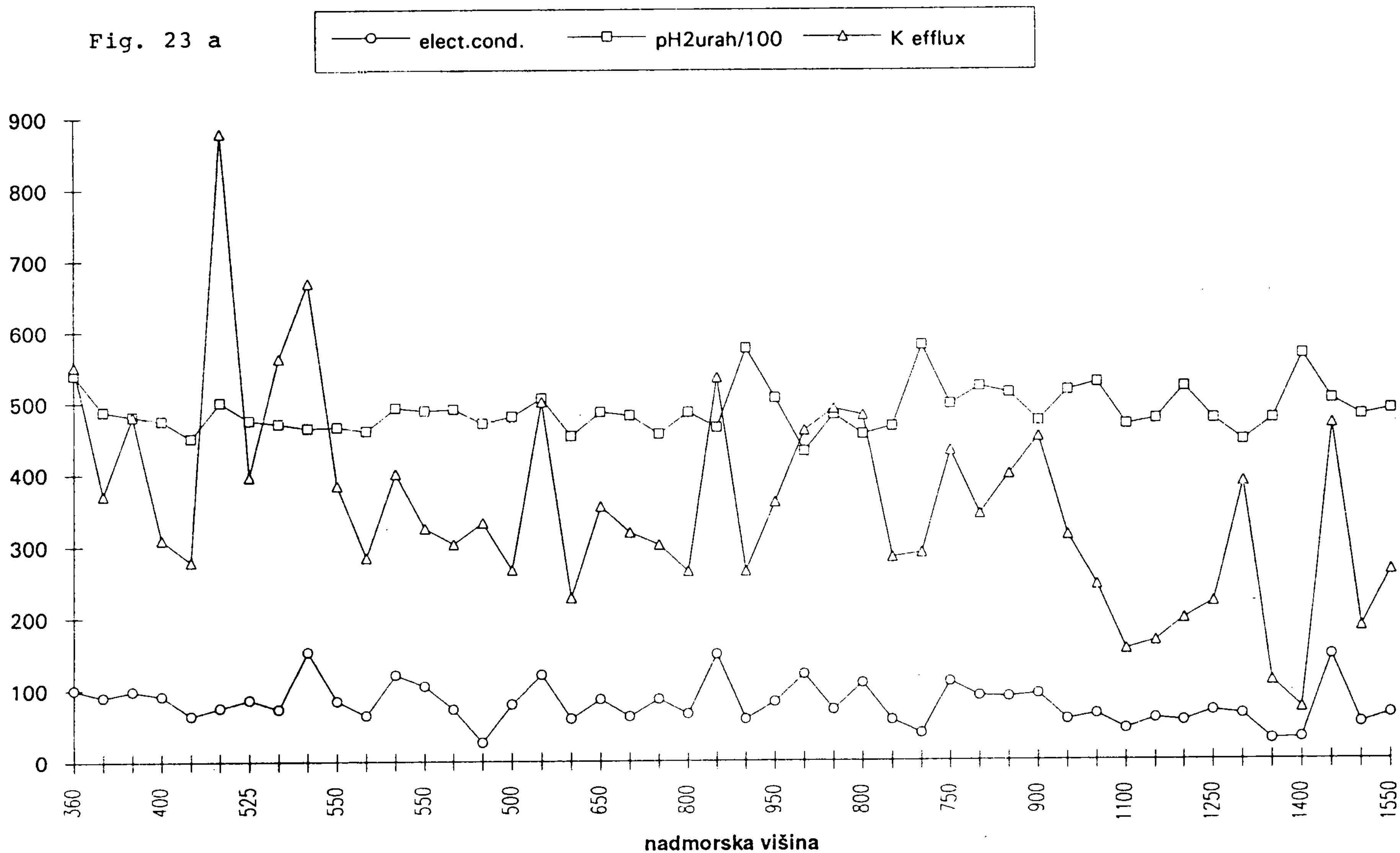
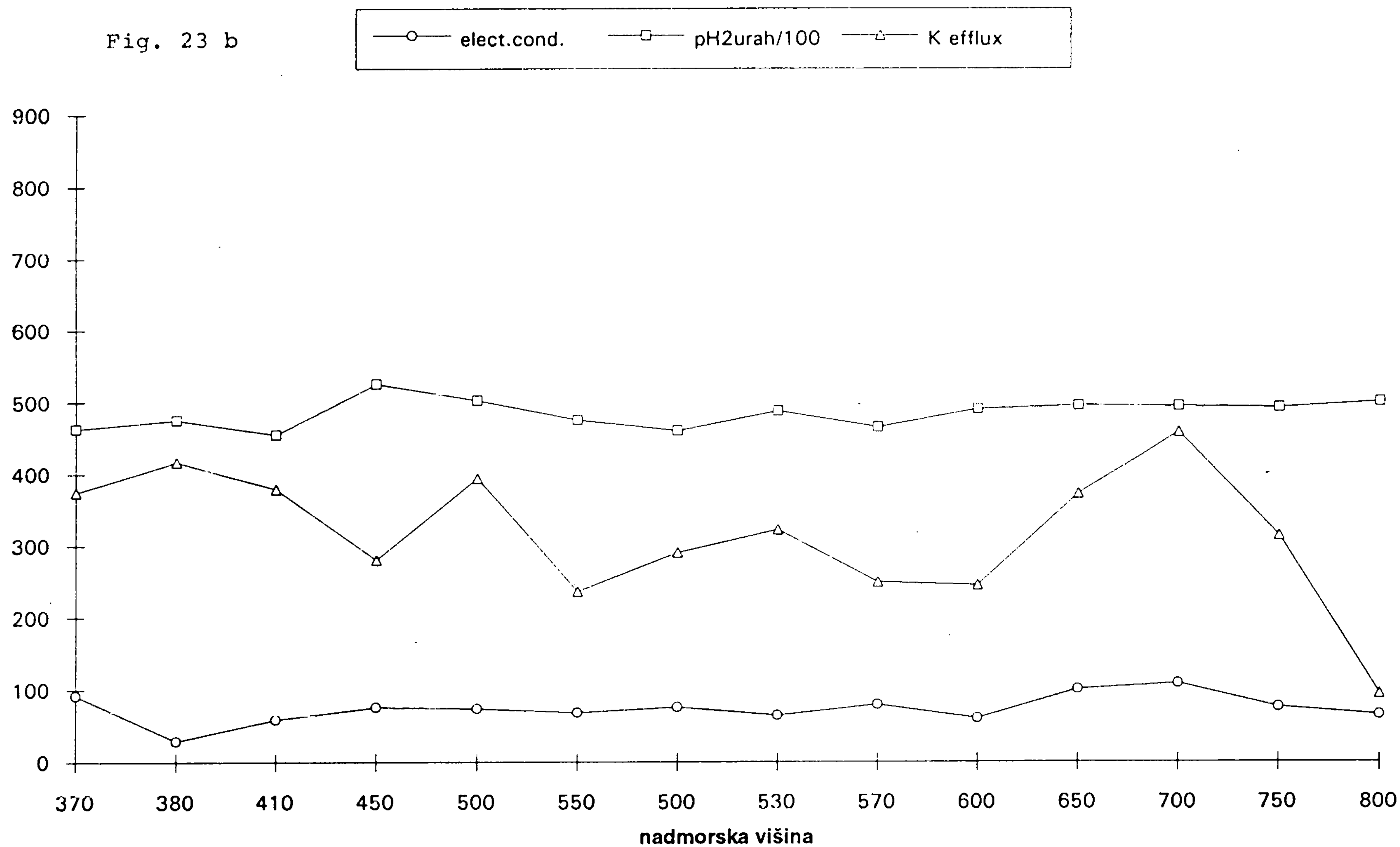

elect.cond.
pH2urah/100
K efflux
900
800
700
600
500
400
300
200
100
0
360
400
525
550
550
500
650
800
950
800
750
900
1100
1250
1400
1550
nadmorska višina

Fig. 23 b



elect.cond.
pH2urah/100
K efflux
900
800
700
600
500
400
300
200
100
0
370
380
410
450
500
550
500
530
570
600
650
700
750
800
nadmorska višina

Fig. 24 a

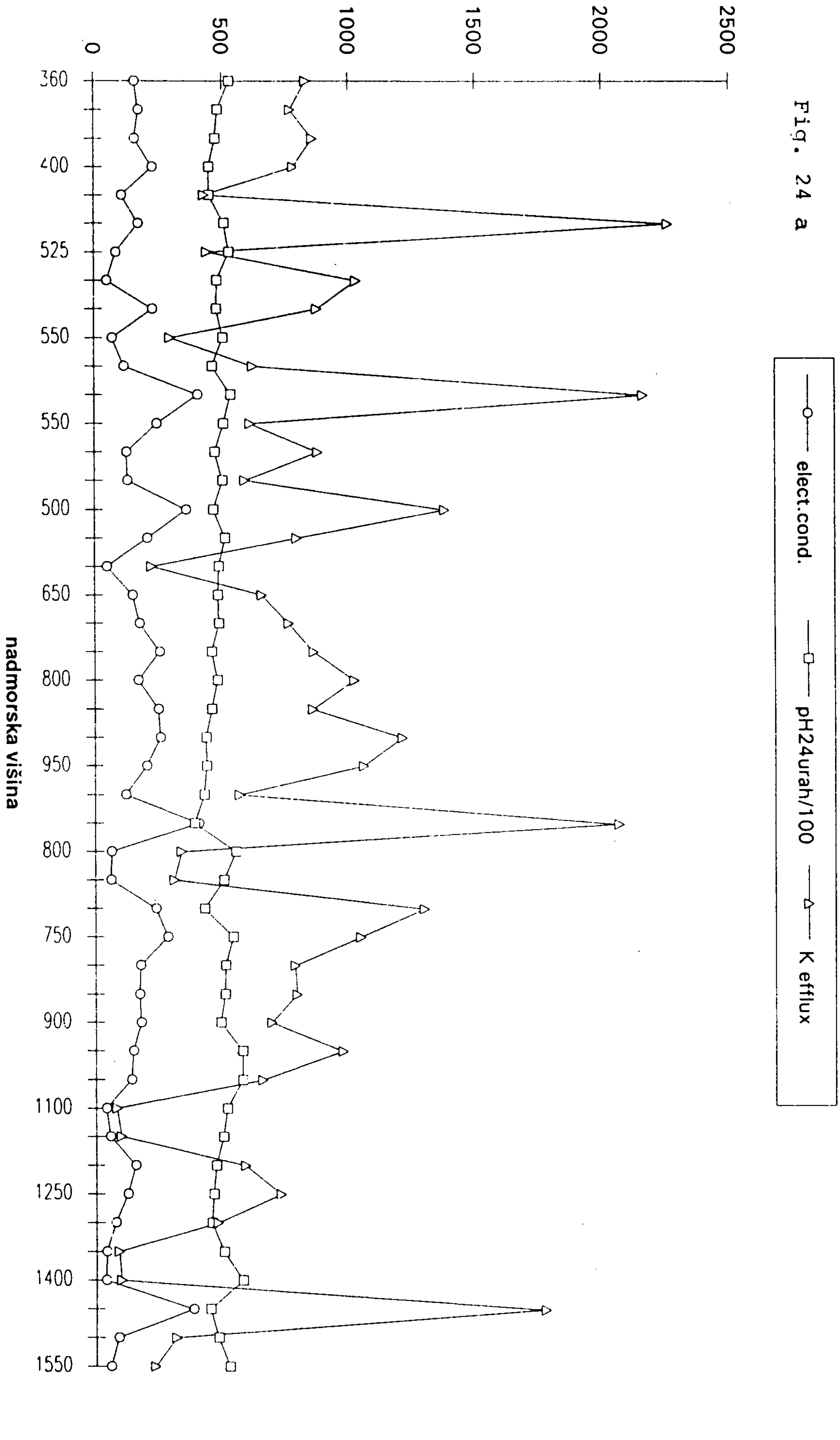
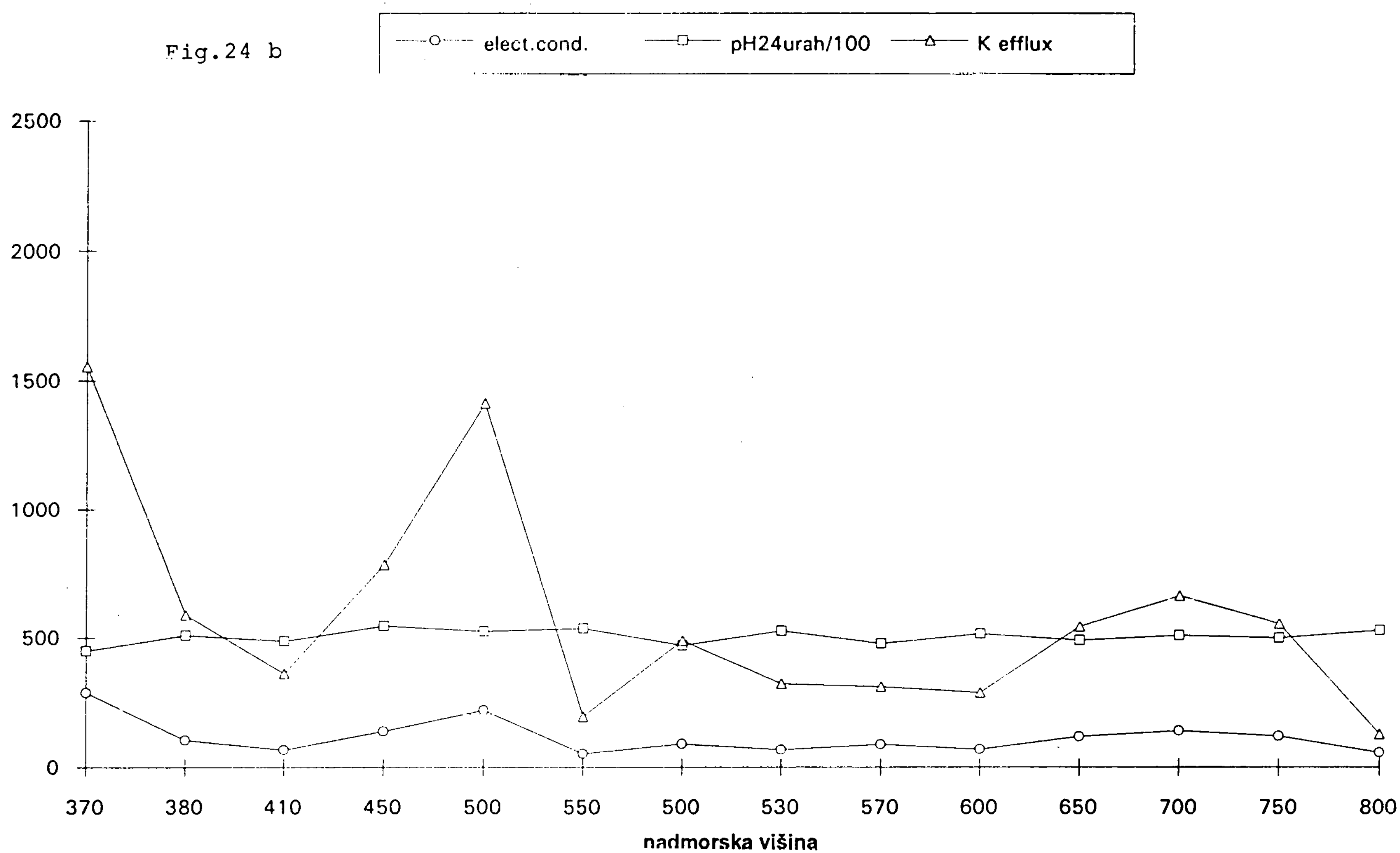

0
500
1000
1500
2000
2500
360
400
525
550
550
500
650
800
950
800
750
900
1100
1250
1400
1550
nadmorska višina
elect.cond.
pH24urah/100
K efflux

Fig.24 b



elect.cond.
pH24urah/100
K efflux
2500
2000
1500
1000
500
0
370
380
410
450
500
550
500
530
570
600
650
700
750
800
nadmorska višina

Fig. 25a

TOTAL SULPHUR CONTENT IN NORWAY SPRUCE NEEDLES, SAMPLING IN 1991

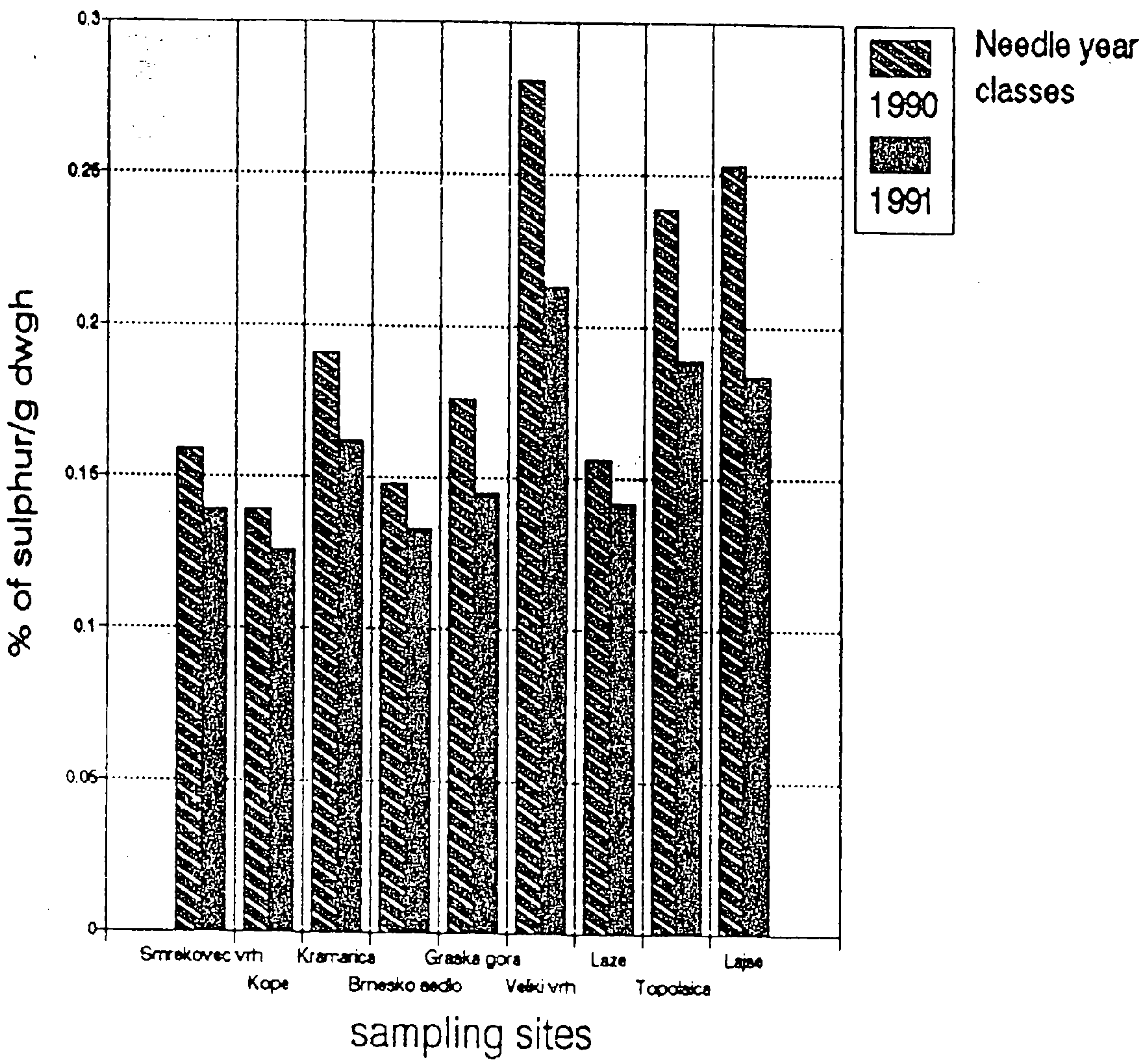


Fig. 25b

CHLOROPHYLL a+b CONTENT IN NEEDLES, 1991 (mg/g dwght)

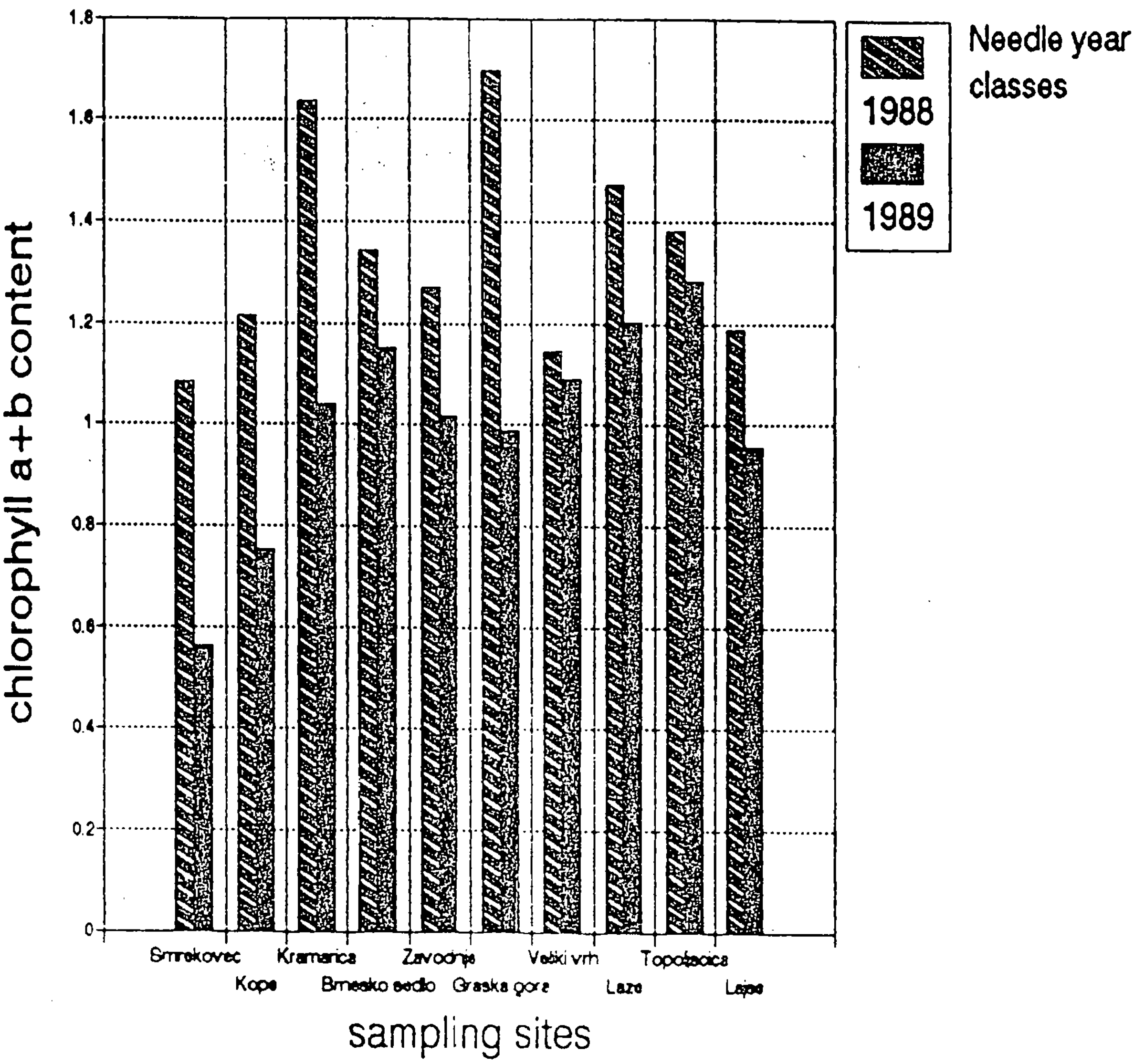


Fig. 25c

TOTAL CAROTENOID CONTENT IN NEEDLES, 1991 (mg/g dwght)

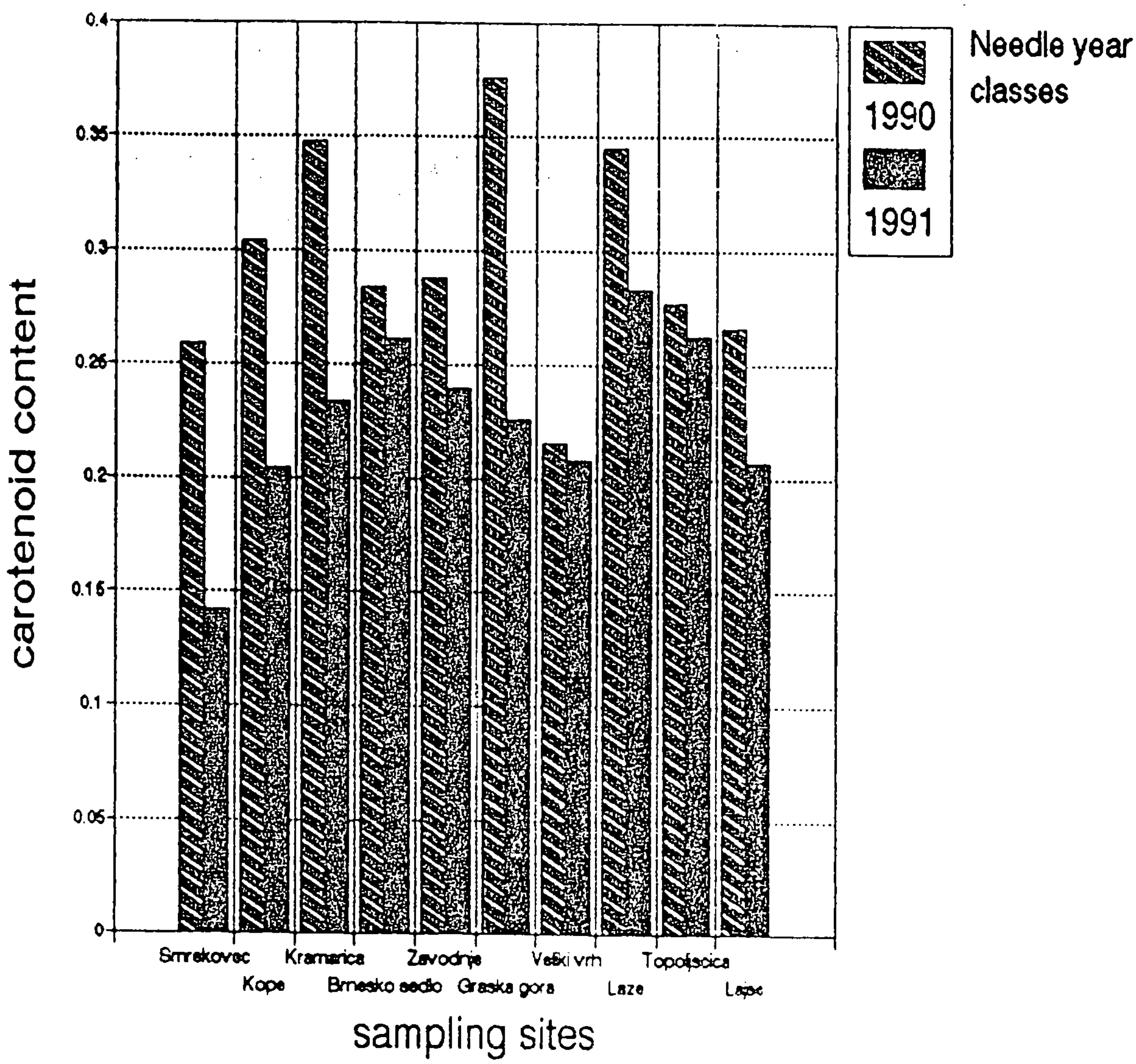


Fig. 25d

PEROXIDASE ACTIVITY IN SPRUCE NEEDLES, 1991 (units/g liofil. needles)

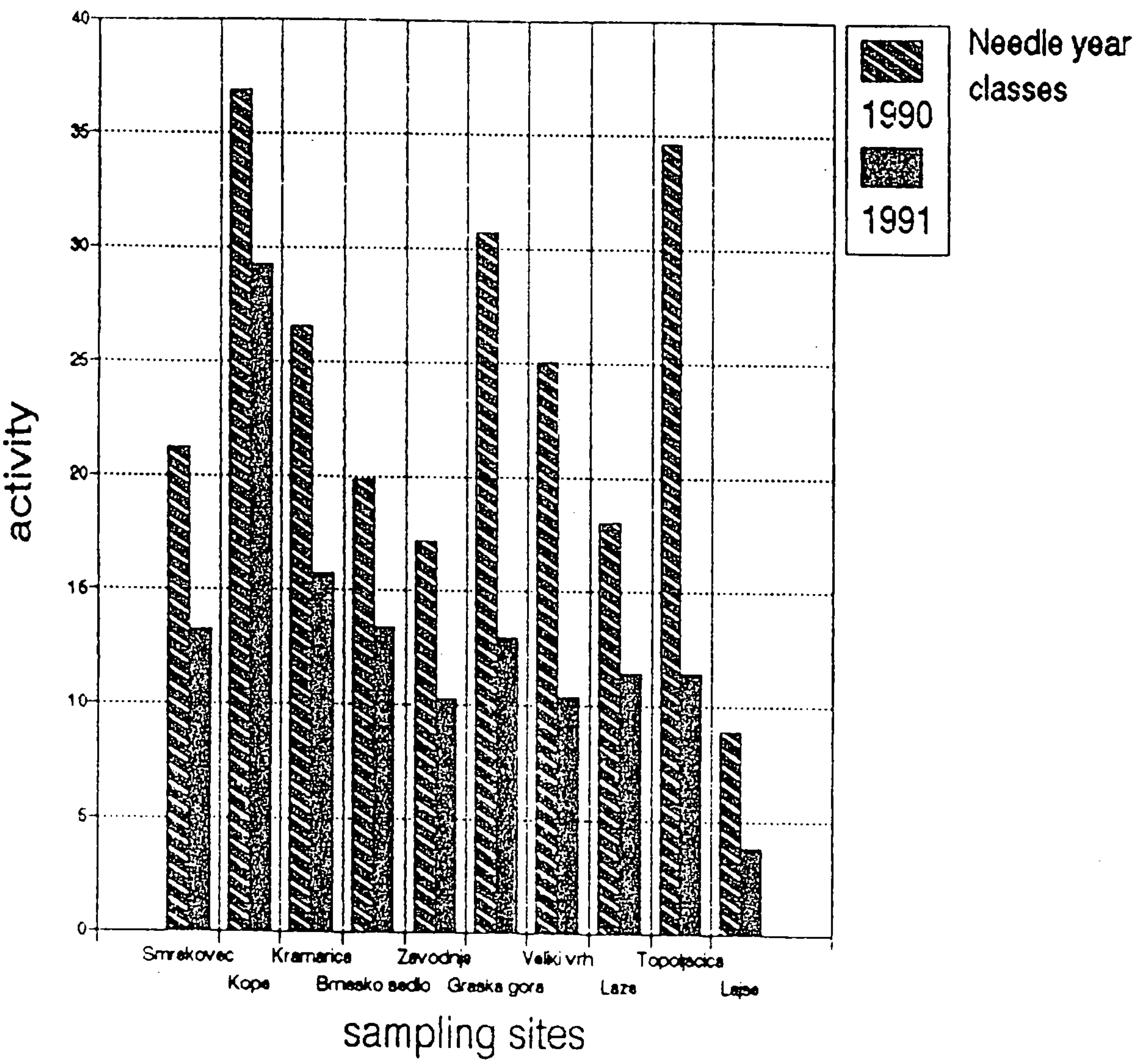


Fig. 25e

WATERSOLUBLE THIOLS CONTENT IN NEEDLES, 1992 (micromol/g liofil. needles)

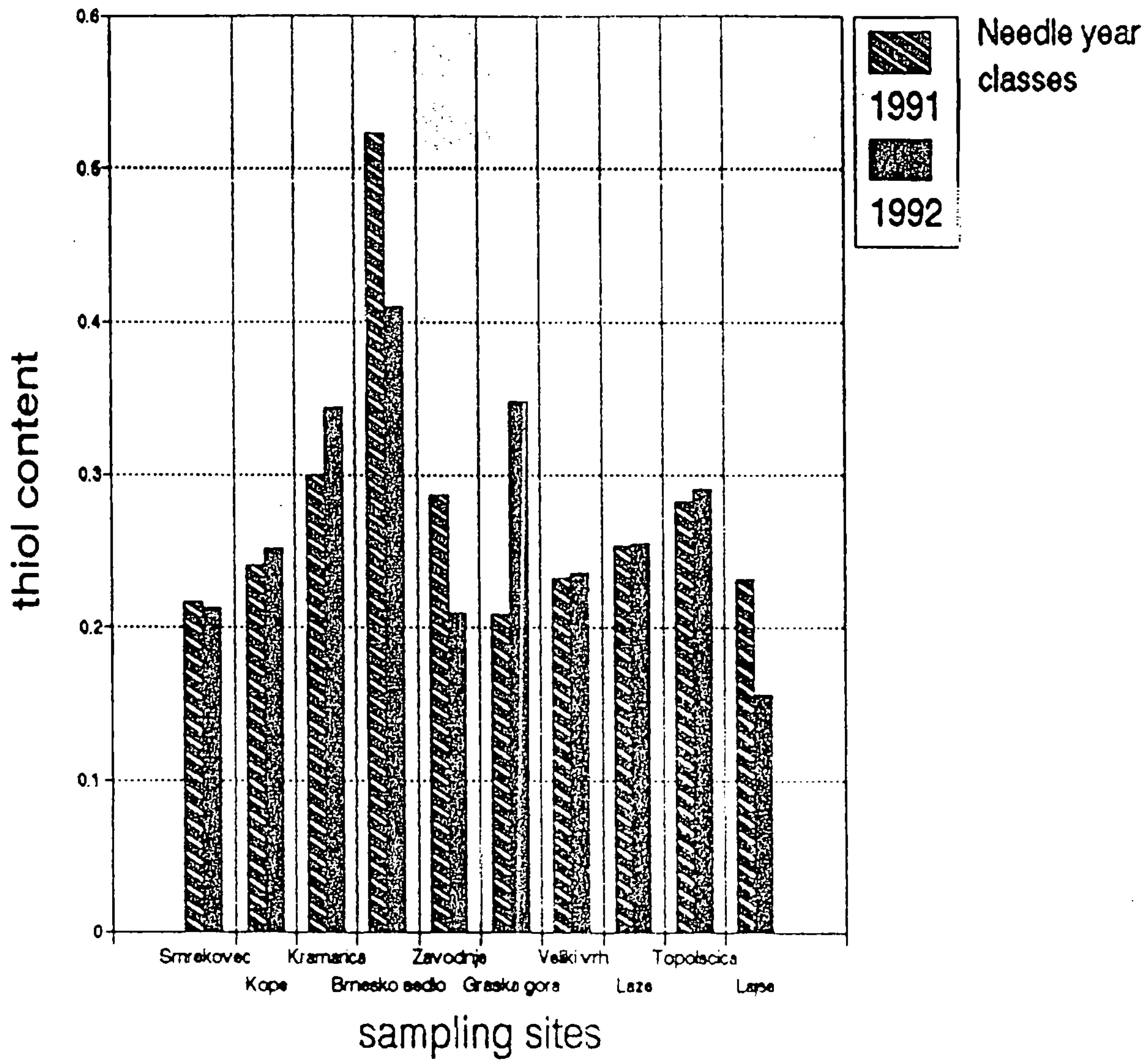


Fig. 25f

CHLOROPHYLL a+b CONTENT IN NEEDLES, 1991 (mg/g dwght)

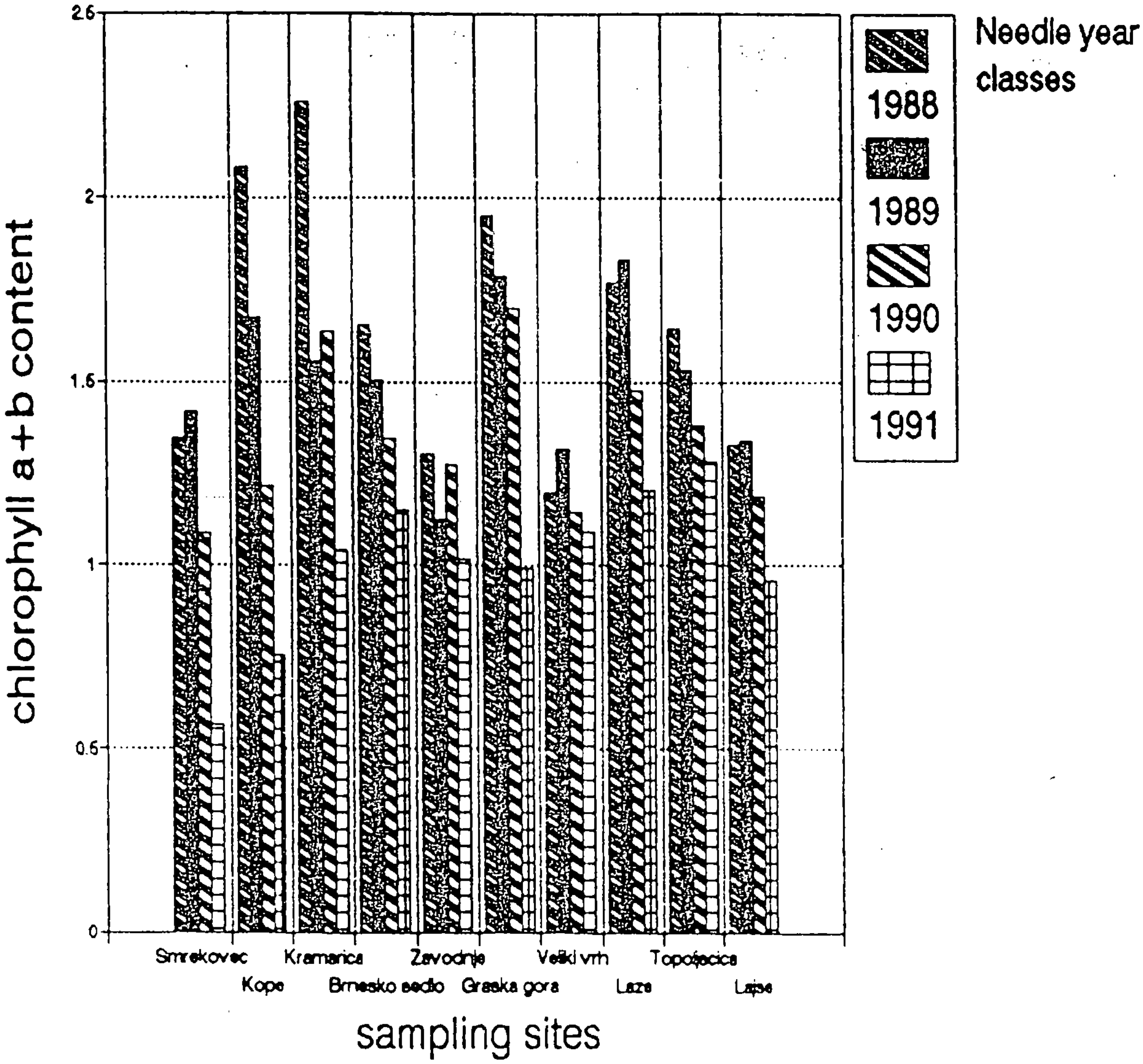


Fig. 25g

TOTAL CAROTENOID CONTENT IN NEEDLES, 1991 (mg/g dwght)

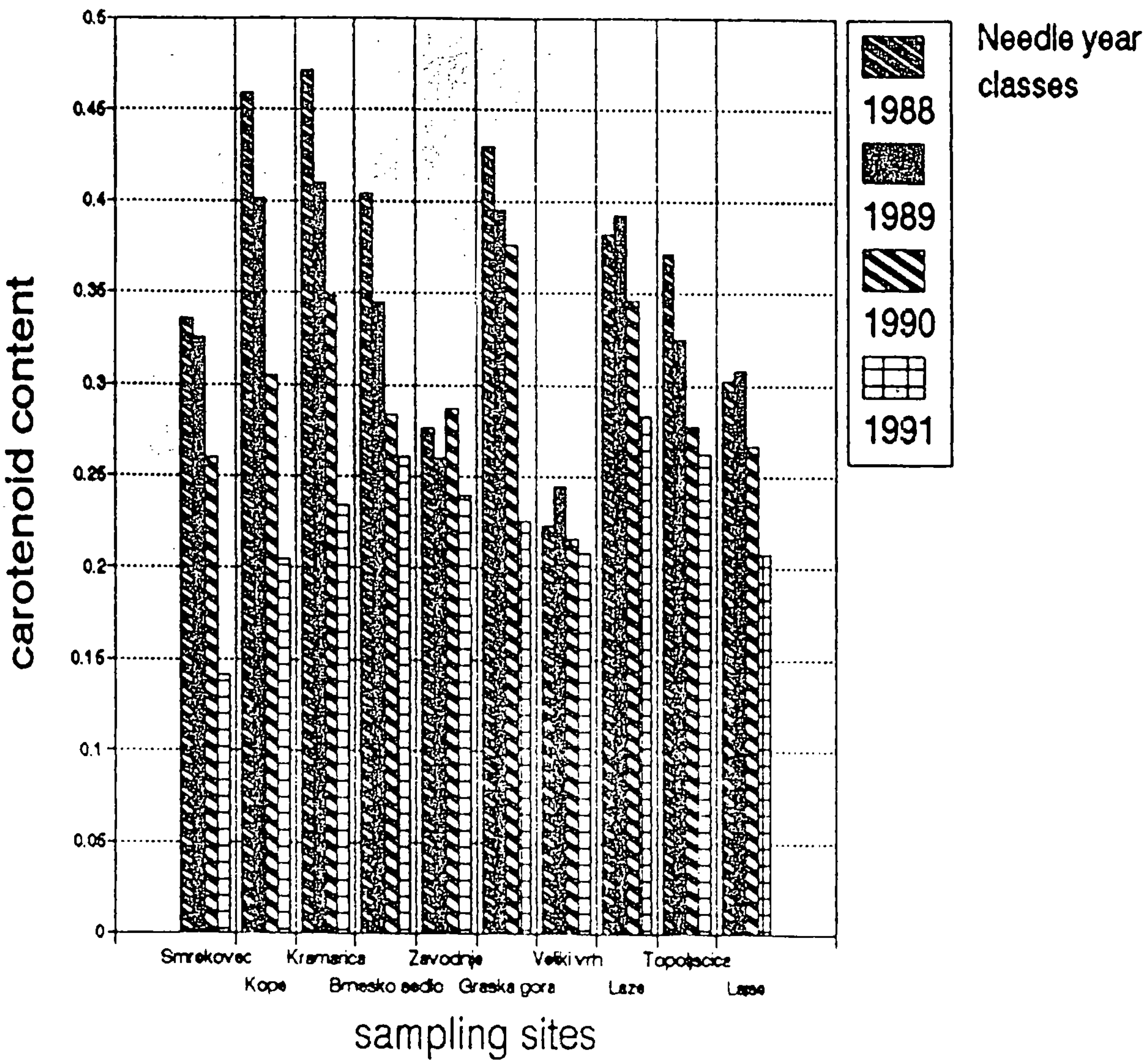


Fig. 25h

PEROXIDASE ACTIVITY IN SPRUCE NEEDLES, 1991 (units/g liofil. needles)

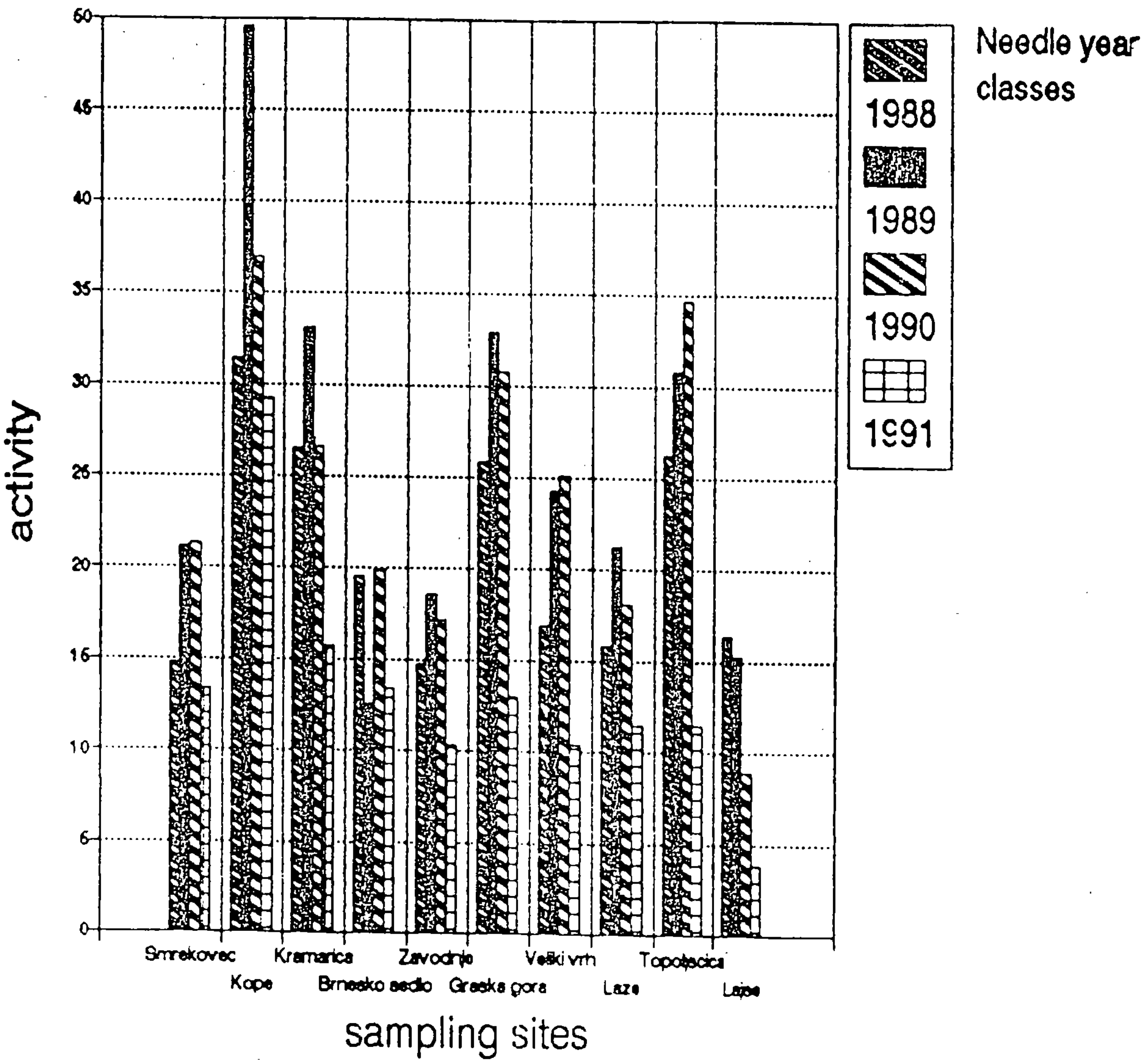
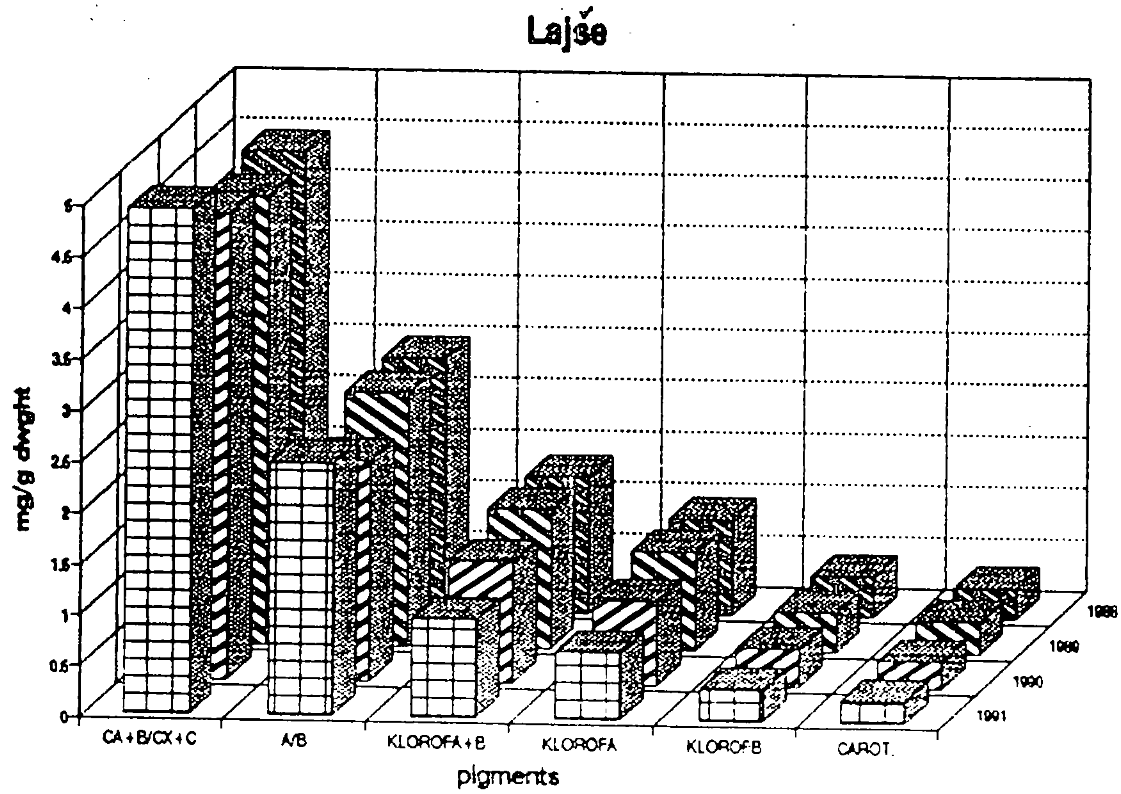


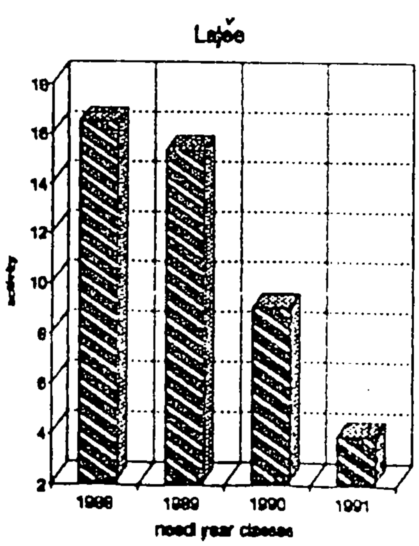
Fig. 26

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

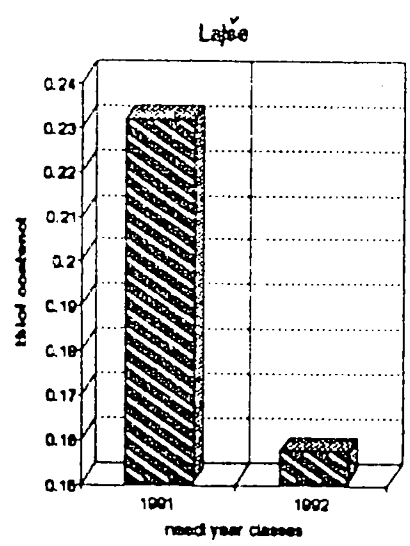
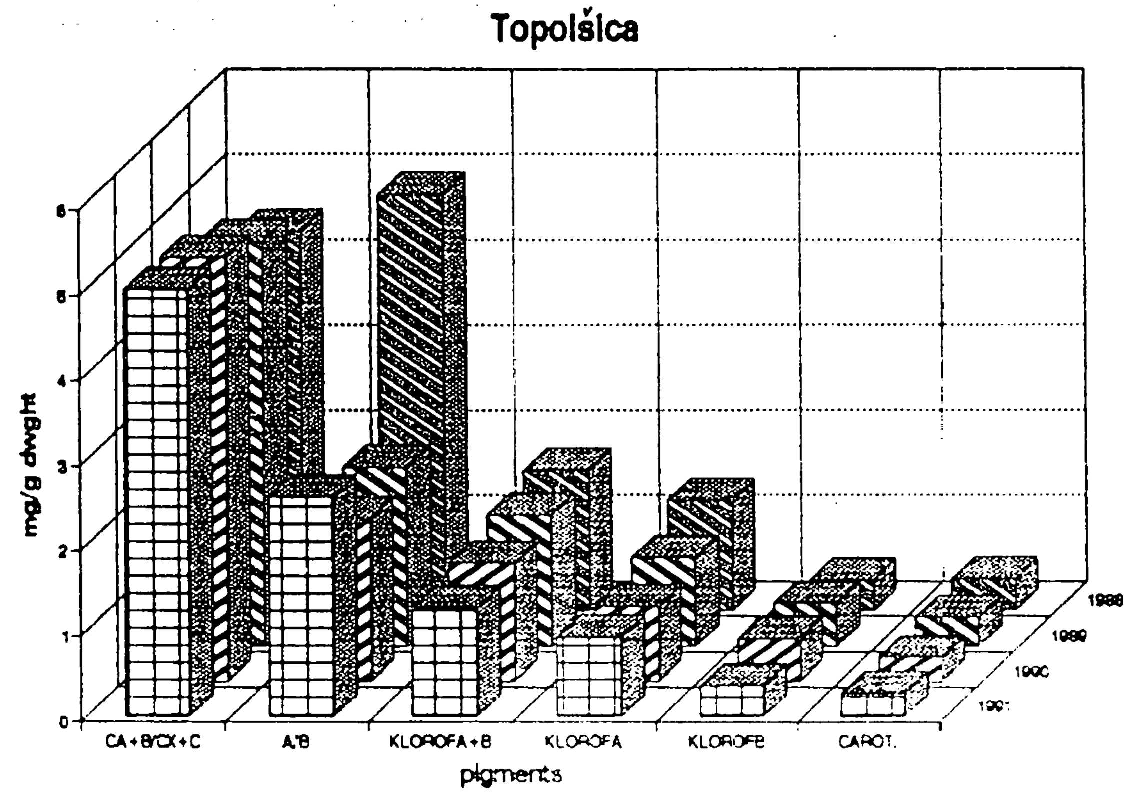


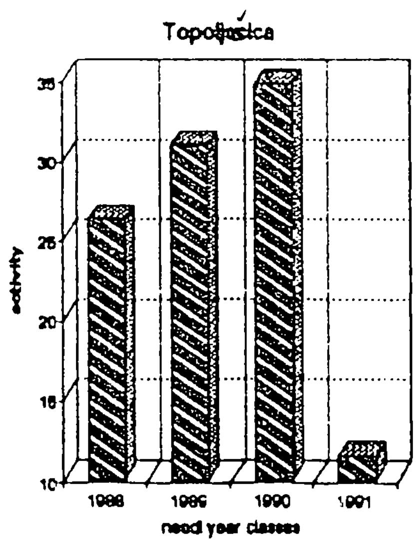
Fig. 27

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

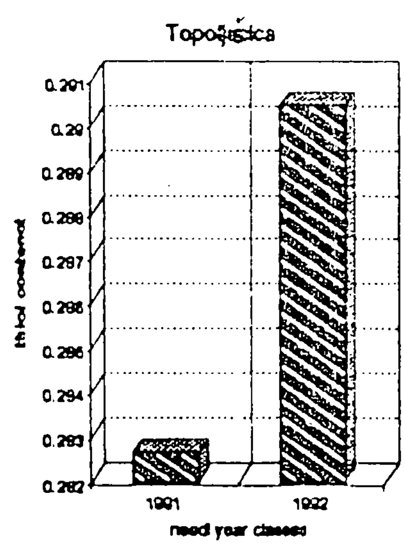
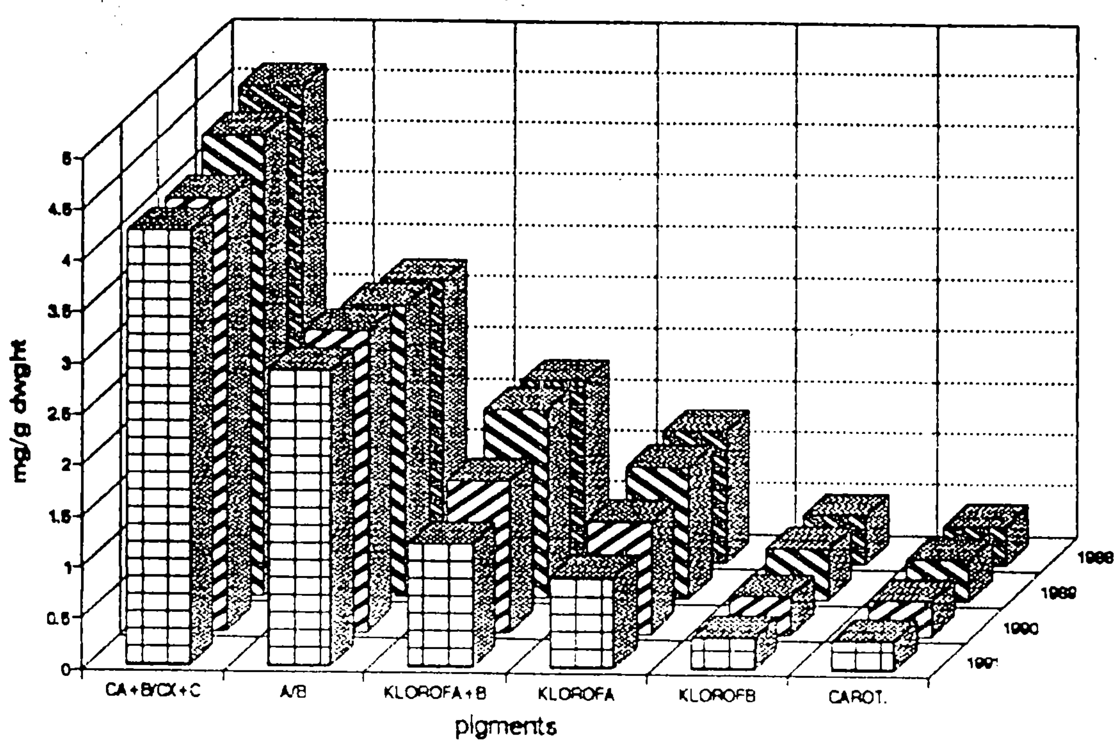


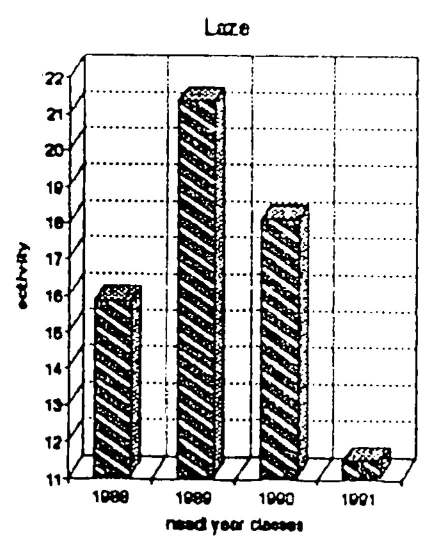
Fig. 28

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

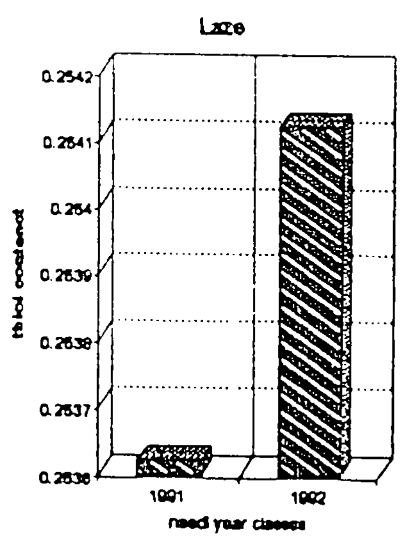
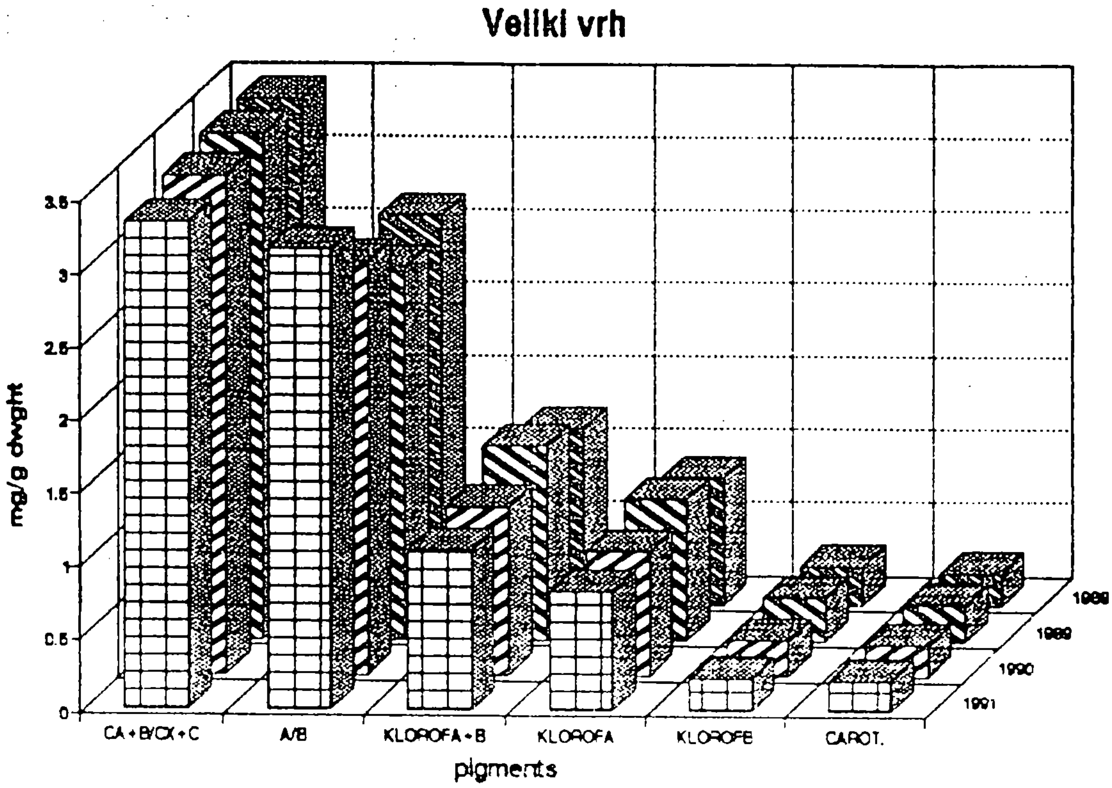


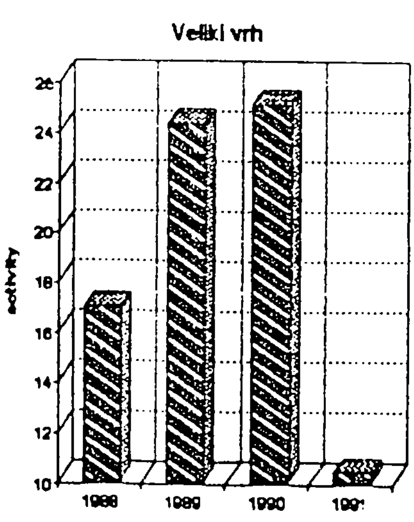
Fig. 29

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

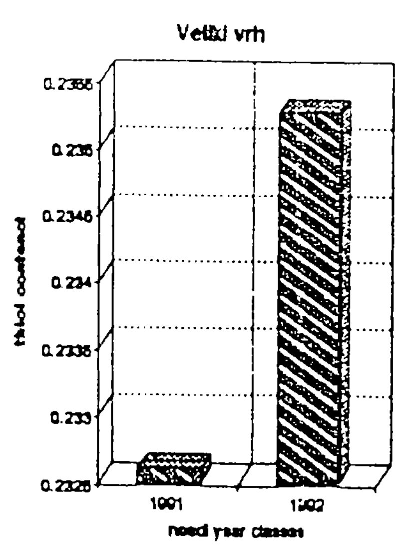
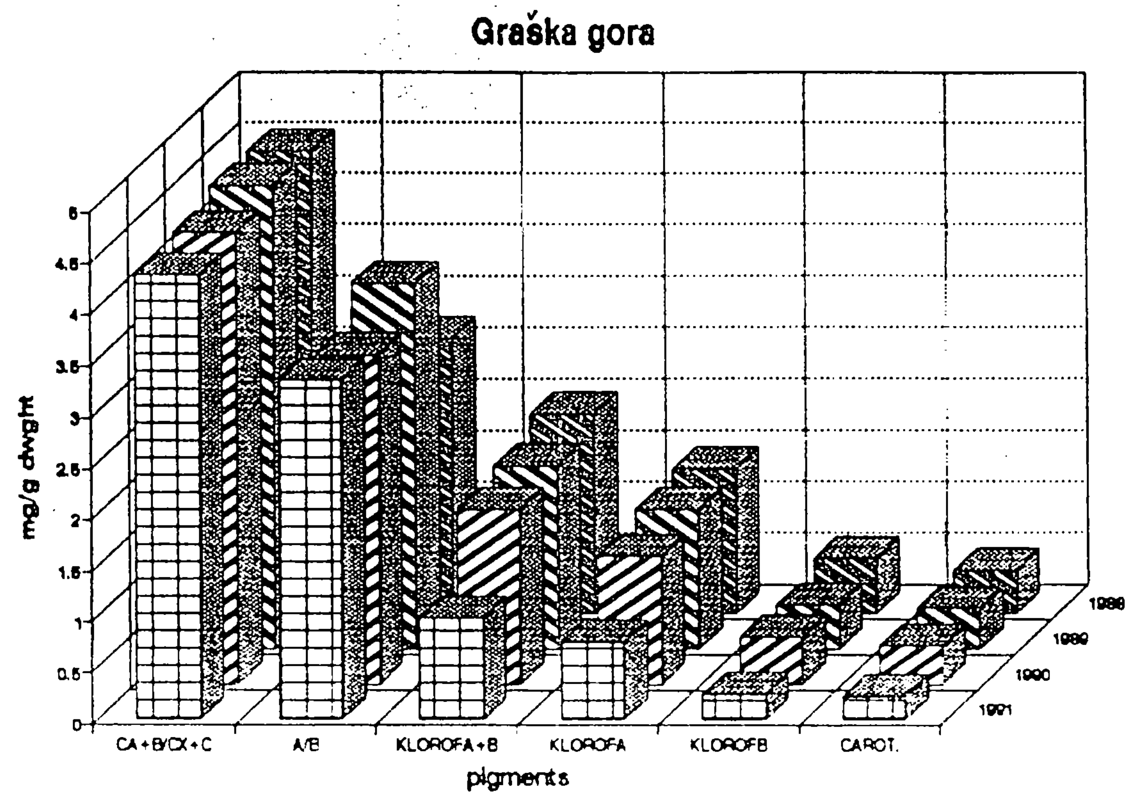


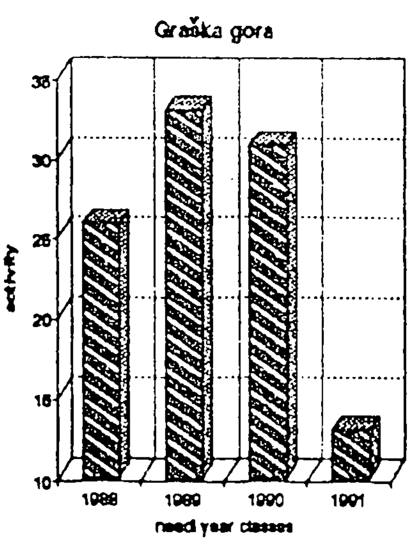
Fig. 30

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

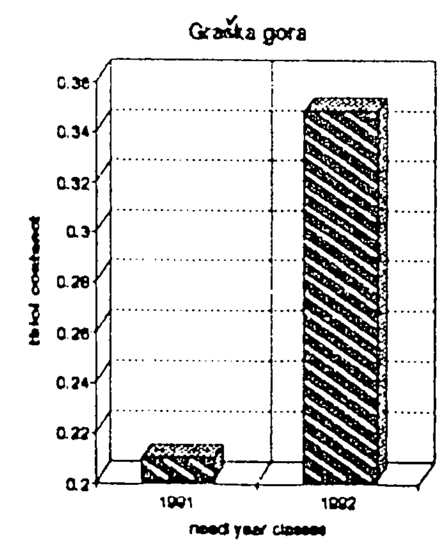
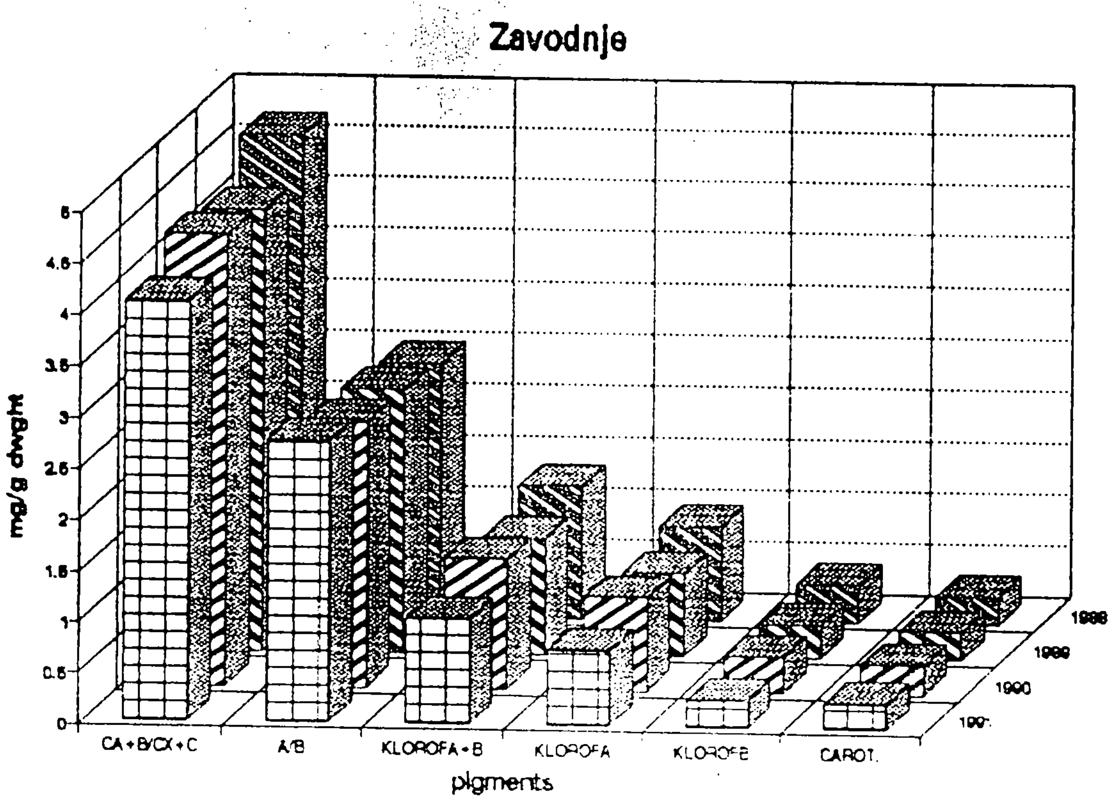


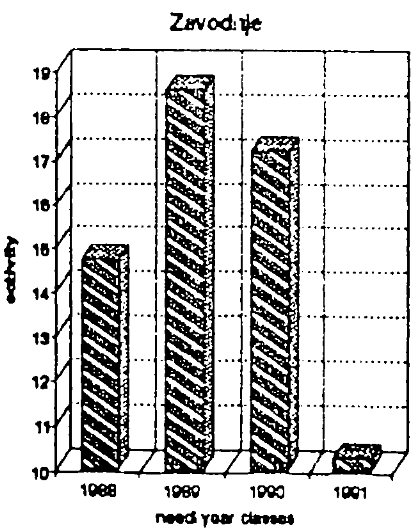
Fig. 31

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

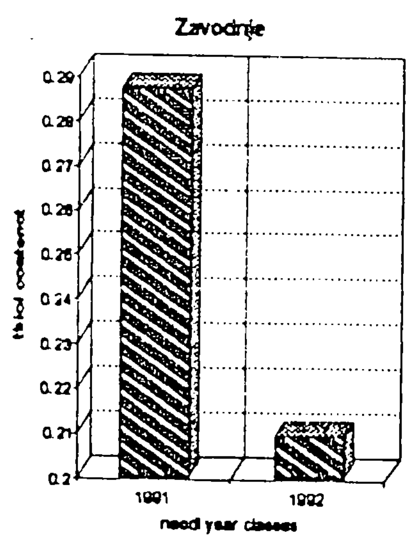
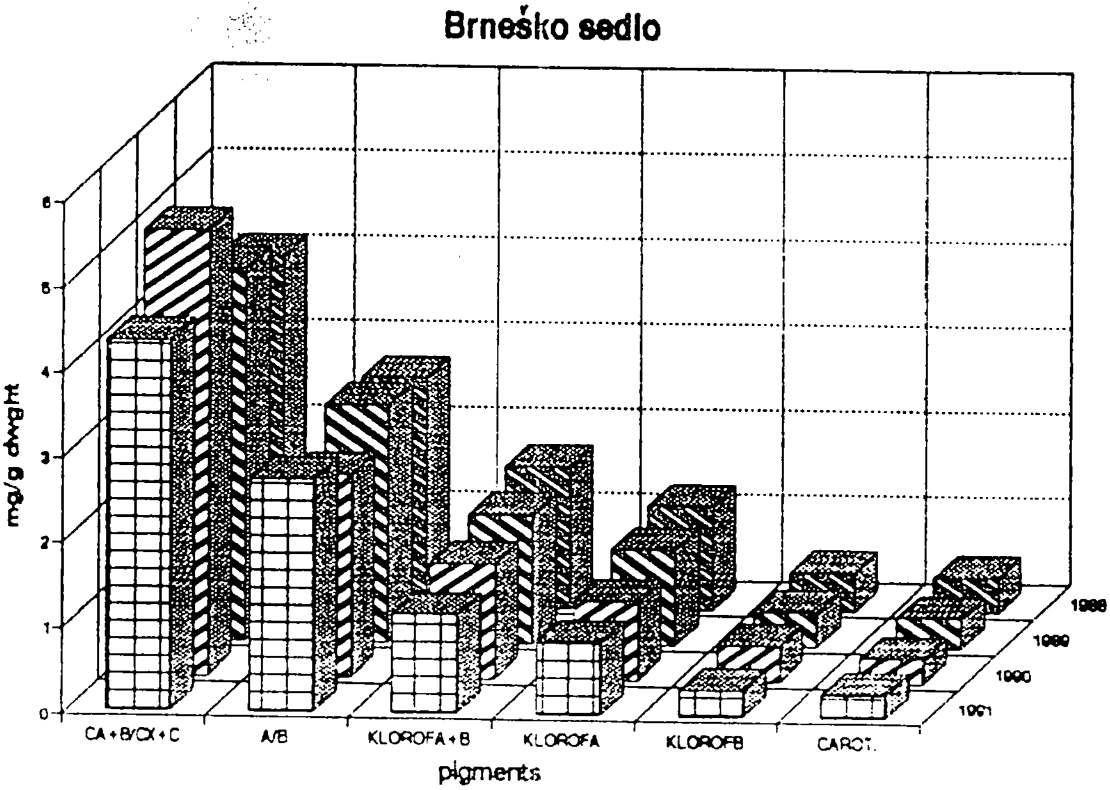


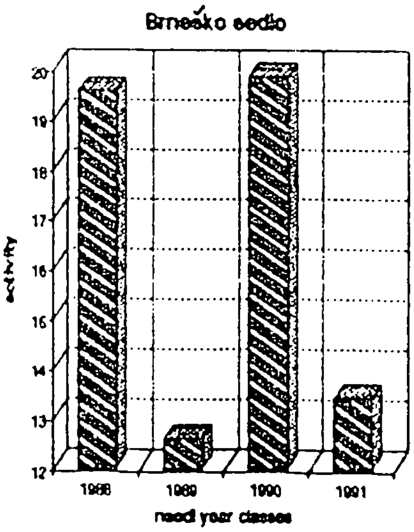
Fig. 32

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thicls content in needles, 1992

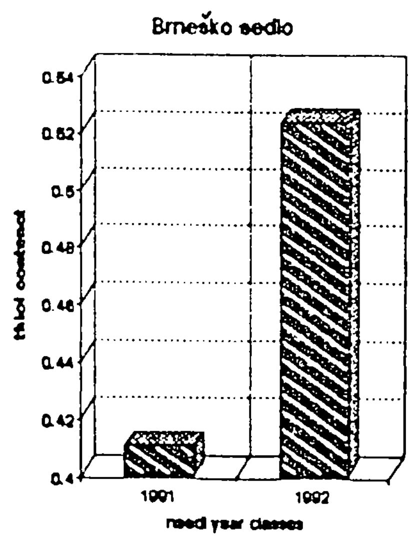
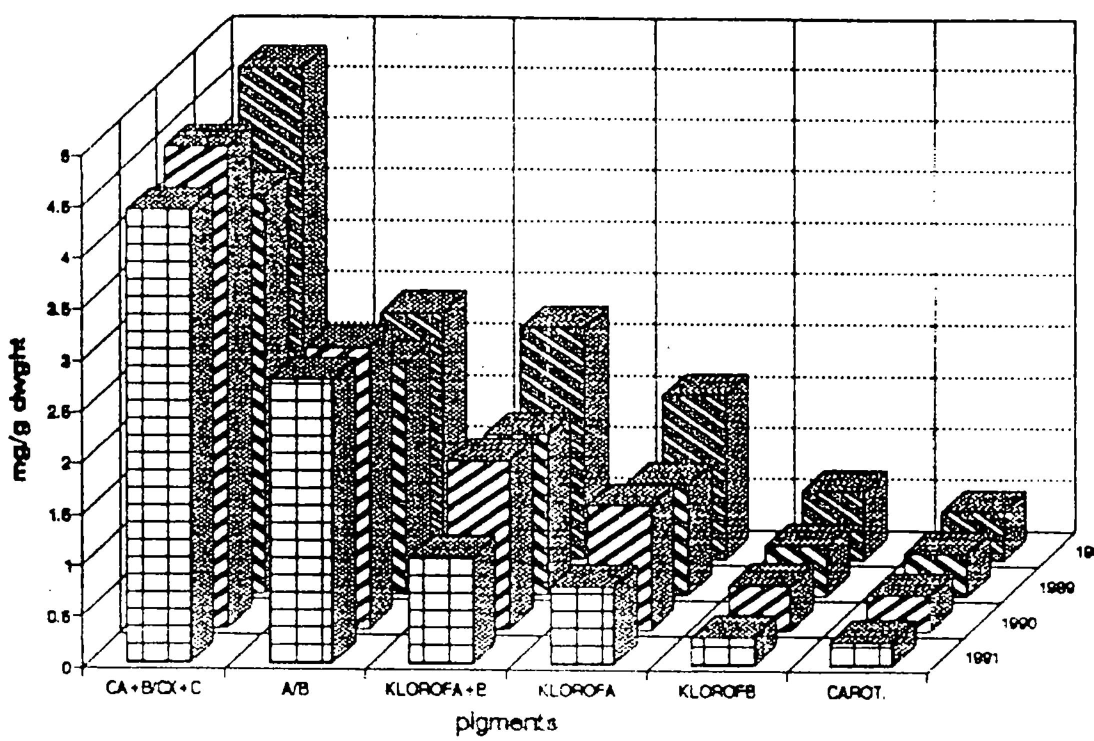


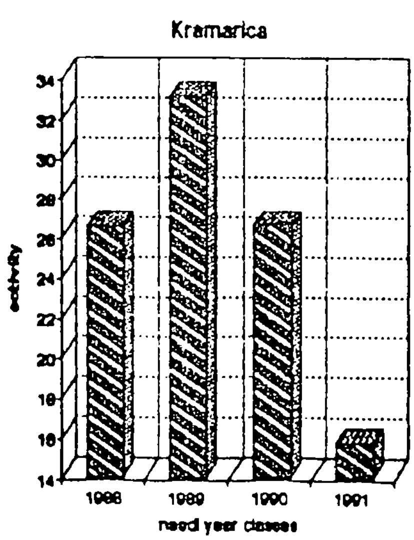
Fig. 33

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

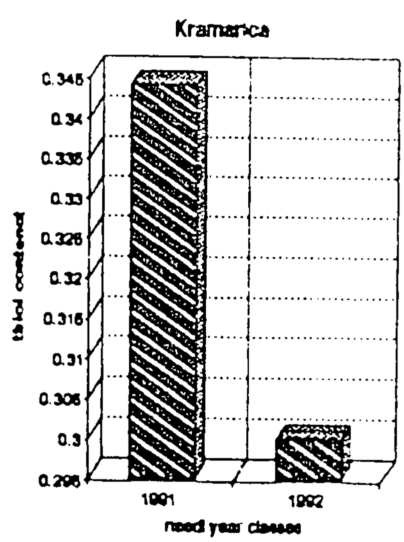
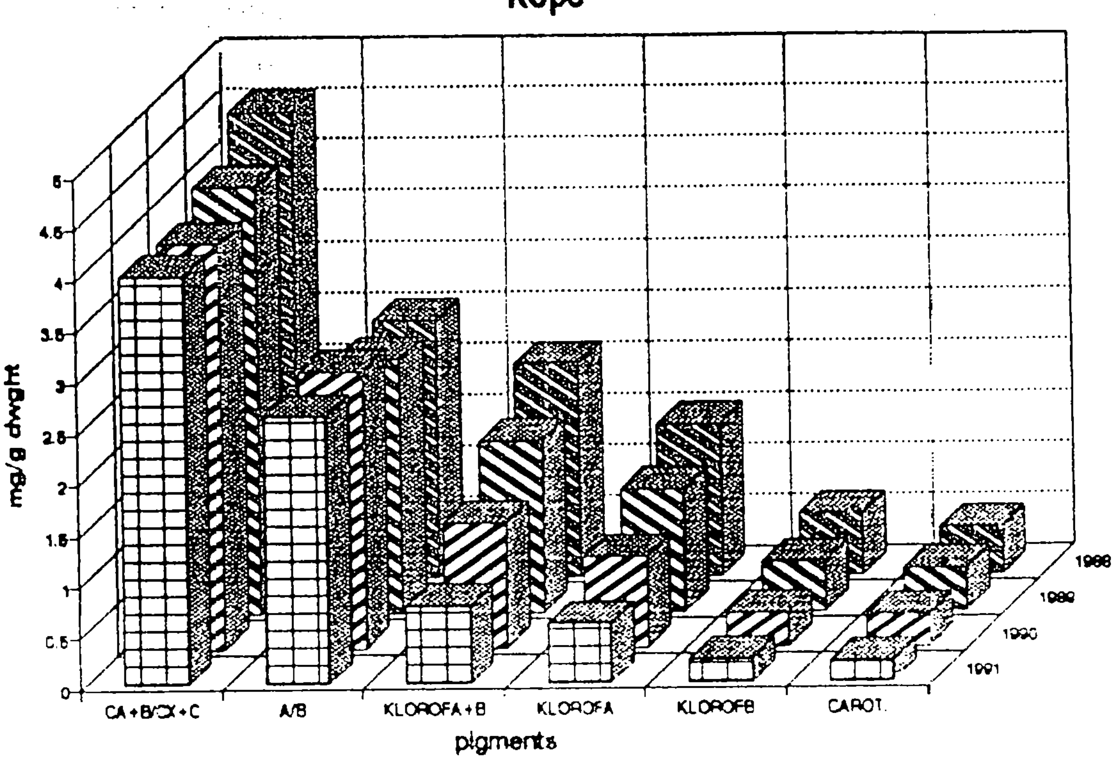


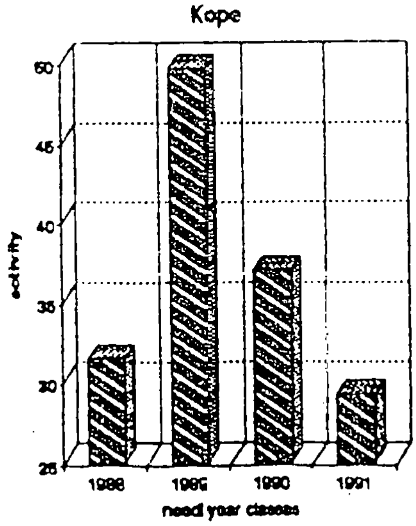
Fig. 34

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles,1991



Watersoluble thiols content in needles, 1992

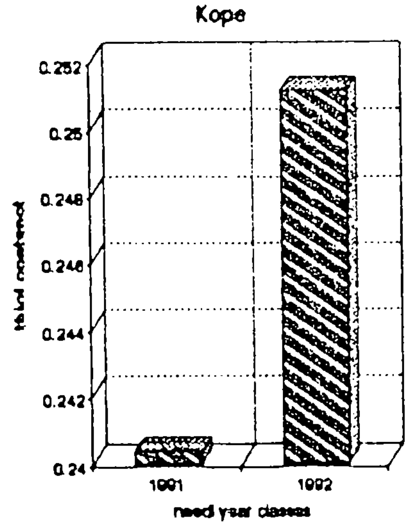
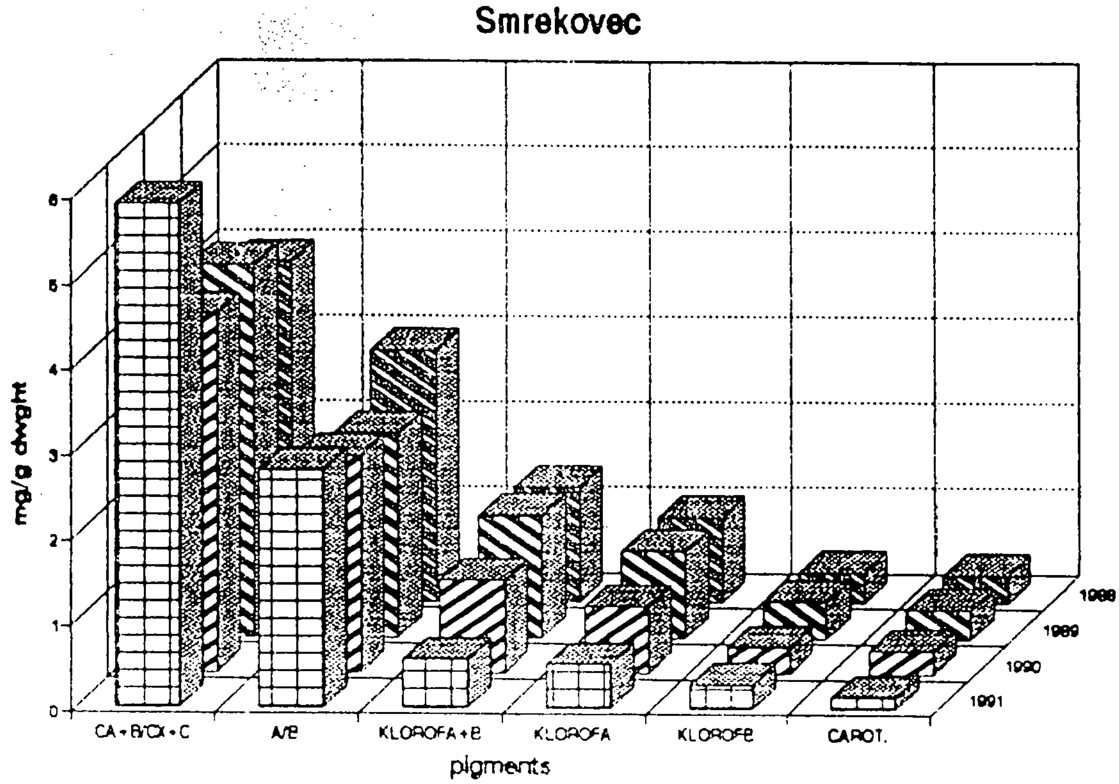


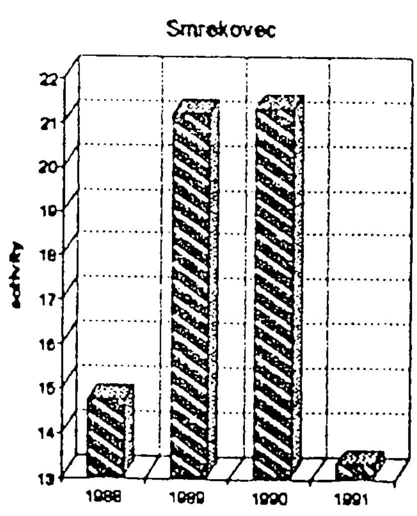
Fig. 35

PHYSIOLOGICAL AND BIOCHEMICAL AIR POLLUTION STRESS INDICATORS IN NORWAY SPRUCE NEEDLES ON SAMPLING SITE

Photosynthetic pigment content in Norway spruce needles, 1991.



Peroxidase activity in spruce needles, 1991



Watersoluble thiols content in needles, 1992

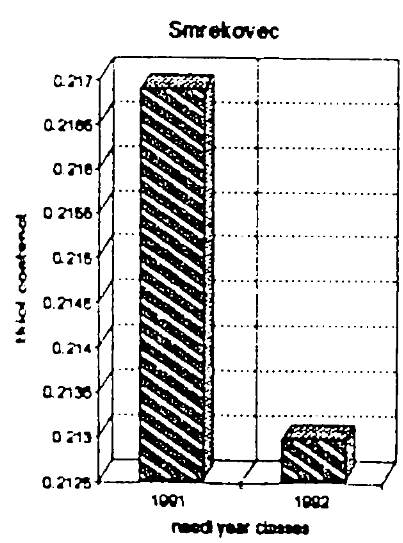


Fig. 36

FOREST DIE-BACK INVENTORY IN SLOVENIA IN 1991
Distribution of IAPt values

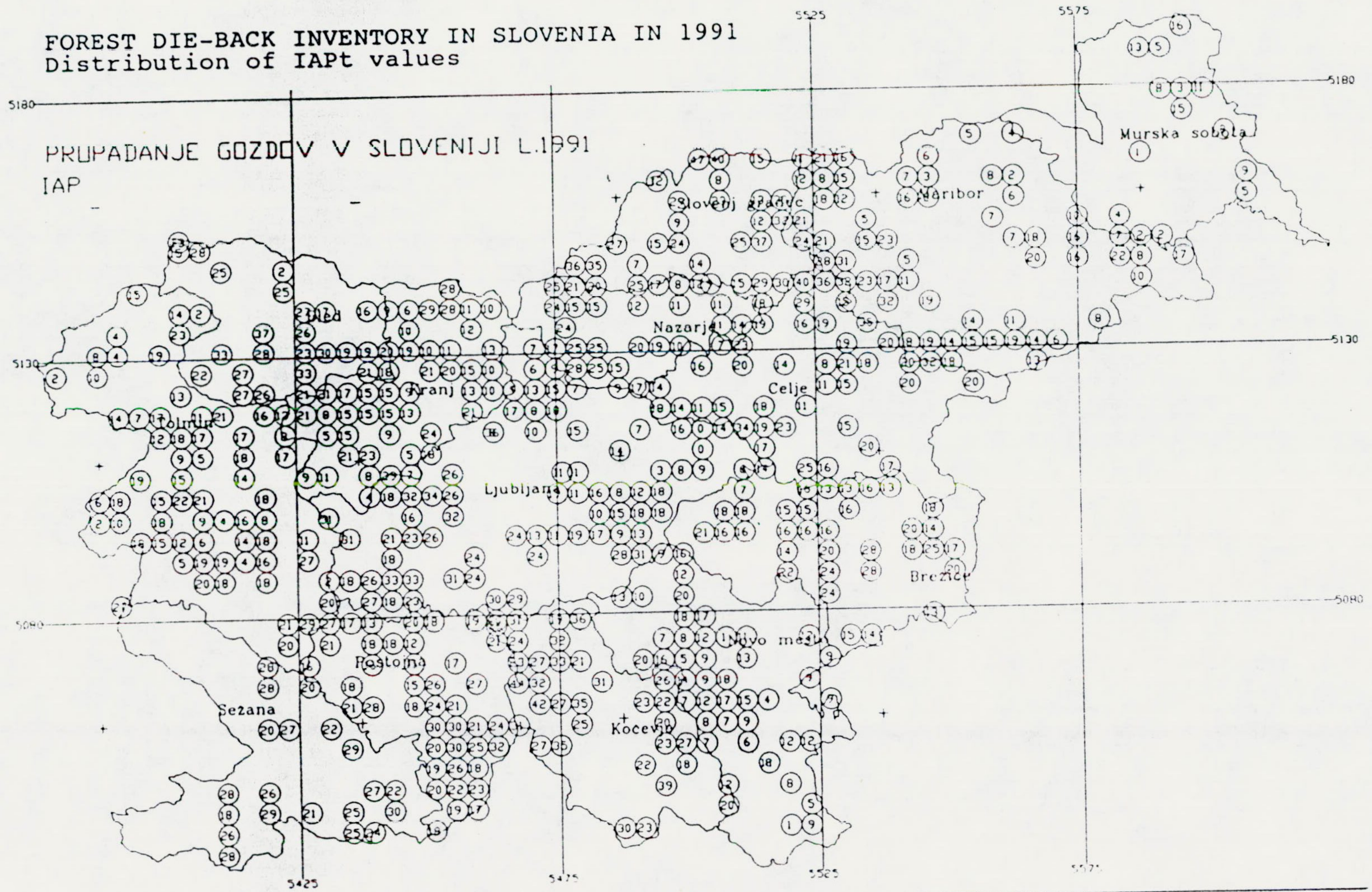
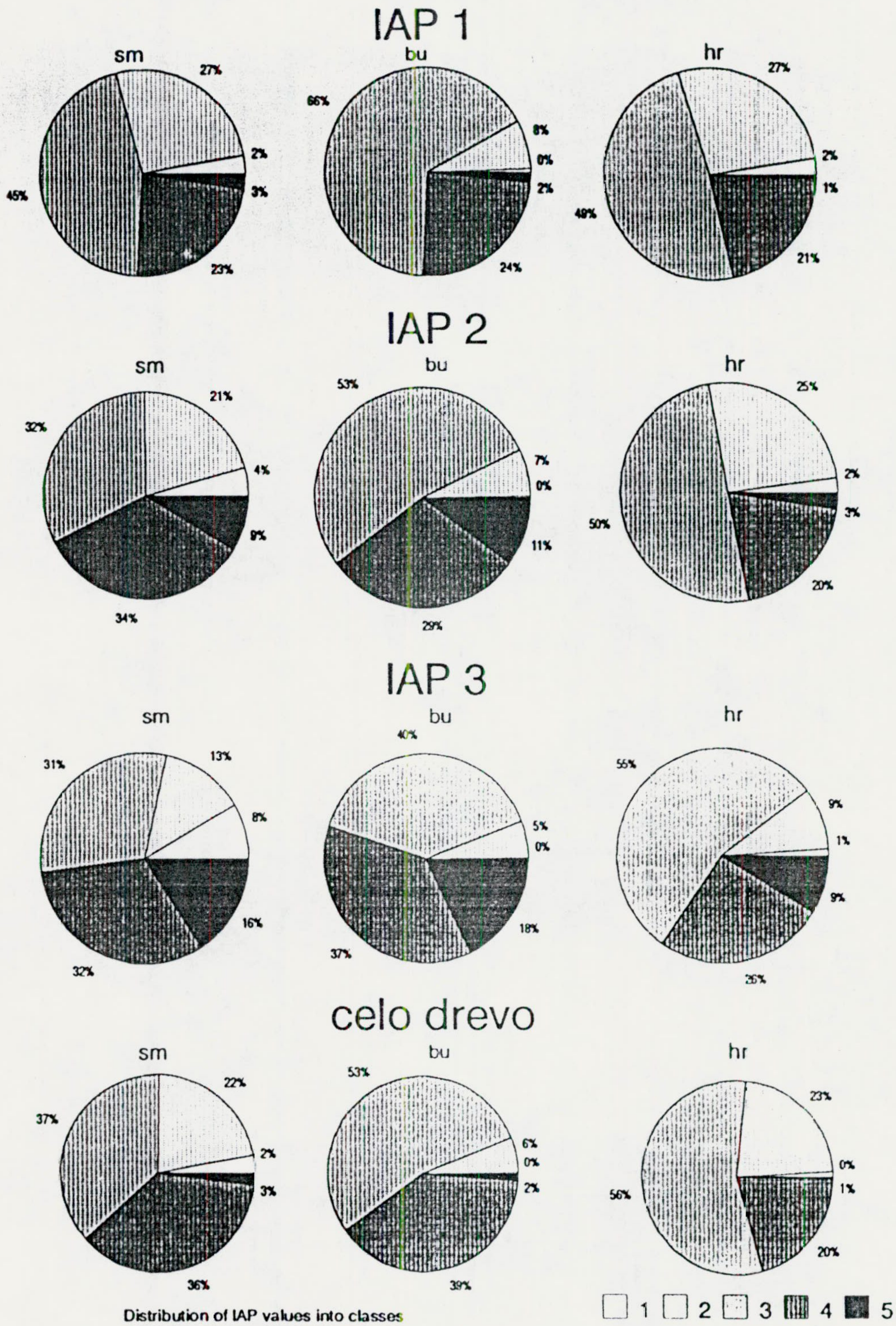


Fig. 37

PERCENTUAL DISTRIBUTION OF OBSERVED TREES ACCORDING TO VALUE OF IAP (index of atmospheric purity) DEVIDED INTO FIVE CLASSES; IAP1=tre base, IAP2=brest height of the trunk, IAP3=tree crowns, IAPt=whole tree; sm=Norway spruce, bu=common beech, hr=oaks.



Distribution of IAP values into classes

IAP classes	values of IAP1,2,3	values of IAPt
1	13.6-18.0	40.6-54.0
2	9.1-13.5	27.1-40.5
3	4.6- 9.0	13.6-27.0
4	1.0- 4.5	1.0-13.5
5	0.0- 0.9	0.0- 0.9

Table 1

Diplomarbeit Koch Marietta

EPIPHYTISCHE FLECHTEN DES POHORJE

Artenliste der bisher gefundenen und bestimmten Flechten

Acrocordia gemmata	
Alectoria sarmentosa	(18.6.91, Sorbus auc., Picea abies; 29.5., 7, Picea abies)
Anaptychia ciliaris	
Arthonia punctiformis	(18.6.91, Sorbus auc.)
Arthonia radiata	(10.4., 9, Acer pspl.; 10.8., 5, Tilia sp.; 25.9., 6, Frax. exc.)
Arthonia stellaris	(10.4., 3, Juglans regia; 22.9., 3, Frax.ex.)
Arthonia vinosa	(18.6.91, Acer pspl.)
Arthopyrenia sp.	(10.8., 2, Acer pspl.)
Arthothelium ruanum	(3.4., 1, Fraxinus exc.)
Bacidia arceutina	
Bacidia circumspecta	(22.9., 4, Acer pspl.)
Bacidia globulosa	
Bacidia laurocerasi	(10.4., 5, Fraxinus exc.)
Bacidia naegelii	(12.2., 3, Salix)
Bacidia rubella	
Baeomyces rufus	(10.4., 5, Gestein; 6.5., 8, Gestein)
Biatora epixanthoidiza	(18.6.91, Acer pspl.; 29.5., 6, Acer pspl.)
Bryoria fuscescens	
Bryoria implexa	

Buellia disciformis	
Buellia griseovirens	(13.3., 1, Fraxinus exc.)
Buellia punctata	
Calicium viride	(3.9., 4, Picea abies)
Caloplaca cerina	
Caloplaca cerinella	(10.8., 1, Juglans reg.; 22.9., 3, Juglans)
Caloplaca herbidella	
Caloplaca holocarpa	(25.9., 1, Tilia cord.)
Candelaria concolor	(18.6.91, Juglans; 10.4., 3, Malus dom.; 25.9., 5, Malus dom.)
Candelariella reflexa	
Candelariella xanthostigma	
Catillaria nigroclavata	(10.8., 1, 3, Juglans regia)
Cetraria chlorophylla	(18.6.91, Fagus sylv.; 22.9., 2, Picea)
Cetraria pinastri	
Cetrelia olivetorum var. cetrarioides	
Cetrelia olivetorum var. olivetorum	
Chaenotheca chrysocephala	
Chaenotheca ferruginea	(10.4., 1, Picea abies)
Cladonia coniocraea	
Cladonia fimbriata	
Cladonia pyxidata	(27.8., 2, Acer pspl.)
Cladonia macilenta	(22.9., 1, Baumstumpf)
Cliostomum corrugatum	(3.4., 1, Fraxinus exc.)
Collema flaccidum	(12.2., 1, Acer pspl.)
Evernia divaricata	(29.5., 5, Acer pspl.)
Evernia prunastri	
Fuscidea cyathoides	(29.5., 4, Fagus sylv.; 22.9., 4, Fagus syl.)

Graphis scripta

Hypogymnia farinacea

Hypogymnia physodes

Hypogymnia tubulosa

Lecania cyrtella

Lecanora allophana

Lecanora argentata

Lecanora carpinea

Lecanora chlarotera

Lecanora circumborealis (10.4., 3, Juglans regia)

Lecanora conizaeoides (10.4., 1, Alnus glutinosa)

Lecanora impudens (18.6.91, Juglans regia)

Lecanora intumescens

Lecanora nemoralis

Lecanora pallida

Lecanora pulicaris

Lecanora sambuci (6.5., 4, Acer pspl.; 10.8., 1, Pyrus com.)

Lecanora subrugosa

Lecanora symmicta

Lecanora varia (22.9., 3, Zaunstangen)

Lecidella achristotera

Lecidella elaeochroma

Lecidella euphorea

Lepraria sp.

Lobaria pulmonaria

Loxospora cismonicum (12.2., 1, Acer pspl.; 6.5., 1, Acer pspl.; 27.8., 2, Abies alba)

Menegazzia terebrata

Micarea peliocarpa (10.4., 1, Alnus glut.)

Mycoblastus sanguinarius (6.5., 8, Picea abies; 27.8., 4, Fagus sylv.; 3.9., 4, Picea abies; 18.6.91, Picea abies)

Mycoblastus sterilis (12.2., 1, Acer pspl; 13.3., 1, Fraxinus exc.)

Nephroma parile (22.9., 2, Acer pspl.)

Ochrolechia alboflavescens (18.6.91, Picea abies)

Ochrolechia pallescens

Ochrolechia szatalaensis

Opegrapha rufescens

Opegrapha vermicellifera (12.2., 1, Pyrus com.)

Opegrapha viridis

Parmelia caperata

Parmelia contorta (29.5., 9, Acer pspl.)

Parmelia elegantula (12.2., 1, Pyrus com.; 25.9., Frax.exc.)

Parmelia exasperatula

Parmelia flaventior (29.5., Juglans regia ; 25.9.,1, Tilia cord.)

Parmelia glabra

Parmelia glabratula

Parmelia saxatilis

Parmelia subargentifera (22.9., 5, Juglans; 25.9. ,6, Juglans)

Parmelia subaurifera

Parmelia subrudecta (29.5., 12, Alnus glut.)

Parmelia sulcata

Parmelina pastillifera

Parmelina tiliacea

Parmeliopsis ambigua

Parmeliopsis hyperopta

Peltigera canina (18.6.91, Acer pspl.)

Peltigera degenii (6.5., 8, Sorbus aucuparia)

Peltigera praetextata

Peridiothelium fuliguncta (3.4., 5, Tilia sp.)

Pertusaria albescens

Pertusaria amara

Pertusaria coccodes

Pertusaria coronata (29.5., 6, Acer pspl.; 22.9., 1, Prunus avium)

Pertusaria hemisphaerica

Pertusaria lactea f. faginea (18.6.91, Acer pspl.)

Pertusaria laevigata (6.5., 1, Fraxinus exc.)

Pertusaria leioplaca

Pertusaria leucostoma

Pertusaria multipuncta

Pertusaria pertusa (27.8., 3, Acer pspl.)

Phaeocalicium compressulum (10.4., 6, Alnus glut.)

Phaeophyscia ciliata (13.3., 2, Juglans regia)

Phaeophyscia orbicularis

Phaeophyscia pusilloides

Phlyctis argena

Physcia adscendens

Physcia aipolia

Physcia endophoenicea (25.9., 6, Juglans regia)

Physcia leptalea (22.9., 5, Juglans regia)

Physcia stellaris

Physcia tenella (10.4., 3, Juglans regia)

Physconia distorta

Physconia servitii ? (6.5., 11, Tilia sp.)

Platismatia glauca

Pseudevernia furfuracea var. ceratea

Pseudevernia furfuracea var. furfuracea

Pyrenula nitida (27.8., 4, Fagus sylv.; 22.9., 2, Acer pspl.)

Pyrenula nitidella (3.4., 3, Fraxinus exc.)

Pyrrhospora quernea (13.3., 1, Fraxinus exc.; 3.4., 1 Abies alba)

Ramalina farinacea

Ramalina panizzei

Rinodina albana (3.4., 10, Salix sp.)

Rinodina archaea (6.5., 6, Tilia sp.)

Rinodina corticola (29.5., 9, Acer pspl.)

Rinodina exigua (3.4., 5, Tilia sp.)

Rinodina glauca (3.4., 10, Juglans regia)

Rinodina sophodes

Saccomorpha uliginosa (12.2., 1, Carpinus betulus)

Scoliciosporum chlorococcum

Scoliciosporum sarothamni (29.5., 2, Cast. sat.; 22.9., 3, Frax. exc.)

Thelotrema lepadinum (29.5., 4, Fagus sylv.; 27.8., 2, 4, Acer pspl.)

Usnea sp.

Xanthoria polycarpa (22.9., 3, Fraxinus exc.)

Xanthoria parietina

Xylographa abietina (29.5., 5, verwittertes Holz; 22.9., 3, Zaun=stangen)

LICHENICOLE PILZE

Abrothallus bertianus auf Parmelia glabratula (6.5., 4, Acer pspl.)

Lichenodiplis lecanorae auf Lecanora pallida (6.5., 1, Acer pspl.)

Stigmidium congestum auf Lecanora chlarotera (6.5., 3, Juglans reg.; 29.5., 1, Juglans regia; 10.8., 1, Juglans regia)

Vouauxiella lichenicola auf Lecanora chlarotera (6.5., 3, Juglans)

Table 2

Occurence of lichens on the Norway spruce trees accorrding to the IAP values of the sampling plots and some other ecological parameters in a profile over highly polluted Šaleška dolina (Šalek valley) in North Slovenia.

(Abrevations: IAP = index of atmospheric purity, N = number of sampling plots in the IAP class, S = average cumulative class of total sulphur content in Norway spruce needles, A = altitude of the sampling plot, RI = average „Richness Index„ for lichens on the plot, SC = values of Socrensen Coefficient according to the plot with the reachest lichen flora, SN = number of lichen species within classes of IAP, H = place of growth: t = trunk, c = crown).

lichen species									
	IAP	1		2		3		4	
	N	6		4		20		30	
	S	2,8		3,2		3,5		3,7	
	SN	25		17		15		12	
	RI	63,5		89,7		97,0		99,4	
	SC	-		66		50		51	
	A	1250-1550		1100-1350		380-1000		360-950	
	H	t	c	t	c	t	c	t	c
Bryoria subcana		+	+	+	+				
Cetraria chlorophylla		+	+	+	+				
C. islandica		+							
C. pinastri		+	+	+				+	
Chaenotheca ferruginea								+	
Chaenotheca sp.		+							
Cladonia chlorophaea						+			
Cl. coniocraea		+				+			
Cl. digitata		+							
Cl. macilenta		+							
Cladonia sp.								+	
Dimerella pineti						+			
Evernia prunastri		+							
Hypogymnia bitteriana			+		+		+		
H. physodes		+	+	+	+		+		
H. tubulosa			+		+				
Lecanora conizaeoides						+		+	+
L. pulicaris		+	+		+				
L. subfusca s. l.		+	+						
L. subintricata		+	+						
Lepraria sp.				+		+			
Lepraria incana								+	
Ocrolechia turneri		+							
Parmelia saxatilis		+	+	+	+	+		+	
Parmeliopsia ambigua		+		+	+	+		+	
P. hyperopta		+		+		+		+	
Platismatia glauca		+	+	+	+				
Pleurococcus sp.					+		+	+	+
Pseudevernia furfuracea		+	+	+	+		+	+	
Scoliciosporum chloroccocum		+	+	+	+	+	+	+	+
Usnea barbata s.str.			+	+	+				
U. florida					+				
U. filipendula			+						
U. subfloridana		+	+				+		

Nomenclature of lichens is after POELT (1974) and WIRTH (1980).

A P P E N D I X

I. Data of Norway spruce needle analysis, sampling in the profile SMREKOVC-VINSKA GORA in 1990.

Data of photosynthetic pigment analysis in Norway spruce needles sampled on the profile SMEREKOVC - VINSKA GORA in 1990. All data are presented as average for two trees for all needle age classes, calculated on needle dry weight.

Sampling site in the profile		Needle age classes			Chlorophyll content A	B (mg/gdwght)	A+B	A/B	Content of carotenoids total.carot.(C) mg/gdwght	A+B/C	Date
TEŠ-proga tč.:	1	sm	p	1990	1.2196	0.4448	1.6644	2.74	0.3084	5.40	10-18-90
TEŠ-proga tč.:	1	sm	p	1989	1.6781	0.6125	2.2906	2.74	0.4368	5.24	10-18-90
TEŠ-proga tč.:	1	sm	p	1988	1.7994	0.6904	2.4898	2.61	0.5051	4.93	10-18-90
TEŠ-proga tč.:	1	sm	p	1987	1.8489	0.7204	2.5693	2.57	0.5359	4.79	10-18-90
TEŠ-proga tč.:	2	sm	p	1990	1.0793	0.3772	1.4565	2.86	0.1192	12.22	10-17-90
TEŠ-proga tč.:	2	sm	p	1989	1.2200	0.4314	1.6514	2.83	0.1512	10.92	10-17-90
TEŠ-proga tč.:	2	sm	p	1988	1.7767	0.6872	2.4639	2.59	0.2646	9.31	10-17-90
TEŠ-proga tč.:	2	sm	p	1987	1.5378	0.5954	2.1332	2.58	0.2079	10.26	10-17-90
TEŠ-proga tč.:	3	sm	p	1990	0.9490	0.3673	1.3163	2.58	0.2592	5.08	10-18-90
TEŠ-proga tč.:	3	sm	p	1989	1.5054	0.6286	2.1340	2.39	0.3856	5.53	10-18-90
TEŠ-proga tč.:	3	sm	p	1988	0.8660	0.3550	1.2210	2.44	0.2403	5.08	10-18-90
TEŠ-proga tč.:	3	sm	p	1987	1.9919	0.8641	2.8560	2.31	0.5600	5.10	10-18-90
TEŠ-proga tč.:	4	sm	p	1990	1.1479	0.4382	1.5861	2.62	0.1280	12.39	10-17-90
TEŠ-proga tč.:	4	sm	p	1989	1.4635	0.5605	2.0240	2.61	0.2118	9.56	10-17-90
TEŠ-proga tč.:	4	sm	p	1988	1.6396	0.6603	2.2999	2.48	0.2673	8.60	10-17-90
TEŠ-proga tč.:	4	sm	p	1987	1.9145	0.8173	2.7318	2.34	0.2925	9.34	10-17-90
TEŠ-proga tč.:	5	sm	p	1990	0.7966	0.3241	1.1207	2.46	0.1361	8.23	10-17-90
TEŠ-proga tč.:	5	sm	p	1989	0.8426	0.3219	1.1645	2.62	0.1578	7.38	10-17-90
TEŠ-proga tč.:	5	sm	p	1988	1.3842	0.5126	1.8968	2.70	0.2689	7.05	10-17-90
TEŠ-proga tč.:	5	sm	p	1987	1.5142	0.6111	2.1253	2.48	0.3042	6.99	10-17-90
TEŠ-proga tč.:	6	sm	p	1990	1.1349	0.4516	1.5865	2.51	0.2562	6.19	10-17-90
TEŠ-proga tč.:	6	sm	p	1989	1.4207	0.5262	1.9469	2.70	0.3268	5.96	10-17-90
TEŠ-proga tč.:	6	sm	p	1988	1.8688	0.7152	2.5840	2.61	0.4815	5.37	10-17-90
TEŠ-proga tč.:	6	sm	p	1987	1.9891	0.7651	2.7542	2.60	0.5175	5.32	10-17-90
TEŠ-proga tč.:	7	sm	p	1990	1.1966	0.4655	1.6621	2.57	0.2704	6.15	10-15-90
TEŠ-proga tč.:	7	sm	p	1989	1.4258	0.5601	1.9859	2.55	0.3624	5.48	10-15-90
TEŠ-proga tč.:	7	sm	p	1988	1.7396	0.7057	2.4453	2.47	0.4661	5.25	10-15-90
TEŠ-proga tč.:	7	sm	p	1987	1.6024	0.6770	2.2794	2.37	0.4435	5.14	10-15-90
TEŠ-proga tč.:	8	sm	p	1990	1.0783	0.3941	1.4724	2.74	0.2782	5.29	10-18-90
TEŠ-proga tč.:	8	sm	p	1989	1.1872	0.4468	1.6340	2.66	0.2962	5.52	10-18-90
TEŠ-proga tč.:	8	sm	p	1988	1.3223	0.5324	1.8547	2.48	0.3367	5.51	10-18-90
TEŠ-proga tč.:	8	sm	p	1987	1.2614	0.5132	1.7746	2.46	0.3296	5.38	10-18-90
TEŠ-proga tč.:	9	sm	p	1990	0.9278	0.4049	1.3327	2.29	0.2142	6.22	10-18-90
TEŠ-proga tč.:	9	sm	p	1989	0.8523	0.3505	1.2028	2.43	0.2067	5.82	10-18-90
TEŠ-proga tč.:	9	sm	p	1988	1.0121	0.4275	1.4396	2.37	0.2520	5.71	10-18-90
TEŠ-proga tč.:	9	sm	p	1987	0.9653	0.4593	1.4246	2.10	0.2341	6.09	10-18-90
TEŠ-proga tč.:	10	sm	p	1990	1.1198	0.4270	1.5468	2.62	0.2497	6.19	10-18-90
TEŠ-proga tč.:	10	sm	p	1989	1.3062	0.4769	1.7831	2.74	0.3209	5.56	10-18-90
TEŠ-proga tč.:	10	sm	p	1988	1.7014	0.6462	2.3476	2.63	0.4424	5.31	10-18-90
TEŠ-proga tč.:	10	sm	p	1987	1.9633	0.7748	2.7381	2.53	0.5265	5.20	10-18-90

TEŠ-proga tč.: 11	sm	p	1990	0.8639	0.3434	1.2073	2.52	0.2424	4.98	10-18-90
TEŠ-proga tč.: 11	sm	p	1989	1.2034	0.4757	1.6791	2.53	0.3195	5.26	10-18-90
TEŠ-proga tč.: 11	sm	p	1988	1.4872	0.6252	2.1124	2.38	0.3817	5.53	10-18-90
TEŠ-proga tč.: 11	sm	p	1987	1.7470	0.7258	2.4728	2.41	0.4459	5.55	10-18-90
TEŠ-proga tč.: 12	sm	p	1990	1.4491	0.6696	2.1187	2.16	0.4086	5.19	10-18-90
TEŠ-proga tč.: 12	sm	p	1989	1.8262	0.7788	2.6050	2.34	0.4797	5.43	10-18-90
TEŠ-proga tč.: 12	sm	p	1988	1.6280	0.7285	2.3565	2.23	0.4179	5.64	10-18-90
TEŠ-proga tč.: 12	sm	p	1987	1.4040	0.6019	2.0059	2.33	0.3978	5.04	10-18-90
TEŠ-proga tč.: 13	sm	p	1990	1.0956	0.9109	2.0065	1.20	0.2010	9.98	10-18-90
TEŠ-proga tč.: 13	sm	p	1989	1.5913	0.6963	2.2876	2.29	0.4185	5.47	10-18-90
TEŠ-proga tč.: 13	sm	p	1988	1.7436	0.7738	2.5174	2.25	0.4515	5.58	10-18-90
TEŠ-proga tč.: 13	sm	p	1987	1.8684	0.8168	2.6852	2.29	0.4808	5.58	10-18-90
TEŠ-proga tč.: 14	sm	p	1990	0.8178	0.3663	1.1841	2.23	0.2210	5.36	10-19-90
TEŠ-proga tč.: 14	sm	p	1989	1.1744	0.4974	1.6718	2.36	0.3049	5.48	10-19-90
TEŠ-proga tč.: 14	sm	p	1988	1.5725	0.6941	2.2666	2.27	0.4127	5.49	10-19-90
TEŠ-proga tč.: 14	sm	p	1987	1.4628	0.7606	2.2234	1.92	0.4156	5.35	10-19-90
TEŠ-proga tč.: 15	sm	p	1990	0.6858	0.2745	0.9603	2.50	0.1630	5.89	10-19-90
TEŠ-proga tč.: 15	sm	p	1989	0.9972	0.4646	1.4618	2.15	0.3050	4.79	10-19-90
TEŠ-proga tč.: 15	sm	p	1988	1.2620	0.5706	1.8326	2.21	0.3775	4.85	10-19-90
TEŠ-proga tč.: 15	sm	p	1987	1.3032	0.6166	1.9198	2.11	0.3951	4.86	10-19-90
TEŠ-proga tč.: 16	sm	p	1990	1.0890	0.4661	1.5551	2.34	0.2826	5.50	10-19-90
TEŠ-proga tč.: 16	sm	p	1989	1.4908	0.7238	2.2146	2.06	0.4164	5.32	10-19-90
TEŠ-proga tč.: 16	sm	p	1988	1.5963	0.7859	2.3822	2.03	0.4300	5.54	10-19-90
TEŠ-proga tč.: 16	sm	p	1987	1.3564	0.6786	2.0350	2.00	0.3724	5.46	10-19-90
TEŠ-proga tč.: 17	sm	p	1990	1.1276	0.4909	1.6185	2.30	0.2797	5.79	10-19-90
TEŠ-proga tč.: 17	sm	p	1989	1.1779	0.4984	1.6763	2.36	0.3129	5.36	10-19-90
TEŠ-proga tč.: 17	sm	p	1988	1.6436	0.7329	2.3765	2.24	0.2678	8.87	10-19-90
TEŠ-proga tč.: 17	sm	p	1987	1.8753	0.8327	2.7080	2.25	0.4516	6.00	10-19-90
TEŠ-proga tč.: 18	sm	p	1990	1.5943	0.6242	2.2185	2.55	0.3224	6.88	10-09-90
TEŠ-proga tč.: 18	sm	p	1989	2.0467	0.8007	2.8474	2.56	0.4491	6.34	10-09-90
TEŠ-proga tč.: 18	sm	p	1988	1.9221	0.7628	2.6849	2.52	0.4341	6.18	10-09-90
TEŠ-proga tč.: 18	sm	p	1987	1.9420	0.7708	2.7128	2.52	0.4480	6.06	10-09-90
TEŠ-proga tč.: 19	sm	p	1990	1.4642	0.5569	2.0211	2.63	0.2883	7.01	10-10-90
TEŠ-proga tč.: 19	sm	p	1989	2.4652	0.9222	3.3874	2.67	0.5508	6.15	10-10-90
TEŠ-proga tč.: 19	sm	p	1988	1.7852	0.6629	2.4481	2.69	0.3931	6.23	10-10-90
TEŠ-proga tč.: 19	sm	p	1987	2.0448	0.7961	2.8409	2.57	0.4593	6.19	10-10-90
TEŠ-proga tč.: 20	sm	p	1990	1.8418	0.6702	2.5120	2.75	0.3635	6.91	10-09-90
TEŠ-proga tč.: 20	sm	p	1989	2.0097	0.7887	2.7984	2.55	0.4012	6.98	10-09-90
TEŠ-proga tč.: 20	sm	p	1988	1.7775	0.6637	2.4412	2.68	0.4182	5.84	10-09-90
TEŠ-proga tč.: 20	sm	p	1987	1.6880	0.6490	2.3370	2.60	0.4282	5.46	10-09-90
TEŠ-proga tč.: 21	sm	p	1990	1.3529	0.4929	1.8458	2.74	0.2737	6.74	10-09-90
TEŠ-proga tč.: 21	sm	p	1989	1.5807	0.5995	2.1802	2.64	0.3469	6.28	10-09-90
TEŠ-proga tč.: 21	sm	p	1988	1.8089	1.3498	3.1587	1.34	0.2193	14.40	10-09-90
TEŠ-proga tč.: 21	sm	p	1987	2.0377	0.7776	2.8153	2.62	0.4843	5.81	10-09-90
TEŠ-proga tč.: 22	sm	p	1990	1.0425	0.3767	1.4192	2.77	0.2202	6.45	10-09-90
TEŠ-proga tč.: 22	sm	p	1989	1.3101	0.5092	1.8193	2.57	0.2847	6.39	10-09-90
TEŠ-proga tč.: 22	sm	p	1988	1.3763	0.5124	1.8887	2.69	0.3262	5.79	10-09-90
TEŠ-proga tč.: 22	sm	p	1987	1.7697	0.7221	2.4918	2.45	0.4398	5.67	10-09-90
TEŠ-proga tč.: 23	sm	p	1990	1.1992	0.4629	1.6621	2.59	0.2571	6.46	10-09-90
TEŠ-proga tč.: 23	sm	p	1989	1.2652	0.4793	1.7445	2.64	0.2899	6.02	10-09-90
TEŠ-proga tč.: 23	sm	p	1988	1.3913	0.5458	1.9371	2.55	0.3325	5.83	10-09-90
TEŠ-proga tč.: 23	sm	p	1987	1.2248	0.4847	1.7095	2.53	0.3085	5.54	10-09-90

TEŠ-proga tč.: 25	sm	p	1990	0.9190	0.4145	1.3335	2.22	0.2396	5.57	10-19-90
TEŠ-proga tč.: 25	sm	p	1989	1.0866	0.4803	1.5669	2.26	0.2851	5.50	10-19-90
TEŠ-proga tč.: 25	sm	p	1988	1.2021	0.5451	1.7472	2.21	0.3242	5.39	10-19-90
TEŠ-proga tč.: 25	sm	p	1987	1.0985	0.5091	1.6076	2.16	0.3077	5.22	10-19-90
TEŠ-proga tč.: 26	sm	p	1990	1.3331	0.7788	2.1119	1.71	0.2111	10.00	10-10-90
TEŠ-proga tč.: 26	sm	p	1989	1.6089	0.6397	2.2486	2.52	0.3448	6.52	10-10-90
TEŠ-proga tč.: 26	sm	p	1988	1.6115	0.7825	2.3940	2.06	0.3232	7.41	10-10-90
TEŠ-proga tč.: 26	sm	p	1987	1.9426	0.7867	2.7293	2.47	0.4496	6.07	10-10-90
TEŠ-proga tč.: 27	sm	p	1990	1.0915	0.4280	1.5195	2.55	0.2504	6.07	10-10-90
TEŠ-proga tč.: 27	sm	p	1989	1.6711	0.6662	2.3373	2.51	0.3723	6.28	10-10-90
TEŠ-proga tč.: 27	sm	p	1988	1.7869	0.7265	2.5134	2.46	0.4002	6.28	10-10-90
TEŠ-proga tč.: 27	sm	p	1987	1.8757	0.7750	2.6507	2.42	0.4351	6.09	10-10-90
TEŠ-proga tč.: 28	sm	p	1990	0.7168	0.2724	0.9892	2.63	0.1864	5.31	10-19-90
TEŠ-proga tč.: 28	sm	p	1989	0.9747	0.3911	1.3658	2.49	0.2547	5.36	10-19-90
TEŠ-proga tč.: 28	sm	p	1988	1.2072	0.5190	1.7262	2.33	0.3207	5.38	10-19-90
TEŠ-proga tč.: 28	sm	p	1987	0.9991	0.4249	1.4240	2.35	0.2681	5.31	10-19-90
TEŠ-proga tč.: 29	sm	p	1990	1.5107	0.5954	2.1061	2.54	0.3291	6.40	10-10-90
TEŠ-proga tč.: 29	sm	p	1989	1.5202	0.5725	2.0927	2.66	0.3510	5.96	10-10-90
TEŠ-proga tč.: 29	sm	p	1988	1.5339	0.8044	2.3383	1.91	0.3093	7.56	10-10-90
TEŠ-proga tč.: 29	sm	p	1987	1.7045	0.6928	2.3973	2.46	0.4209	5.70	10-10-90
TEŠ-proga tč.: 30	sm	p	1990	1.0516	0.4127	1.4643	2.55	0.2104	6.96	10-10-90
TEŠ-proga tč.: 30	sm	p	1989	1.3241	0.4951	1.8192	2.67	0.2914	6.24	10-10-90
TEŠ-proga tč.: 30	sm	p	1988	1.3571	0.5357	1.8928	2.53	0.3286	5.76	10-10-90
TEŠ-proga tč.: 30	sm	p	1987	1.1740	0.4704	1.6444	2.50	0.2899	5.67	10-10-90
TEŠ-proga tč.: 31	sm	p	1990	1.6093	0.6544	2.2637	2.46	0.3726	6.08	10-10-90
TEŠ-proga tč.: 31	sm	p	1989	2.1589	0.8387	2.9976	2.57	0.4817	6.22	10-10-90
TEŠ-proga tč.: 31	sm	p	1988	1.9963	0.7528	2.7491	2.65	0.4874	5.64	10-10-90
TEŠ-proga tč.: 31	sm	p	1987	2.1439	0.8495	2.9934	2.52	0.5224	5.73	10-10-90
TEŠ-proga tč.: 32	sm	p	1990	1.7525	0.7335	2.4860	2.39	0.3992	6.23	10-11-90
TEŠ-proga tč.: 32	sm	p	1989	1.9549	0.7815	2.7364	2.50	0.4723	5.79	10-11-90
TEŠ-proga tč.: 32	sm	p	1988	1.7529	0.7176	2.4705	2.44	0.4172	5.92	10-11-90
TEŠ-proga tč.: 32	sm	p	1987	1.8088	0.7508	2.5596	2.41	0.4512	5.67	10-11-90
TEŠ-proga tč.: 33	sm	p	1990	1.2604	0.4815	1.7419	2.62	0.3176	5.48	10-12-90
TEŠ-proga tč.: 33	sm	p	1989	1.6234	0.6079	2.2313	2.67	0.3962	5.63	10-12-90
TEŠ-proga tč.: 33	sm	p	1988	1.6229	0.6471	2.2700	2.51	0.3981	5.70	10-12-90
TEŠ-proga tč.: 33	sm	p	1987	1.8568	0.7541	2.6109	2.46	0.4621	5.65	10-12-90
TEŠ-proga tč.: 34	sm	p	1990	1.6895	0.6836	2.3731	2.47	0.3923	6.05	10-11-90
TEŠ-proga tč.: 34	sm	p	1989	1.9015	0.7551	2.6566	2.52	0.4399	6.04	10-11-90
TEŠ-proga tč.: 34	sm	p	1988	0.8334	0.3355	1.1689	2.48	0.1980	5.90	10-11-90
TEŠ-proga tč.: 34	sm	p	1987	1.9204	0.8224	2.7428	2.34	0.4852	5.65	10-11-90
TEŠ-proga tč.: 35	sm	p	1990	1.3128	0.5428	1.8556	2.42	0.3261	5.69	10-11-90
TEŠ-proga tč.: 35	sm	p	1989	1.5752	0.6405	2.2157	2.46	0.3901	5.68	10-11-90
TEŠ-proga tč.: 35	sm	p	1988	1.6347	0.6774	2.3121	2.41	0.4088	5.66	10-11-90
TEŠ-proga tč.: 35	sm	p	1987	1.6138	0.6694	2.2832	2.41	0.4042	5.65	10-11-90
TEŠ-proga tč.: 36	sm	p	1990	1.4294	0.6177	2.0471	2.31	0.3501	5.85	10-11-90
TEŠ-proga tč.: 36	sm	p	1989	1.5420	0.6230	2.1650	2.48	0.3793	5.71	10-11-90
TEŠ-proga tč.: 36	sm	p	1988	1.5459	0.6323	2.1782	2.44	0.3811	5.72	10-11-90
TEŠ-proga tč.: 36	sm	p	1987	1.4665	0.6139	2.0804	2.39	0.3728	5.58	10-11-90
TEŠ-proga tč.: 37	sm	p	1990	0.8901	0.4187	1.3088	2.13	0.1804	7.25	10-11-90
TEŠ-proga tč.: 37	sm	p	1989	2.1782	0.9165	3.0947	2.38	0.4955	6.25	10-11-90
TEŠ-proga tč.: 37	sm	p	1988	1.2477	0.5429	1.7906	2.30	0.2852	6.28	10-11-90
TEŠ-proga tč.: 37	sm	p	1987	1.2727	0.5632	1.8359	2.26	0.2975	6.17	10-11-90

TEŠ-proga tč.: 38	sm	p	1990	0.9423	0.4285	1.3708	2.20	0.2732	5.02	10-12-90
TEŠ-proga tč.: 38	sm	p	1989	0.9358	0.4164	1.3522	2.25	0.2587	5.23	10-12-90
TEŠ-proga tč.: 38	sm	p	1988	0.8331	0.3930	1.2261	2.12	0.2306	5.32	10-12-90
TEŠ-proga tč.: 38	sm	p	1987	0.9473	0.4284	1.3757	2.21	0.2706	5.08	10-12-90
TEŠ-proga tč.: 39	sm	p	1990	0.9040	0.4414	1.3454	2.05	0.2515	5.35	10-12-90
TEŠ-proga tč.: 39	sm	p	1989	1.1808	0.5575	1.7383	2.12	0.3073	5.66	10-12-90
TEŠ-proga tč.: 39	sm	p	1988	1.1131	0.5541	1.6672	2.01	0.2997	5.56	10-12-90
TEŠ-proga tč.: 39	sm	p	1987	0.9750	0.4872	1.4622	2.00	0.2740	5.34	10-12-90
TEŠ-proga tč.: 40	sm	p	1990	0.7332	0.3173	1.0505	2.31	0.2059	5.10	10-12-90
TEŠ-proga tč.: 40	sm	p	1989	0.8273	0.3860	1.2133	2.14	0.2335	5.20	10-12-90
TEŠ-proga tč.: 40	sm	p	1988	0.7981	0.3653	1.1634	2.18	0.2326	5.00	10-12-90
TEŠ-proga tč.: 40	sm	p	1987	0.7411	0.3793	1.1204	1.95	0.2228	5.03	10-12-90
TEŠ-proga tč.: 41	sm	p	1990	1.4160	0.5486	1.9646	2.58	0.3221	6.10	10-11-90
TEŠ-proga tč.: 41	sm	p	1989	1.7286	0.6915	2.4201	2.50	0.4032	6.00	10-11-90
TEŠ-proga tč.: 41	sm	p	1988	1.6450	0.6543	2.2993	2.51	0.3916	5.87	10-11-90
TEŠ-proga tč.: 41	sm	p	1987	1.5584	0.6342	2.1926	2.46	0.3928	5.58	10-11-90
TEŠ-proga tč.: 42	sm	p	1990	0.9613	0.4178	1.3791	2.30	0.2782	4.96	10-12-90
TEŠ-proga tč.: 42	sm	p	1989	1.1899	0.4922	1.6821	2.42	0.2975	5.65	10-12-90
TEŠ-proga tč.: 42	sm	p	1988	1.0615	0.4339	1.4954	2.45	0.2727	5.48	10-12-90
TEŠ-proga tč.: 42	sm	p	1987	1.2087	0.5223	1.7310	2.31	0.3111	5.56	10-12-90
TEŠ-proga tč.: 43	sm	p	1990	0.9184	0.2797	1.1981	3.28	0.2037	5.88	10-15-90
TEŠ-proga tč.: 43	sm	p	1989	1.2402	0.3652	1.6054	3.40	0.2581	6.22	10-15-90
TEŠ-proga tč.: 43	sm	p	1988	1.2025	0.3755	1.5780	3.20	0.2633	5.99	10-15-90
TEŠ-proga tč.: 43	sm	p	1987	1.3614	0.3952	1.7566	3.44	0.2948	5.96	10-15-90
TEŠ-proga tč.: 44	sm	p	1990	0.8475	0.3447	1.1922	2.46	0.2253	5.29	10-15-90
TEŠ-proga tč.: 44	sm	p	1989	1.1009	0.4571	1.5580	2.41	0.2869	5.43	10-15-90
TEŠ-proga tč.: 44	sm	p	1988	1.1384	0.4747	1.6131	2.40	0.2964	5.44	10-15-90
TEŠ-proga tč.: 44	sm	p	1987	0.8380	0.3619	1.1999	2.32	0.2177	5.51	10-15-90
TEŠ-proga tč.: 45	sm	p	1990	1.3810	0.6140	1.9950	2.25	0.3564	5.60	10-12-90
TEŠ-proga tč.: 45	sm	p	1989	1.7068	0.7267	2.4335	2.35	0.4515	5.39	10-12-90
TEŠ-proga tč.: 45	sm	p	1988	1.7634	0.7652	2.5286	2.30	1.0510	2.41	10-12-90
TEŠ-proga tč.: 45	sm	p	1987	1.8897	0.8524	2.7421	2.22	0.5343	5.13	10-12-90
TEŠ-proga tč.: 46	sm	p	1990	1.0821	0.1847	1.2668	5.86	0.1706	7.43	10-15-90
TEŠ-proga tč.: 46	sm	p	1989	1.4846	0.3035	1.7881	4.89	0.2636	6.78	10-15-90
TEŠ-proga tč.: 46	sm	p	1988	1.5256	0.3592	1.8848	4.25	0.2964	6.36	10-15-90
TEŠ-proga tč.: 46	sm	p	1987	1.4071	0.3560	1.7631	3.95	0.2964	5.95	10-15-90
TEŠ-proga tč.: 47	sm	p	1990	1.3492	0.5276	1.8768	2.56	0.3586	5.23	10-12-90
TEŠ-proga tč.: 47	sm	p	1989	1.6490	0.6460	2.2950	2.55	0.4118	5.57	10-12-90
TEŠ-proga tč.: 47	sm	p	1988	1.6105	0.6268	2.2373	2.57	0.4117	5.43	10-12-90
TEŠ-proga tč.: 47	sm	p	1987	1.4064	0.5776	1.9840	2.43	0.3690	5.38	10-12-90
TEŠ-proga tč.: 48	sm	p	1990	0.9849	0.4234	1.4083	2.33	0.2540	5.54	10-19-90
TEŠ-proga tč.: 48	sm	p	1989	1.3304	0.5450	1.8754	2.44	0.3694	5.08	10-19-90
TEŠ-proga tč.: 48	sm	p	1988	1.4865	0.6509	2.1374	2.28	0.3968	5.39	10-19-90
TEŠ-proga tč.: 48	sm	p	1987	1.3279	0.5781	1.9060	2.30	0.3434	5.55	10-19-90
TEŠ-proga tč.: 49	sm	p	1990	1.0964	0.4718	1.5682	2.32	0.3387	4.63	10-22-90
TEŠ-proga tč.: 49	sm	p	1989	1.1422	0.5143	1.6565	2.22	0.3506	4.72	10-22-90
TEŠ-proga tč.: 49	sm	p	1988	1.2195	0.5743	1.7938	2.12	0.3864	4.64	10-22-90
TEŠ-proga tč.: 49	sm	p	1987	1.1998	0.5857	1.7855	2.05	0.3834	4.66	10-22-90
TEŠ-proga tč.: 50	sm	p	1990	1.0532	0.4521	1.5053	2.33	0.2941	5.12	10-22-90
TEŠ-proga tč.: 50	sm	p	1989	1.3381	0.5677	1.9058	2.36	0.3986	4.78	10-22-90
TEŠ-proga tč.: 50	sm	p	1988	1.2021	0.6250	1.8271	1.92	0.3477	5.25	10-22-90
TEŠ-proga tč.: 50	sm	p	1987	1.4481	0.6429	2.0910	2.25	0.4324	4.84	10-22-90

TEŠ-proga tč.: 51	sm	p	1990	1.4147	0.5385	1.9532	2.63	0.3056	6.39	10-15-90
TEŠ-proga tč.: 51	sm	p	1989	1.7215	0.6544	2.3759	2.63	0.3796	6.26	10-15-90
TEŠ-proga tč.: 51	sm	p	1988	1.7921	0.7184	2.5105	2.49	0.4133	6.07	10-15-90
TEŠ-proga tč.: 51	sm	p	1987	1.7717	0.6991	2.4708	2.53	0.4467	5.53	10-15-90
TEŠ-proga tč.: 52	sm	p	1990	1.3874	0.5306	1.9180	2.61	0.2979	6.44	10-15-90
TEŠ-proga tč.: 52	sm	p	1989	1.5974	0.6297	2.2271	2.54	0.3414	6.52	10-15-90
TEŠ-proga tč.: 52	sm	p	1988	1.7098	0.6848	2.3946	2.50	0.3845	6.23	10-15-90
TEŠ-proga tč.: 52	sm	p	1987	1.7211	0.6977	2.4188	2.47	0.4237	5.71	10-15-90
TEŠ-proga tč.: 53	sm	p	1990	0.8125	0.1939	1.0064	4.19	0.1700	5.92	10-15-90
TEŠ-proga tč.: 53	sm	p	1989	1.0733	0.2796	1.3529	3.84	0.2412	5.61	10-15-90
TEŠ-proga tč.: 53	sm	p	1988	1.1813	0.3319	1.5132	3.56	0.2634	5.74	10-15-90
TEŠ-proga tč.: 53	sm	p	1987	1.1361	0.3006	1.4367	3.78	0.2550	5.63	10-15-90
TEŠ-proga tč.: 54	sm	p	1990	0.9128	0.2237	1.1365	4.08	0.2114	5.38	10-15-90
TEŠ-proga tč.: 54	sm	p	1989	1.2583	0.3781	1.6364	3.33	0.2925	5.59	10-15-90
TEŠ-proga tč.: 54	sm	p	1988	3.4265	-.4174	3.0091	-8.2	0.5097	5.90	10-15-90
TEŠ-proga tč.: 54	sm	p	1987	1.0976	0.2854	1.3830	3.85	0.2452	5.64	10-15-90
TEŠ-proga tč.: 55	sm	p	1990	1.2929	0.3408	1.6337	3.79	0.2558	6.39	10-15-90
TEŠ-proga tč.: 55	sm	p	1989	1.3101	0.3856	1.6957	3.40	0.2947	5.75	10-15-90
TEŠ-proga tč.: 55	sm	p	1988	1.5239	0.4649	1.9888	3.28	0.3427	5.80	10-15-90
TEŠ-proga tč.: 55	sm	p	1987	1.2749	0.3415	1.6164	3.73	0.2841	5.69	10-15-90
TEŠ-proga tč.: 56	sm	p	1990	1.1426	0.3456	1.4882	3.31	0.2511	5.93	10-15-90
TEŠ-proga tč.: 56	sm	p	1989	1.4291	0.4251	1.8542	3.36	0.3058	6.06	10-15-90
TEŠ-proga tč.: 56	sm	p	1988	1.1940	0.3421	1.5361	3.49	0.2735	5.62	10-15-90
TEŠ-proga tč.: 56	sm	p	1987	1.3229	0.3471	1.6700	3.81	0.2727	6.12	10-15-90
TEŠ-proga tč.: 57	sm	p	1990	0.7954	0.3366	1.1320	2.36	0.2508	4.51	10-22-90
TEŠ-proga tč.: 57	sm	p	1989	1.0695	0.4651	1.5346	2.30	0.3569	4.30	10-22-90
TEŠ-proga tč.: 57	sm	p	1988	1.0428	0.4828	1.5256	2.16	0.3572	4.27	10-22-90
TEŠ-proga tč.: 57	sm	p	1987	1.0551	0.4925	1.5476	2.14	0.3579	4.32	10-22-90
TEŠ-proga tč.: 58	sm	p	1990	0.7842	0.3428	1.1270	2.29	0.2701	4.17	10-22-90
TEŠ-proga tč.: 58	sm	p	1989	1.0608	0.4733	1.5341	2.24	0.3360	4.57	10-22-90
TEŠ-proga tč.: 58	sm	p	1988	0.8053	0.3833	1.1886	2.10	0.2652	4.48	10-22-90
TEŠ-proga tč.: 58	sm	p	1987	1.0492	0.4868	1.5360	2.16	0.3511	4.37	10-22-90
TEŠ-proga tč.: 59	sm	p	1990	0.8785	0.3921	1.2706	2.24	0.2762	4.60	10-22-90
TEŠ-proga tč.: 59	sm	p	1989	0.9199	0.4526	1.3725	2.03	0.3189	4.30	10-22-90
TEŠ-proga tč.: 59	sm	p	1988	0.8472	0.4183	1.2655	2.03	0.3219	3.93	10-22-90
TEŠ-proga tč.: 59	sm	p	1987	0.7310	0.3654	1.0964	2.00	0.2719	4.03	10-22-90
TEŠ-proga tč.: 60	sm	p	1990	0.8504	0.4157	1.2661	2.05	0.2585	4.90	10-19-90
TEŠ-proga tč.: 60	sm	p	1989	0.8660	0.4405	1.3065	1.97	0.2776	4.71	10-19-90
TEŠ-proga tč.: 60	sm	p	1988	0.9227	0.4650	1.3877	1.98	0.2844	4.88	10-19-90
TEŠ-proga tč.: 60	sm	p	1987	1.1370	0.5458	1.6828	2.08	0.3499	4.81	10-19-90
TEŠ-proga tč.: 61	sm	p	1990	0.8022	0.2788	1.0810	2.88	0.2159	5.01	10-22-90
TEŠ-proga tč.: 61	sm	p	1989	1.0788	0.4303	1.5091	2.51	0.2815	5.36	10-22-90
TEŠ-proga tč.: 61	sm	p	1988	1.3585	0.5274	1.8859	2.58	0.3659	5.15	10-22-90
TEŠ-proga tč.: 61	sm	p	1987	1.4331	0.5978	2.0309	2.40	0.3887	5.22	10-22-90
TEŠ-proga tč.: 62	sm	p	1990	1.0130	0.3760	1.3890	2.69	0.2507	5.54	10-22-90
TEŠ-proga tč.: 62	sm	p	1989	1.4300	0.5349	1.9649	2.67	0.3645	5.39	10-22-90
TEŠ-proga tč.: 62	sm	p	1988	1.4383	0.5798	2.0181	2.48	0.3483	5.79	10-22-90
TEŠ-proga tč.: 62	sm	p	1987	1.5521	0.6378	2.1899	2.43	0.3881	5.64	10-22-90
Graška gora	sm	p	1990	1.4374	0.5668	2.0042	2.54	0.3170	6.32	10-23-90
Graška gora	sm	p	1989	1.8494	0.7254	2.5748	2.55	0.3987	6.46	10-23-90
Graška gora	sm	p	1988	1.9944	0.7973	2.7917	2.50	0.4702	5.94	10-23-90
Graška gora	sm	p	1987	1.8093	0.5138	2.3231	3.52	0.4716	4.93	10-23-90

Pirešica (Krošelj)	sm	p	1990	1.0727	0.4834	1.5561	2.22	0.2470	6.30	10-23-90
Pirešica (Krošelj)	sm	p	1989	1.6563	0.6405	2.2968	2.59	0.3976	5.78	10-23-90
Pirešica (Krošelj)	sm	p	1988	1.7767	0.7164	2.4931	2.48	0.3140	7.94	10-23-90
Pirešica (Krošelj)	sm	p	1987	1.4588	0.5964	2.0552	2.45	0.3654	5.62	10-23-90
Široko pri Lajšah	sm	p	1990	1.1220	0.4401	1.5621	2.55	0.2563	6.09	10-23-90
Široko pri Lajšah	sm	p	1989	1.3853	0.5552	1.9405	2.50	0.3088	6.28	10-23-90
Široko pri Lajšah	sm	p	1988	1.2300	0.4842	1.7142	2.54	0.2963	5.79	10-23-90
Široko pri Lajšah	sm	p	1987	1.1775	0.4851	1.6626	2.43	0.2947	5.64	10-23-90
Topolšica	sm	p	1990	1.6228	0.6123	2.2351	2.65	0.3446	6.49	10-23-90
Topolšica	sm	p	1989	1.6745	0.6946	2.3691	2.41	0.3746	6.32	10-23-90
Topolšica	sm	p	1988	1.5786	0.6568	2.2354	2.40	0.3831	5.84	10-23-90
Topolšica	sm	p	1987	1.6130	0.6991	2.3121	2.31	0.4115	5.62	10-23-90
Veliki vrh	sm	p	1990	1.3690	0.5656	1.9346	2.42	0.3142	6.16	10-23-90
Veliki vrh	sm	p	1989	1.2619	0.5286	1.7905	2.39	0.2215	8.08	10-23-90
Veliki vrh	sm	p	1988	0.9753	0.4481	1.4234	2.18	0.2610	5.45	10-23-90
Veliki vrh	sm	p	1987	1.0631	0.4484	1.5115	2.37	0.2844	5.31	10-23-90
Zavodnje (Prednji vrh)	sm	p	1990	1.3443	0.6156	1.9599	2.18	0.3207	6.11	10-23-90
Zavodnje (Prednji vrh)	sm	p	1989	1.3987	0.6019	2.0006	2.32	0.3408	5.87	10-23-90
Zavodnje (Prednji vrh)	sm	p	1988	1.4155	0.6457	2.0612	2.19	0.3592	5.74	10-23-90
Zavodnje (Prednji vrh)	sm	p	1987	1.2087	0.5706	1.7793	2.12	0.3226	5.52	10-23-90

* sm = Picea abies (L.)Karst.
  p = average data

Data of needle diffusate analysis in Norway spruce needles sampled on the profile SMEREKCVC - VINSKA GORA IN 1990

1. Measurements of pH in needle diffusate

Acidity of needle diffusate (pH)

Sampling site	Time of shaking		2 hours				24 hours			
	Needle age		1990	1989	1988	1987	1990	1989	1988	1987
** Objekt: TEŠ-proga tč.: 1										
TEŠ-proga tč.: 1	sm		4.51	4.38	4.67	4.83	5.25	4.74	4.76	4.82
TEŠ-proga tč.: 1	sm		4.99	5.37	5.32	5.49	5.52	5.72	5.49	5.30
TEŠ-proga tč.: 1	sm	P	4.75	4.88	5.00	5.16	5.38	5.23	5.12	5.06
** Objekt: TEŠ-proga tč.: 2										
TEŠ-proga tč.: 2	sm		4.80	4.70	4.70	4.80	4.50	4.50	4.10	4.10
TEŠ-proga tč.: 2	sm		4.80	4.90	4.90	4.90	4.90	5.10	4.30	4.10
TEŠ-proga tč.: 2	sm	P	4.80	4.80	4.80	4.85	4.70	4.80	4.20	4.10
** Objekt: TEŠ-proga tč.: 3										
TEŠ-proga tč.: 3	sm		4.98	5.12	5.44	5.65	4.76	4.75	4.59	4.44
TEŠ-proga tč.: 3	sm		4.53	4.92	4.89	5.10	4.34	4.19	4.12	4.31
TEŠ-proga tč.: 3	sm	P	4.76	5.02	5.17	5.38	4.55	4.47	4.36	4.38
** Objekt: TEŠ-proga tč.: 4										
TEŠ-proga tč.: 4	sm		5.40	5.50	5.50	5.80	5.30	5.80	5.20	5.60
TEŠ-proga tč.: 4	sm		5.70	5.80	5.70	5.70	6.10	5.70	5.80	5.90
TEŠ-proga tč.: 4	sm	P	5.55	5.65	5.60	5.75	5.70	5.75	5.50	5.75
** Objekt: TEŠ-proga tč.: 5										
TEŠ-proga tč.: 5	sm		5.00	4.80	5.00	5.40	5.40	5.60	5.30	5.40
TEŠ-proga tč.: 5	sm		4.50	4.70	4.90	4.80	4.80	4.40	4.80	4.60
TEŠ-proga tč.: 5	sm	P	4.75	4.75	4.95	5.10	5.10	5.00	5.05	5.00
** Objekt: TEŠ-proga tč.: 6										
TEŠ-proga tč.: 6	sm		4.66	4.54	4.68	4.87	4.90	4.87	4.97	5.20
TEŠ-proga tč.: 6	sm		4.32	4.35	4.42	4.68	4.34	4.21	4.42	4.50
TEŠ-proga tč.: 6	sm	P	4.49	4.45	4.55	4.78	4.62	4.54	4.70	4.85
** Objekt: TEŠ-proga tč.: 7										
TEŠ-proga tč.: 7	sm		4.70	4.80	4.80	5.10	5.20	4.40	4.50	4.70
TEŠ-proga tč.: 7	sm		4.60	4.70	4.90	5.10	4.90	4.80	4.70	4.80
TEŠ-proga tč.: 7	sm	P	4.65	4.75	4.85	5.10	5.05	4.60	4.60	4.75
** Objekt: TEŠ-proga tč.: 8										

TEŠ-proga tč.: 8	sm		5.30	5.40	5.90	5.70	4.90	4.40	4.70	4.80
TEŠ-proga tč.: 8	sm		4.90	5.00	5.10	5.10	5.42	4.99	5.02	5.25
TEŠ-proga tč.: 8	sm	P	5.10	5.20	5.50	5.40	5.16	4.70	4.86	5.03
** Objekt: TEŠ-proga tč.: 9										
TEŠ-proga tč.: 9	sm		4.80	4.87	4.63	4.90	4.90	5.15	4.71	4.78
TEŠ-proga tč.: 9	sm		4.58	4.62	4.75	4.87	5.31	4.80	4.85	5.05
TEŠ-proga tč.: 9	sm	P	4.69	4.75	4.69	4.89	5.11	4.98	4.78	4.92
** Objekt: TEŠ-proga tč.: 10										
TEŠ-proga tč.: 10	sm		4.51	4.59	4.93	5.29	5.21	5.16	5.62	5.67
TEŠ-proga tč.: 10	sm		4.79	4.76	4.84	5.12	5.24	5.14	5.15	5.40
TEŠ-proga tč.: 10	sm	P	4.65	4.67	4.88	5.21	5.23	5.15	5.39	5.54
** Objekt: TEŠ-proga tč.: 11										
TEŠ-proga tč.: 11	sm		5.26	5.52	5.16	5.17	5.17	6.21	4.90	4.85
TEŠ-proga tč.: 11	sm		4.00	5.00	5.30	5.40	5.50	5.30	5.40	5.30
TEŠ-proga tč.: 11	sm	P	4.63	5.26	5.23	5.29	5.33	5.75	5.15	5.08
** Objekt: TEŠ-proga tč.: 12										
TEŠ-proga tč.: 12	sm		4.80	4.99	4.89	4.95	5.58	5.51	5.64	5.65
TEŠ-proga tč.: 12	sm		5.38	5.31	5.36	0.00	6.27	5.96	5.79	0.00
TEŠ-proga tč.: 12	sm	P	5.09	5.15	5.12	4.95	5.92	5.74	5.71	5.65
** Objekt: TEŠ-proga tč.: 14										
TEŠ-proga tč.: 14	sm		4.68	4.83	4.74	4.88	5.33	5.14	5.36	5.15
TEŠ-proga tč.: 14	sm		4.43	4.61	4.91	5.08	5.11	4.65	4.77	5.00
TEŠ-proga tč.: 14	sm	P	4.55	4.72	4.83	4.98	5.22	4.90	5.07	5.08
** Objekt: TEŠ-proga tč.: 15										
TEŠ-proga tč.: 15	sm		4.96	5.11	5.32	5.30	5.03	5.20	5.27	5.35
TEŠ-proga tč.: 15	sm		4.72	5.12	5.10	5.23	4.60	4.94	5.21	5.53
TEŠ-proga tč.: 15	sm	P	4.84	5.12	5.21	5.27	4.82	5.07	5.24	5.44
** Objekt: TEŠ-proga tč.: 16										
TEŠ-proga tč.: 16	sm		4.98	5.39	4.86	5.14	4.62	5.15	4.52	5.02
TEŠ-proga tč.: 16	sm		4.71	5.04	5.03	5.19	4.65	5.01	5.13	5.16
TEŠ-proga tč.: 16	sm	P	4.85	5.21	4.95	5.17	4.64	5.08	5.03	5.09
** Objekt: TEŠ-proga tč.: 17										
TEŠ-proga tč.: 17	sm		5.68	5.22	5.36	5.05	4.95	6.26	5.36	4.96
TEŠ-proga tč.: 17	sm		4.50	4.70	5.00	4.70	4.40	4.50	4.50	4.50
TEŠ-proga tč.: 17	sm	P	5.09	4.96	5.18	4.88	4.68	5.38	4.93	4.73
** Objekt: TEŠ-proga tč.: 18										
TEŠ-proga tč.: 18	sm		4.47	4.99	4.38	4.39	3.87	3.69	3.91	3.69
TEŠ-proga tč.: 18	sm		6.47	6.58	6.17	5.84	4.55	4.85	4.38	4.41
TEŠ-proga tč.: 18	sm	P	5.47	5.79	5.28	5.12	4.21	4.27	4.15	4.05
** Objekt: TEŠ-proga tč.: 19										
TEŠ-proga tč.: 19	sm		4.37	4.46	4.54	4.93	4.59	4.58	4.50	4.83
TEŠ-proga tč.: 19	sm		4.26	4.83	4.89	5.10	5.13	5.45	5.67	5.66

TEŠ-proga tč.: 19	sm	P	4.32	4.65	4.71	5.01	4.86	5.02	5.08	5.25
** Objekt: TEŠ-proga tč.: 20										
TEŠ-proga tč.: 20	sm		4.93	4.63	5.32	4.97	6.43	6.12	6.10	6.05
TEŠ-proga tč.: 20	sm		4.18	4.46	4.88	4.63	4.50	4.87	5.23	5.64
TEŠ-proga tč.: 20	sm	P	4.55	4.54	5.10	4.80	5.46	5.50	5.67	5.84
** Objekt: TEŠ-proga tč.: 21										
TEŠ-proga tč.: 21	sm		6.36	5.21	5.01	4.41	5.44	3.99	4.06	3.81
TEŠ-proga tč.: 21	sm		4.52	4.42	4.76	4.87	3.87	3.78	3.74	3.80
TEŠ-proga tč.: 21	sm	P	5.44	4.82	4.88	4.64	4.66	3.89	3.90	3.81
** Objekt: TEŠ-proga tč.: 22										
TEŠ-proga tč.: 22	sm		4.32	4.46	4.42	4.98	4.12	4.69	4.49	5.77
TEŠ-proga tč.: 22	sm		3.96	4.14	4.14	4.45	3.78	3.84	3.87	4.05
TEŠ-proga tč.: 22	sm	P	4.14	4.30	4.28	4.72	3.95	4.27	4.18	4.91
** Objekt: TEŠ-proga tč.: 23										
TEŠ-proga tč.: 23	sm		5.20	5.80	4.59	6.05	4.25	3.91	3.81	3.89
TEŠ-proga tč.: 23	sm		4.26	4.31	4.11	5.23	4.86	4.83	4.97	5.78
TEŠ-proga tč.: 23	sm	P	4.73	5.05	4.35	5.64	4.56	4.37	4.39	4.83
** Objekt: TEŠ-proga tč.: 25										
TEŠ-proga tč.: 25	sm		4.60	5.40	5.70	6.00	4.70	4.60	5.00	4.60
TEŠ-proga tč.: 25	sm		4.70	6.10	6.10	5.80	4.00	4.10	4.70	4.40
TEŠ-proga tč.: 25	sm	P	4.65	5.75	5.90	5.90	4.35	4.35	4.60	4.50
** Objekt: TEŠ-proga tč.: 26										
TEŠ-proga tč.: 26	sm		9.30	4.48	4.90	4.83	3.89	4.37	4.75	4.83
TEŠ-proga tč.: 26	sm		4.32	4.79	5.15	5.29	4.33	4.80	5.25	5.24
TEŠ-proga tč.: 26	sm	P	6.81	4.64	5.03	5.08	4.11	4.58	5.00	5.04
** Objekt: TEŠ-proga tč.: 27										
TEŠ-proga tč.: 27	sm		4.70	4.90	4.80	5.00	5.20	4.90	4.10	3.90
TEŠ-proga tč.: 27	sm		4.80	4.80	4.90	5.20	4.70	4.70	4.60	4.80
TEŠ-proga tč.: 27	sm	P	4.75	4.85	4.85	5.10	4.95	4.80	4.35	4.35
** Objekt: TEŠ-proga tč.: 28										
TEŠ-proga tč.: 28	sm		4.19	4.26	4.32	4.55	4.20	4.35	4.13	4.07
TEŠ-proga tč.: 28	sm		5.01	4.84	5.13	5.06	5.12	4.78	5.01	4.94
TEŠ-proga tč.: 28	sm	P	4.60	4.55	4.73	4.80	4.66	4.57	4.57	4.51
** Objekt: TEŠ-proga tč.: 29										
TEŠ-proga tč.: 29	sm		4.70	4.94	4.98	4.97	4.83	5.08	5.43	5.06
TEŠ-proga tč.: 29	sm		4.15	4.67	5.00	5.14	4.16	4.61	4.94	5.17
TEŠ-proga tč.: 29	sm	P	4.43	4.81	4.99	5.05	4.50	4.85	5.19	5.12
** Objekt: TEŠ-proga tč.: 30										
TEŠ-proga tč.: 30	sm		4.51	4.97	5.00	5.17	4.41	4.94	4.98	5.19
TEŠ-proga tč.: 30	sm		4.39	4.75	5.07	5.19	4.41	4.69	5.12	5.23
TEŠ-proga tč.: 30	sm	P	4.45	4.86	5.04	5.18	4.41	4.82	5.05	5.21

** Objekt: TEŠ-proga tč.: 31										
TEŠ-proga tč.: 31	sm		4.51	4.57	4.58	4.75	5.30	5.00	4.91	4.92
TEŠ-proga tč.: 31	sm		4.59	4.47	4.75	4.89	5.12	4.71	4.73	5.10
TEŠ-proga tč.: 31	sm	P	4.55	4.52	4.67	4.82	5.21	4.86	4.82	5.01
** Objekt: TEŠ-proga tč.: 32										
TEŠ-proga tč.: 32	sm		5.74	4.76	5.10	4.29	5.51	4.62	5.09	4.28
TEŠ-proga tč.: 32	sm		5.09	5.35	5.02	5.09	5.28	5.58	4.89	5.04
TEŠ-proga tč.: 32	sm	P	5.42	5.05	5.06	4.69	5.40	5.10	4.99	4.66
** Objekt: TEŠ-proga tč.: 33										
TEŠ-proga tč.: 33	sm		5.10	4.70	4.90	5.10	4.60	4.30	4.30	4.40
TEŠ-proga tč.: 33	sm		5.10	4.90	5.10	5.20	5.00	5.00	5.10	5.10
TEŠ-proga tč.: 33	sm	P	5.10	4.80	5.00	5.15	4.80	4.65	4.70	4.75
** Objekt: TEŠ-proga tč.: 34										
TEŠ-proga tč.: 34	sm		4.70	4.80	4.90	4.90	5.10	4.90	4.90	4.80
TEŠ-proga tč.: 34	sm		4.50	4.60	4.80	4.70	5.30	5.10	4.90	5.30
TEŠ-proga tč.: 34	sm	P	4.60	4.70	4.85	4.80	5.20	5.00	4.90	5.05
** Objekt: TEŠ-proga tč.: 35										
TEŠ-proga tč.: 35	sm		5.60	4.90	5.10	5.20	5.70	4.80	4.90	5.00
TEŠ-proga tč.: 35	sm		4.50	4.90	5.00	5.00	4.20	4.60	4.80	5.00
TEŠ-proga tč.: 35	sm	P	5.05	4.90	5.05	5.10	4.95	4.70	4.85	5.00
** Objekt: TEŠ-proga tč.: 36										
TEŠ-proga tč.: 36	sm		5.07	5.04	4.98	4.87	5.33	5.26	5.34	5.43
TEŠ-proga tč.: 36	sm		4.51	4.72	5.22	4.89	4.62	4.83	5.43	5.03
TEŠ-proga tč.: 36	sm	P	4.79	4.88	5.10	4.88	4.98	5.04	5.38	5.23
** Objekt: TEŠ-proga tč.: 37										
TEŠ-proga tč.: 37	sm		4.94	5.20	4.95	4.92	5.45	6.29	5.91	5.14
TEŠ-proga tč.: 37	sm		4.84	4.63	4.70	4.76	5.44	4.36	4.09	3.99
TEŠ-proga tč.: 37	sm	P	4.89	4.92	4.83	4.84	5.45	5.33	5.00	4.57
** Objekt: TEŠ-proga tč.: 38										
TEŠ-proga tč.: 38	sm		4.50	4.60	5.00	4.80	4.40	4.60	4.70	4.90
TEŠ-proga tč.: 38	sm		4.50	4.60	4.70	4.90	4.70	4.60	4.80	4.80
TEŠ-proga tč.: 38	sm	P	4.50	4.60	4.85	4.85	4.55	4.60	4.75	4.85
** Objekt: TEŠ-proga tč.: 39										
TEŠ-proga tč.: 39	sm		4.62	4.51	4.52	4.86	4.82	4.85	4.80	5.02
TEŠ-proga tč.: 39	sm		4.69	4.78	4.92	4.82	5.18	5.21	4.82	4.88
TEŠ-proga tč.: 39	sm	P	4.66	4.65	4.72	4.84	5.00	5.03	4.81	4.95
** Objekt: TEŠ-proga tč.: 40										
TEŠ-proga tč.: 40	sm		4.88	4.58	4.64	4.95	5.07	4.76	4.48	4.82
TEŠ-proga tč.: 40	sm		4.67	4.69	4.70	4.87	4.98	4.79	4.73	4.89
TEŠ-proga tč.: 40	sm	P	4.78	4.64	4.67	4.91	5.03	4.78	4.61	4.86
** Objekt: TEŠ-proga tč.: 41										
TEŠ-proga tč.: 41	sm		4.50	4.70	4.80	4.90	4.80	4.90	5.20	5.20

TEŠ-proga tč.: 41	sm		4.50	4.70	4.80	4.80	4.70	4.70	4.90	4.90
TEŠ-proga tč.: 41	sm	P	4.50	4.70	4.80	4.85	4.75	4.80	5.05	5.05
** Objekt: TEŠ-proga tč.: 42										
TEŠ-proga tč.: 42	sm		4.80	5.10	5.10	5.00	5.12	5.81	5.34	5.38
TEŠ-proga tč.: 42	sm		4.40	4.40	4.60	4.70	4.53	4.75	4.91	4.97
TEŠ-proga tč.: 42	sm	P	4.60	4.75	4.85	4.85	4.83	5.28	5.12	5.17
** Objekt: TEŠ-proga tč.: 43										
TEŠ-proga tč.: 43	sm		4.70	5.00	4.80	5.00	4.73	5.24	4.96	5.34
TEŠ-proga tč.: 43	sm		4.60	5.00	5.20	5.10	4.84	4.94	5.26	5.38
TEŠ-proga tč.: 43	sm	P	4.65	5.00	5.00	5.05	4.79	5.09	5.11	5.36
** Objekt: TEŠ-proga tč.: 44										
TEŠ-proga tč.: 44	sm		4.40	4.50	4.70	4.80	4.60	4.50	5.20	4.90
TEŠ-proga tč.: 44	sm		4.60	4.50	4.30	4.70	4.70	4.50	4.40	4.80
TEŠ-proga tč.: 44	sm	P	4.50	4.50	4.50	4.75	4.65	4.50	4.80	4.85
** Objekt: TEŠ-proga tč.: 45										
TEŠ-proga tč.: 45	sm		4.34	4.63	4.74	4.80	4.24	4.31	4.36	4.52
TEŠ-proga tč.: 45	sm		4.37	4.88	4.75	5.36	4.12	4.66	4.54	5.07
TEŠ-proga tč.: 45	sm	P	4.36	4.75	4.75	5.08	4.18	4.49	4.45	4.79
** Objekt: TEŠ-proga tč.: 46										
TEŠ-proga tč.: 46	sm		4.76	4.86	4.97	5.17	5.03	4.76	4.87	4.98
TEŠ-proga tč.: 46	sm		4.67	4.75	4.80	5.18	4.77	4.71	4.66	5.00
TEŠ-proga tč.: 46	sm	P	4.71	4.81	4.88	5.17	4.90	4.74	4.77	4.99
** Objekt: TEŠ-proga tč.: 47										
TEŠ-proga tč.: 47	sm		4.67	4.95	4.84	5.16	4.56	4.92	4.77	5.06
TEŠ-proga tč.: 47	sm		4.75	4.81	5.04	5.20	4.71	4.77	5.28	5.31
TEŠ-proga tč.: 47	sm	P	4.71	4.88	4.94	5.18	4.63	4.84	5.03	5.18
** Objekt: TEŠ-proga tč.: 48										
TEŠ-proga tč.: 48	sm		4.78	5.42	4.95	5.43	5.00	5.03	5.06	5.48
TEŠ-proga tč.: 48	sm		5.28	5.36	5.46	5.37	5.42	5.54	5.28	5.25
TEŠ-proga tč.: 48	sm	P	5.03	5.39	5.21	5.40	5.21	5.29	5.17	5.37
** Objekt: TEŠ-proga tč.: 49										
TEŠ-proga tč.: 49	sm		4.43	4.58	4.63	4.66	4.80	4.65	4.71	4.59
TEŠ-proga tč.: 49	sm		4.39	4.68	4.81	4.98	4.15	4.35	4.33	4.34
TEŠ-proga tč.: 49	sm	P	4.41	4.63	4.72	4.82	4.48	4.50	4.52	4.46
** Objekt: TEŠ-proga tč.: 50										
TEŠ-proga tč.: 50	sm		4.50	4.70	4.70	4.80	5.30	4.90	5.00	5.00
TEŠ-proga tč.: 50	sm		4.90	4.80	4.90	5.20	5.60	5.30	5.30	5.50
TEŠ-proga tč.: 50	sm	P	4.70	4.75	4.80	5.00	5.45	5.10	5.15	5.25
** Objekt: TEŠ-proga tč.: 51										
TEŠ-proga tč.: 51	sm		4.54	4.52	4.71	4.94	4.84	5.00	4.99	5.32
TEŠ-proga tč.: 51	sm		4.30	4.59	4.80	4.94	4.70	4.73	5.42	5.36
TEŠ-proga tč.: 51	sm	P	4.42	4.55	4.75	4.94	4.77	4.87	5.21	5.34

** Objekt: TEŠ-proga tč.: 52

TEŠ-proga tč.: 52	sm		4.97	4.82	5.01	5.23	4.95	4.86	5.57	5.25
TEŠ-proga tč.: 52	sm		5.30	5.67	5.63	5.56	5.66	6.06	6.11	5.58
TEŠ-proga tč.: 52	sm	P	5.13	5.25	5.32	5.40	5.31	5.46	5.84	5.42

** Objekt: TEŠ-proga tč.: 53

TEŠ-proga tč.: 53	sm		4.67	4.99	5.08	5.18	5.52	5.75	5.90	5.78
TEŠ-proga tč.: 53	sm		4.95	5.04	5.37	0.00	4.91	4.76	5.06	0.00
TEŠ-proga tč.: 53	sm	P	4.81	5.02	5.23	5.18	5.21	5.25	5.48	5.78

** Objekt: TEŠ-proga tč.: 54

TEŠ-proga tč.: 54	sm		4.70	4.60	4.70	4.90	5.80	5.30	5.60	5.30
TEŠ-proga tč.: 54	sm		4.70	4.90	5.00	5.70	5.90	5.40	5.20	5.50
TEŠ-proga tč.: 54	sm	P	4.70	4.75	4.85	5.30	5.85	5.35	5.40	5.40

** Objekt: TEŠ-proga tč.: 55

TEŠ-proga tč.: 55	sm		4.50	4.60	4.70	4.80	4.90	4.50	4.60	4.60
TEŠ-proga tč.: 55	sm		4.60	4.60	4.80	4.90	4.90	4.90	4.80	5.30
TEŠ-proga tč.: 55	sm	P	4.55	4.60	4.75	4.85	4.90	4.70	4.70	4.95

** Objekt: TEŠ-proga tč.: 56

TEŠ-proga tč.: 56	sm		4.82	4.76	5.13	5.11	5.48	5.19	5.81	5.54
TEŠ-proga tč.: 56	sm		4.70	4.97	4.96	5.11	5.09	5.33	5.47	5.51
TEŠ-proga tč.: 56	sm	P	4.76	4.87	5.04	5.11	5.29	5.26	5.64	5.53

** Objekt: TEŠ-proga tč.: 57

TEŠ-proga tč.: 57	sm		4.66	4.68	4.85	0.00	4.65	4.82	5.06	0.00
TEŠ-proga tč.: 57	sm		4.57	4.61	4.63	4.71	4.87	4.71	4.65	5.06
TEŠ-proga tč.: 57	sm	P	4.62	4.65	4.74	4.71	4.76	4.77	4.86	5.06

** Objekt: TEŠ-proga tč.: 58

TEŠ-proga tč.: 58	sm		4.60	4.70	5.10	5.90	5.20	4.80	5.00	5.90
TEŠ-proga tč.: 58	sm		4.70	5.10	5.40	5.10	5.20	5.50	6.20	5.70
TEŠ-proga tč.: 58	sm	P	4.65	4.90	5.25	5.50	5.20	5.15	5.60	5.80

** Objekt: TEŠ-proga tč.: 59

TEŠ-proga tč.: 59	sm		4.90	5.00	5.10	5.40	5.70	5.20	5.50	5.40
TEŠ-proga tč.: 59	sm		4.80	4.90	4.90	5.20	4.50	4.60	4.80	4.90
TEŠ-proga tč.: 59	sm	P	4.85	4.95	5.00	5.30	5.10	4.90	5.15	5.15

** Objekt: TEŠ-proga tč.: 60

TEŠ-proga tč.: 60	sm		4.99	5.24	5.39	5.70	5.20	5.53	5.40	5.74
TEŠ-proga tč.: 60	sm		4.91	4.64	4.81	5.26	4.85	4.65	4.73	5.05
TEŠ-proga tč.: 60	sm	P	4.95	4.94	5.10	5.48	5.03	5.09	5.07	5.40

** Objekt: TEŠ-proga tč.: 61

TEŠ-proga tč.: 61	sm		4.89	4.78	5.07	5.06	5.70	4.95	5.04	5.29
TEŠ-proga tč.: 61	sm		4.99	5.06	5.26	5.32	5.69	5.05	5.35	5.36
TEŠ-proga tč.: 61	sm	P	4.94	4.92	5.17	5.19	5.70	5.00	5.20	5.33

** Objekt: TEŠ-proga tč.: 62

TEŠ-proga tč.: 62	sm		4.70	4.90	4.90	5.00	5.00	5.40	4.90	4.80
TEŠ-proga tč.: 62	sm		4.40	5.10	4.90	5.10	5.10	5.20	5.30	5.20
TEŠ-proga tč.: 62	sm	P	4.55	5.00	4.90	5.05	5.05	5.30	5.10	5.00
** Objekt: Graška gora										
Graška gora	sm		5.00	5.00	5.30	5.40	5.60	5.90	5.70	5.80
Graška gora	sm		4.80	4.90	4.90	5.00	5.60	5.30	5.20	5.60
Graška gora	sm	P	4.90	4.95	5.10	5.20	5.60	5.60	5.45	5.70
** Objekt: Pirešica (Krošelj)										
Pirešica (Krošelj)	sm		4.50	4.80	4.90	4.90	5.50	5.10	5.30	5.10
Pirešica (Krošelj)	sm		4.70	4.70	4.90	4.90	5.90	5.10	5.40	5.60
Pirešica (Krošelj)	sm	P	4.60	4.75	4.90	4.90	5.70	5.10	5.35	5.35
** Objekt: Široko pri Lajšah										
Široko pri Lajšah	sm		4.50	4.90	4.80	4.90	5.60	5.40	5.30	5.20
Široko pri Lajšah	sm		4.80	4.70	4.90	4.90	5.40	5.40	5.50	5.20
Šircko pri Lajšah	sm	P	4.65	4.80	4.85	4.90	5.50	5.40	5.40	5.20
** Objekt: Topolšica										
Topolšica	sm		4.60	4.80	4.80	4.80	4.80	4.70	5.10	4.90
Topolšica	sm		4.80	4.70	4.60	4.80	4.90	4.80	4.90	4.90
Topolšica	sm	P	4.70	4.75	4.70	4.80	4.85	4.75	5.00	4.90
** Objekt: Zavodnje (Prednji vrh)										
Zavodnje (Prednji vrh)	sm		4.70	4.70	5.10	5.10	4.90	4.70	5.30	5.00
Zavodnje (Prednji vrh)	sm		4.60	4.70	5.00	5.50	4.40	4.50	0.00	4.90
Zavodnje (Prednji vrh)	sm	P	4.65	4.70	5.05	5.30	4.65	4.60	2.65	4.95

** First two rows are data of two trees on plot, the third row (P) is average.

2. Measurements of electrical conductivity of needle diffusate (uS/cm-1)

Sampling site	Time of shaking		2 hours				24 hours			
	Needle age		1990	1989	1988	1987	1990	1989	1988	1987
** Objekt: TEŠ-proga tč.: 1										
TEŠ-proga tč.: 1	sm		106	70	64	92	36	52	69	108
TEŠ-proga tč.: 1	sm		58	59	76	70	40	63	64	87
TEŠ-proga tč.: 1	sm	P	82	64	70	81	38	58	66	98
** Objekt: TEŠ-proga tč.: 2										
TEŠ-proga tč.: 2	sm		62	53	66	68	119	110	300	332
TEŠ-proga tč.: 2	sm		49	49	52	60	60	67	158	238
TEŠ-proga tč.: 2	sm	P	56	51	59	64	90	88	229	285
** Objekt: TEŠ-proga tč.: 3										
TEŠ-proga tč.: 3	sm		96	103	71	57	184	206	421	309
TEŠ-proga tč.: 3	sm		169	187	156	120	338	557	533	640
TEŠ-proga tč.: 3	sm	P	132	145	114	88	261	382	477	474
** Objekt: TEŠ-proga tč.: 4										
TEŠ-proga tč.: 4	sm		46	35	53	34	49	37	54	40
TEŠ-proga tč.: 4	sm		23	24	31	29	30	41	43	37
TEŠ-proga tč.: 4	sm	P	34	30	42	32	40	39	48	38
** Objekt: TEŠ-proga tč.: 5										
TEŠ-proga tč.: 5	sm		28	26	27	18	22	24	26	48
TEŠ-proga tč.: 5	sm		38	30	32	31	28	58	48	70
TEŠ-proga tč.: 5	sm	P	33	28	30	24	25	41	37	59
** Objekt: TEŠ-proga tč.: 6										
TEŠ-proga tč.: 6	sm		33	55	50	42	35	51	42	40
TEŠ-proga tč.: 6	sm		78	71	73	53	64	102	87	74
TEŠ-proga tč.: 6	sm	P	56	63	62	48	50	76	64	57
** Objekt: TEŠ-proga tč.: 7										
TEŠ-proga tč.: 7	sm		50	59	81	61	37	139	190	144
TEŠ-proga tč.: 7	sm		52	76	77	43	45	111	139	115
TEŠ-proga tč.: 7	sm	P	51	68	79	52	41	125	164	130
** Objekt: TEŠ-proga tč.: 8										
TEŠ-proga tč.: 8	sm		49	45	39	38	74	169	80	140
TEŠ-proga tč.: 8	sm		57	63	69	63	47	138	331	243
TEŠ-proga tč.: 8	sm	P	53	54	54	50	60	154	206	192

** Objekt: TEŠ-proga tč.: 9										
TEŠ-proga tč.: 9	sm		59	49	87	74	68	50	139	142
TEŠ-proga tč.: 9	sm		66	68	91	83	36	63	84	102
TEŠ-proga tč.: 9	sm	P	62	58	89	78	52	56	112	122
** Objekt: TEŠ-proga tč.: 10										
TEŠ-proga tč.: 10	sm		45	46	43	29	27	30	32	23
TEŠ-proga tč.: 10	sm		28	40	54	41	24	52	39	32
TEŠ-proga tč.: 10	sm	P	36	43	48	35	26	41	36	28
** Objekt: TEŠ-proga tč.: 11										
TEŠ-proga tč.: 11	sm		84	80	85	86	332	229	289	254
TEŠ-proga tč.: 11	sm		89	49	70	56	35	49	76	100
TEŠ-proga tč.: 11	sm	P	86	64	78	71	184	139	182	177
** Objekt: TEŠ-proga tč.: 12										
TEŠ-proga tč.: 12	sm		55	57	44	63	40	64	41	50
TEŠ-proga tč.: 12	sm		41	54	53	0	120	229	203	0
TEŠ-proga tč.: 12	sm	P	50	56	48	63	80	146	122	50
** Objekt: TEŠ-proga tč.: 14										
TEŠ-proga tč.: 14	sm		80	91	136	121	92	154	179	246
TEŠ-proga tč.: 14	sm		88	93	108	106	144	203	260	288
TEŠ-proga tč.: 14	sm	P	84	92	122	114	118	178	220	267
** Objekt: TEŠ-proga tč.: 15										
TEŠ-proga tč.: 15	sm		94	123	130	70	158	238	245	175
TEŠ-proga tč.: 15	sm		72	53	57	58	99	106	75	91
TEŠ-proga tč.: 15	sm	P	83	88	94	64	128	172	161	133
** Objekt: TEŠ-proga tč.: 16										
TEŠ-proga tč.: 16	sm		62	58	86	88	123	142	160	182
TEŠ-proga tč.: 16	sm		130	120	106	86	201	208	204	220
TEŠ-proga tč.: 16	sm	P	96	89	96	87	162	175	182	201
** Objekt: TEŠ-proga tč.: 17										
TEŠ-proga tč.: 17	sm		98	119	132	217	248	351	379	202
TEŠ-proga tč.: 17	sm		72	99	65	88	117	214	173	189
TEŠ-proga tč.: 17	sm	P	85	109	98	152	182	282	276	196
** Objekt: TEŠ-proga tč.: 18										
TEŠ-proga tč.: 18	sm		59	48	87	102	267	345	387	513
TEŠ-proga tč.: 18	sm		16	28	25	25	160	127	381	452
TEŠ-proga tč.: 18	sm	P	38	38	56	64	214	236	384	482
** Objekt: TEŠ-proga tč.: 19										
TEŠ-proga tč.: 19	sm		83	67	135	69	71	90	256	146
TEŠ-proga tč.: 19	sm		71	44	86	76	36	35	46	50
TEŠ-proga tč.: 19	sm	P	77	56	110	72	54	62	151	98
** Objekt: TEŠ-proga tč.: 20										

TEŠ-proga tč.: 20	sm		84	116	104	115	21	41	30	46
TEŠ-proga tč.: 20	sm		97	100	105	144	63	85	166	69
TEŠ-proga tč.: 20	sm	P	90	108	104	130	42	63	98	58
** Objekt: TEŠ-proga tč.: 21										
TEŠ-proga tč.: 21	sm		30	52	96	143	66	293	385	475
TEŠ-proga tč.: 21	sm		76	90	102	97	393	519	632	664
TEŠ-proga tč.: 21	sm	P	53	71	99	120	230	406	508	570
** Objekt: TEŠ-proga tč.: 22										
TEŠ-proga tč.: 22	sm		120	163	197	122	105	81	110	72
TEŠ-proga tč.: 22	sm		110	78	108	103	137	158	168	0
TEŠ-proga tč.: 22	sm	P	115	120	152	112	121	120	139	36
** Objekt: TEŠ-proga tč.: 23										
TEŠ-proga tč.: 23	sm		42	64	95	70	156	368	429	602
TEŠ-proga tč.: 23	sm		121	99	103	70	46	36	41	25
TEŠ-proga tč.: 23	sm	P	82	82	99	70	101	202	235	314
** Objekt: TEŠ-proga tč.: 25										
TEŠ-proga tč.: 25	sm		63	70	86	96	96	194	142	192
TEŠ-proga tč.: 25	sm		47	45	34	36	371	316	293	302
TEŠ-proga tč.: 25	sm	P	55	58	60	66	234	255	218	247
** Objekt: TEŠ-proga tč.: 26										
TEŠ-proga tč.: 26	sm		148	177	124	108	264	316	203	194
TEŠ-proga tč.: 26	sm		158	118	126	150	249	178	228	294
TEŠ-proga tč.: 26	sm	P	153	148	125	129	256	247	216	244
** Objekt: TEŠ-proga tč.: 27										
TEŠ-proga tč.: 27	sm		61	53	65	58	74	173	227	382
TEŠ-proga tč.: 27	sm		61	77	77	74	108	167	188	189
TEŠ-proga tč.: 27	sm	P	61	65	71	66	91	170	208	286
** Objekt: TEŠ-proga tč.: 28										
TEŠ-proga tč.: 28	sm		71	82	108	80	110	298	301	243
TEŠ-proga tč.: 28	sm		83	89	77	70	113	209	212	266
TEŠ-proga tč.: 28	sm	P	77	86	92	75	112	254	256	254
** Objekt: TEŠ-proga tč.: 29										
TEŠ-proga tč.: 29	sm		88	64	67	106	122	189	72	176
TEŠ-proga tč.: 29	sm		97	61	66	48	128	162	185	115
TEŠ-proga tč.: 29	sm	P	92	62	66	77	125	176	128	146
** Objekt: TEŠ-proga tč.: 30										
TEŠ-proga tč.: 30	sm		112	77	140	77	201	163	283	209
TEŠ-proga tč.: 30	sm		86	94	76	95	123	135	134	220
TEŠ-proga tč.: 30	sm	P	99	86	108	88	162	149	208	214
** Objekt: TEŠ-proga tč.: 31										
TEŠ-proga tč.: 31	sm		51	57	69	51	25	42	56	58
TEŠ-proga tč.: 31	sm		38	61	75	79	30	53	91	72

TEŠ-proga tč.: 31	sm	P	44	59	72	65	28	43	74	65
** Objekt: TEŠ-proga tč.: 32										
TEŠ-proga tč.: 32	sm		174	181	145	236	394	332	298	466
TEŠ-proga tč.: 32	sm		56	60	158	173	62	81	232	318
TEŠ-proga tč.: 32	sm	P	115	120	152	204	228	206	265	392
** Objekt: TEŠ-proga tč.: 33										
TEŠ-proga tč.: 33	sm		75	102	70	69	310	471	408	377
TEŠ-proga tč.: 33	sm		39	56	46	42	269	247	276	246
TEŠ-proga tč.: 33	sm	P	57	79	58	56	290	359	342	312
** Objekt: TEŠ-proga tč.: 34										
TEŠ-proga tč.: 34	sm		24	36	49	16	78	196	296	228
TEŠ-proga tč.: 34	sm		18	16	25	18	37	63	132	58
TEŠ-proga tč.: 34	sm	P	21	26	37	17	58	130	214	143
** Objekt: TEŠ-proga tč.: 35										
TEŠ-proga tč.: 35	sm		37	85	116	94	50	147	198	180
TEŠ-proga tč.: 35	sm		78	58	56	64	124	106	145	137
TEŠ-proga tč.: 35	sm	P	58	72	86	79	87	126	172	158
** Objekt: TEŠ-proga tč.: 36										
TEŠ-proga tč.: 36	sm		81	98	103	91	173	233	228	214
TEŠ-proga tč.: 36	sm		113	109	97	128	271	255	209	318
TEŠ-proga tč.: 36	sm	P	97	104	100	110	222	244	218	266
** Objekt: TEŠ-proga tč.: 37										
TEŠ-proga tč.: 37	sm		153	100	130	149	364	260	344	332
TEŠ-proga tč.: 37	sm		118	139	169	177	365	546	608	698
TEŠ-proga tč.: 37	sm	P	136	120	150	163	364	403	476	515
** Objekt: TEŠ-proga tč.: 38										
TEŠ-proga tč.: 38	sm		82	68	70	109	135	132	204	248
TEŠ-proga tč.: 38	sm		75	59	84	70	68	101	185	184
TEŠ-proga tč.: 38	sm	P	78	64	77	90	102	116	194	216
** Objekt: TEŠ-proga tč.: 39										
TEŠ-proga tč.: 39	sm		85	90	87	121	67	81	117	179
TEŠ-proga tč.: 39	sm		73	78	107	122	41	58	174	241
TEŠ-proga tč.: 39	sm	P	79	84	97	122	54	70	146	210
** Objekt: TEŠ-proga tč.: 40										
TEŠ-proga tč.: 40	sm		97	162	151	131	109	268	339	265
TEŠ-proga tč.: 40	sm		78	142	155	192	69	190	232	350
TEŠ-proga tč.: 40	sm	P	88	152	153	162	89	229	286	308
** Objekt: TEŠ-proga tč.: 41										
TEŠ-proga tč.: 41	sm		59	76	73	68	34	41	4[illegible]	41
TEŠ-proga tč.: 41	sm		49	70	69	98	25	58	63	81
TEŠ-proga tč.: 41	sm	P	54	73	71	83	30	50	52	61

** Objekt: TEŠ-proga tč.: 42

TEŠ-proga tč.: 42	sm		108	63	150	143	158	80	249	259
TEŠ-proga tč.: 42	sm		96	110	98	96	103	94	133	93
TEŠ-proga tč.: 42	sm	P	102	86	124	120	130	37	191	176

** Objekt: TEŠ-proga tč.: 43

TEŠ-proga tč.: 43	sm		85	76	108	107	152	145	256	246
TEŠ-proga tč.: 43	sm		89	74	80	90	122	201	180	213
TEŠ-proga tč.: 43	sm	P	87	75	94	98	137	173	218	230

** Objekt: TEŠ-proga tč.: 44

TEŠ-proga tč.: 44	sm		62	63	57	87	55	88	44	173
TEŠ-proga tč.: 44	sm		68	65	128	32	93	129	228	134
TEŠ-proga tč.: 44	sm	P	65	64	92	60	74	108	136	154

** Objekt: TEŠ-proga tč.: 45

TEŠ-proga tč.: 45	sm		82	99	109	88	198	242	247	255
TEŠ-proga tč.: 45	sm		122	83	143	0	207	215	332	208
TEŠ-proga tč.: 45	sm	P	102	91	126	44	202	228	290	232

** Objekt: TEŠ-proga tč.: 46

TEŠ-proga tč.: 46	sm		69	96	79	101	57	145	128	204
TEŠ-proga tč.: 46	sm		109	101	144	130	165	176	262	241
TEŠ-proga tč.: 46	sm	P	89	98	112	116	111	160	195	222

** Objekt: TEŠ-proga tč.: 47

TEŠ-proga tč.: 47	sm		102	84	113	72	188	182	262	158
TEŠ-proga tč.: 47	sm		102	96	93	91	190	169	176	159
TEŠ-proga tč.: 47	sm	P	102	90	103	82	189	176	219	158

** Objekt: TEŠ-proga tč.: 48

TEŠ-proga tč.: 48	sm		84	86	108	62	87	137	152	28
TEŠ-proga tč.: 48	sm		115	114	90	133	124	183	170	223
TEŠ-proga tč.: 48	sm	P	100	100	99	98	106	160	161	126

** Objekt: TEŠ-proga tč.: 49

TEŠ-proga tč.: 49	sm		72	77	102	154	65	86	144	281
TEŠ-proga tč.: 49	sm		104	106	68	87	305	490	486	573
TEŠ-proga tč.: 49	sm	P	88	92	85	120	185	288	315	427

** Objekt: TEŠ-proga tč.: 50

TEŠ-proga tč.: 50	sm		19	24	26	26	42	105	82	157
TEŠ-proga tč.: 50	sm		29	34	22	22	38	105	48	53
TEŠ-proga tč.: 50	sm	P	24	29	24	24	40	105	65	105

** Objekt: TEŠ-proga tč.: 51

TEŠ-proga tč.: 51	sm		76	62	62	64	56	74	56	47
TEŠ-proga tč.: 51	sm		58	56	46	51	44	62	36	46
TEŠ-proga tč.: 51	sm	P	67	59	54	58	50	68	46	46

** Objekt: TEŠ-proga tč.: 52

TEŠ-proga tč.: 52	sm		92	110	101	118	136	131	133	260

TEŠ-proga tč.: 52	sm		58	43	66	61	169	144	315	269
TEŠ-proga tč.: 52	sm	P	75	76	84	90	152	138	224	264
** Objekt: TEŠ-proga tč.: 53										
TEŠ-proga tč.: 53	sm		72	66	70	65	45	44	56	58
TEŠ-proga tč.: 53	sm		92	81	66	0	260	395	372	0
TEŠ-proga tč.: 53	sm	P	82	74	68	65	152	220	214	58
** Objekt: TEŠ-proga tč.: 54										
TEŠ-proga tč.: 54	sm		52	76	69	56	46	53	43	53
TEŠ-proga tč.: 54	sm		56	61	78	74	34	53	78	161
TEŠ-proga tč.: 54	sm	P	54	68	74	65	40	53	60	107
** Objekt: TEŠ-proga tč.: 55										
TEŠ-proga tč.: 55	sm		66	72	82	72	52	110	160	169
TEŠ-proga tč.: 55	sm		75	79	108	71	54	70	136	62
TEŠ-proga tč.: 55	sm	P	70	76	95	72	53	90	148	116
** Objekt: TEŠ-proga tč.: 56										
TEŠ-proga tč.: 56	sm		50	52	38	49	45	57	42	69
TEŠ-proga tč.: 56	sm		76	77	65	91	76	79	60	93
TEŠ-proga tč.: 56	sm	P	63	64	52	70	60	68	51	81
** Objekt: TEŠ-proga tč.: 57										
TEŠ-proga tč.: 57	sm		98	94	104	0	112	108	108	0
TEŠ-proga tč.: 57	sm		66	64	95	67	52	69	81	54
TEŠ-proga tč.: 57	sm	P	82	79	100	67	82	88	94	54
** Objekt: TEŠ-proga tč.: 58										
TEŠ-proga tč.: 58	sm		67	74	101	46	43	94	88	36
TEŠ-proga tč.: 58	sm		83	47	50	70	54	44	49	55
TEŠ-proga tč.: 58	sm	P	75	60	76	58	48	69	68	46
** Objekt: TEŠ-proga tč.: 59										
TEŠ-proga tč.: 59	sm		66	124	98	82	56	97	73	77
TEŠ-proga tč.: 59	sm		74	75	99	66	104	139	167	120
TEŠ-proga tč.: 59	sm	P	70	100	98	74	80	118	120	98
** Objekt: TEŠ-proga tč.: 60										
TEŠ-proga tč.: 60	sm		93	81	104	121	104	76	172	130
TEŠ-proga tč.: 60	sm		58	136	147	132	142	203	157	192
TEŠ-proga tč.: 60	sm	P	96	108	126	126	123	140	184	161
** Objekt: TEŠ-proga tč.: 61										
TEŠ-proga tč.: 61	sm		51	70	62	67	38	110	143	96
TEŠ-proga tč.: 61	sm		66	83	69	64	54	130	106	128
TEŠ-proga tč.: 61	sm	P	58	76	66	65	46	120	124	112
** Objekt: TEŠ-proga tč.: 62										
TEŠ-proga tč.: 62	sm		50	46	52	60	39	58	64	113
TEŠ-proga tč.: 62	sm		53	84	68	53	36	54	59	54
TEŠ-proga tč.: 62	sm	P	52	65	60	56	38	56	62	84

** Objekt: Graška gora

Graška gora	sm		54	46	49	52	84	41	56	55
Graška gora	sm		29	47	46	45	44	51	64	52
Graška gora	sm	P	42	46	48	48	64	46	60	54

** Objekt: Pirešica (Krošelj)

Pirešica (Krošelj)	sm		50	48	53	76	50	77	72	197
Pirešica (Krošelj)	sm		70	92	93	112	57	100	121	140
Pirešica (Krošelj)	sm	P	60	70	73	94	54	88	96	168

** Objekt: Široko pri Lajšah

Široko pri Lajšah	sm		50	46	52	55	15	35	22	50
Široko pri Lajšah	sm		57	54	64	70	21	20	36	36
Široko pri Lajšah	sm	P	54	50	58	62	18	28	29	43

** Objekt: Topolšica

Topolšica	sm		74	83	94	126	64	74	51	164
Topolšica	sm		51	77	91	67	63	83	136	174
Topolšica	sm	P	62	80	92	96	64	78	94	169

** Objekt: Zavodnje (Prednji vrh)

Zavodnje (Prednji vrh)	sm		85	74	59	68	60	89	47	112
Zavodnje (Prednji vrh)	sm		85	98	92	78	126	257	0	241
Zavodnje (Prednji vrh)	sm	P	85	86	76	73	93	173	24	176

** The same remarks as at pH measurements.

3. Potassium (K) efflux measurements in needle diffusates. Data are presented in mg of K per g of needle dry weight (mgK/gdwght)

Sampling site	Time of shaking		2 hours				24 hours			
	Needle age		1990	1989	1988	1987	1990	1989	1988	1987
** Objekt: TEŠ-proga tč.:	1									
TEŠ-proga tč.: 1	sm		378	278	311	428	197	201	326	525
TEŠ-proga tč.: 1	sm		258	250	366	328	161	264	263	414
TEŠ-proga tč.: 1	sm	P	318	264	338	378	179	232	294	470
** Objekt: TEŠ-proga tč.:	2									
TEŠ-proga tč.: 2	sm		230	199	247	227	478	382	788	921
TEŠ-proga tč.: 2	sm		162	171	178	217	216	247	437	735
TEŠ-proga tč.: 2	sm	P	196	185	212	222	347	314	612	828
** Objekt: TEŠ-proga tč.:	3									
TEŠ-proga tč.: 3	sm		435	312	139	56	790	935	1811	989
TEŠ-proga tč.: 3	sm		501	625	396	387	1374	2613	2130	2710
TEŠ-proga tč.: 3	sm	P	468	468	268	222	1082	1774	1970	1850
** Objekt: TEŠ-proga tč.:	4									
TEŠ-proga tč.: 4	sm		129	72	115	50	129	54	115	67
TEŠ-proga tč.: 4	sm		60	73	86	77	60	145	103	116
TEŠ-proga tč.: 4	sm	P	94	72	100	64	94	100	109	92
** Objekt: TEŠ-proga tč.:	5									
TEŠ-proga tč.: 5	sm		144	113	109	119	62	38	54	205
TEŠ-proga tč.: 5	sm		139	106	97	122	40	141	113	140
TEŠ-proga tč.: 5	sm	P	142	110	103	120	51	90	84	172
** Objekt: TEŠ-proga tč.:	6									
TEŠ-proga tč.: 6	sm		190	412	308	242	232	392	269	260
TEŠ-proga tč.: 6	sm		273	362	359	236	273	564	453	353
TEŠ-proga tč.: 6	sm	P	232	387	334	239	252	478	361	306
** Objekt: TEŠ-proga tč.:	7									
TEŠ-proga tč.: 7	sm		113	183	283	230	94	852	949	905
TEŠ-proga tč.: 7	sm		136	256	243	107	119	604	654	612
TEŠ-proga tč.: 7	sm	P	124	220	263	168	106	728	802	758
** Objekt: TEŠ-proga tč.:	8									
TEŠ-proga tč.: 8	sm		126	162	111	128	216	582	586	462
TEŠ-proga tč.: 8	sm		186	232	145	166	186	589	1121	965
TEŠ-proga tč.: 8	sm	P	156	197	128	147	201	586	854	714

** Objekt: TEŠ-proga tč.: 9

TEŠ-proga tč.: 9	sm		163	137	252	194	181	68	218	432
TEŠ-proga tč.: 9	sm		179	195	230	229	54	130	169	320
TEŠ-proga tč.: 9	sm	P	171	166	241	212	118	99	194	376

** Objekt: TEŠ-proga tč.: 10

TEŠ-proga tč.: 10	sm		115	216	283	105	77	108	159	53
TEŠ-proga tč.: 10	sm		39	93	116	84	20	56	33	34
TEŠ-proga tč.: 10	sm	P	77	154	200	94	48	82	96	44

** Objekt: TEŠ-proga tč.: 11

TEŠ-proga tč.: 11	sm		348	372	263	270	1856	1196	972	922
TEŠ-proga tč.: 11	sm		143	115	239	186	54	115	271	401
TEŠ-proga tč.: 11	sm	P	246	244	251	228	955	656	622	662

** Objekt: TEŠ-proga tč.: 12

TEŠ-proga tč.: 12	sm		298	316	214	325	99	355	150	172
TEŠ-proga tč.: 12	sm		284	310	259	0	1043	1588	1207	0
TEŠ-proga tč.: 12	sm	P	291	313	236	325	571	972	678	172

** Objekt: TEŠ-proga tč.: 14

TEŠ-proga tč.: 14	sm		406	484	591	53	406	658	643	891
TEŠ-proga tč.: 14	sm		313	415	494	454	434	726	905	1033
TEŠ-proga tč.: 14	sm	P	360	450	542	254	420	692	774	962

** Objekt: TEŠ-proga tč.: 15

TEŠ-proga tč.: 15	sm		452	542	594	329	759	1056	1187	903
TEŠ-proga tč.: 15	sm		345	254	251	249	487	527	348	421
TEŠ-proga tč.: 15	sm	P	398	398	422	289	623	792	768	662

** Objekt: TEŠ-proga tč.: 16

TEŠ-proga tč.: 16	sm		164	230	275	283	437	707	621	661
TEŠ-proga tč.: 16	sm		401	456	368	295	755	861	895	861
TEŠ-proga tč.: 16	sm	P	282	343	322	289	596	784	758	761

** Objekt: TEŠ-proga tč.: 17

TEŠ-proga tč.: 17	sm		554	507	580	946	1219	1151	1364	1383
TEŠ-proga tč.: 17	sm		252	355	258	368	485	937	919	969
TEŠ-proga tč.: 17	sm	P	403	431	419	657	852	1044	1142	1176

** Objekt: TEŠ-proga tč.: 18

TEŠ-proga tč.: 18	sm		530	357	627	667	1613	1745	1961	1592
TEŠ-proga tč.: 18	sm		104	221	146	148	2956	343	2226	2365
TEŠ-proga tč.: 18	sm	P	317	289	386	408	2284	1294	2094	1978

** Objekt: TEŠ-proga tč.: 19

TEŠ-proga tč.: 19	sm		495	313	718	407	476	441	1175	831
TEŠ-proga tč.: 19	sm		412	253	521	455	185	175	223	255
TEŠ-proga tč.: 19	sm	P	454	283	620	431	330	308	699	543

** Objekt: TEŠ-proga tč.: 20

TEŠ-proga tč.: 20	sm		337	510	440	520	135	271	157	253
TEŠ-proga tč.: 20	sm		249	452	494	550	265	403	572	345
TEŠ-proga tč.: 20	sm	P	293	481	467	535	200	337	364	299
** Objekt: TEŠ-proga tč.: 21										
TEŠ-proga tč.: 21	sm		262	400	727	931	393	1809	2042	2276
TEŠ-proga tč.: 21	sm		429	581	755	662	2201	2323	2578	2371
TEŠ-proga tč.: 21	sm	P	346	490	741	796	1297	2066	2310	2324
** Objekt: TEŠ-proga tč.: 22										
TEŠ-proga tč.: 22	sm		472	647	787	520	623	467	617	504
TEŠ-proga tč.: 22	sm		345	273	338	386	431	666	676	530
TEŠ-proga tč.: 22	sm	P	408	460	562	453	527	566	646	517
** Objekt: TEŠ-proga tč.: 23										
TEŠ-proga tč.: 23	sm		244	420	550	529	853	1987	1832	2608
TEŠ-proga tč.: 23	sm		440	301	285	230	189	127	151	122
TEŠ-proga tč.: 23	sm	P	342	360	418	380	521	1057	992	1365
** Objekt: TEŠ-proga tč.: 25										
TEŠ-proga tč.: 25	sm		248	333	421	487	438	912	1052	890
TEŠ-proga tč.: 25	sm		158	195	141	164	767	1504	1465	1442
TEŠ-proga tč.: 25	sm	P	203	264	281	326	602	1208	1256	1166
** Objekt: TEŠ-proga tč.: 26										
TEŠ-proga tč.: 26	sm		575	543	583	478	983	1005	956	879
TEŠ-proga tč.: 26	sm		637	526	516	656	1088	707	921	1223
TEŠ-proga tč.: 26	sm	P	606	534	550	567	1036	856	938	1051
** Objekt: TEŠ-proga tč.: 27										
TEŠ-proga tč.: 27	sm		287	277	335	290	307	940	1075	1531
TEŠ-proga tč.: 27	sm		284	250	318	364	835	1101	1055	1075
TEŠ-proga tč.: 27	sm	P	286	264	326	327	571	1020	1065	1303
** Objekt: TEŠ-proga tč.: 28										
TEŠ-proga tč.: 28	sm		258	337	423	348	454	1052	1014	976
TEŠ-proga tč.: 28	sm		410	265	217	204	562	667	743	856
TEŠ-proga tč.: 28	sm	P	334	301	320	276	508	860	873	916
** Objekt: TEŠ-proga tč.: 29										
TEŠ-proga tč.: 29	sm		435	370	366	534	623	678	411	880
TEŠ-proga tč.: 29	sm		407	267	311	221	679	844	863	594
TEŠ-proga tč.: 29	sm	P	421	318	338	378	651	761	637	737
** Objekt: TEŠ-proga tč.: 30										
TEŠ-proga tč.: 30	sm		432	314	478	404	786	703	944	1072
TEŠ-proga tč.: 30	sm		264	395	319	386	462	608	607	923
TEŠ-proga tč.: 30	sm	P	348	354	398	395	624	656	776	998
** Objekt: TEŠ-proga tč.: 31										
TEŠ-proga tč.: 31	sm		238	299	347	247	119	211	243	371
TEŠ-proga tč.: 31	sm		133	155	487	498	133	232	543	480

TEŠ-proga tč.: 31	sm	P	186	227	417	372	126	222	393	426

** Objekt: TEŠ-proga tč.: 32

TEŠ-proga tč.: 32	sm		1561	703	684	817	2744	1168	1307	1250
TEŠ-proga tč.: 32	sm		266	298	651	630	380	418	1054	1139
TEŠ-proga tč.: 32	sm	P	914	500	668	724	1562	793	1180	1194

** Objekt: TEŠ-proga tč.: 33

TEŠ-proga tč.: 33	sm		403	367	220	231	1402	1884	1631	1702
TEŠ-proga tč.: 33	sm		107	164	130	89	864	373	907	884
TEŠ-proga tč.: 33	sm	P	255	266	175	160	1133	1378	1269	1293

** Objekt: TEŠ-proga tč.: 34

TEŠ-proga tč.: 34	sm		302	474	606	509	81	253	548	226
TEŠ-proga tč.: 34	sm		206	191	333	214	412	923	1574	1283
TEŠ-proga tč.: 34	sm	P	254	332	470	362	246	588	1061	754

** Objekt: TEŠ-proga tč.: 35

TEŠ-proga tč.: 35	sm		146	406	568	488	183	1045	1135	1139
TEŠ-proga tč.: 35	sm		276	199	219	263	629	709	862	849
TEŠ-proga tč.: 35	sm	P	211	302	394	376	406	877	998	994

** Objekt: TEŠ-proga tč.: 36

TEŠ-proga tč.: 36	sm		308	346	326	204	582	677	653	532
TEŠ-proga tč.: 36	sm		265	301	403	418	543	541	742	812
TEŠ-proga tč.: 36	sm	P	286	324	364	311	562	609	698	672

** Objekt: TEŠ-proga tč.: 37

TEŠ-proga tč.: 37	sm		749	396	434	426	2201	1564	1462	1323
TEŠ-proga tč.: 37	sm		496	403	412	229	2112	2760	2497	1418
TEŠ-proga tč.: 37	sm	P	622	400	423	328	2156	2162	1980	1370

** Objekt: TEŠ-proga tč.: 38

TEŠ-proga tč.: 38	sm		372	308	299	441	743	736	884	962
TEŠ-proga tč.: 38	sm		314	260	401	290	314	505	917	870
TEŠ-proga tč.: 38	sm	P	343	284	350	366	528	620	900	916

** Objekt: TEŠ-proga tč.: 39

TEŠ-proga tč.: 39	sm		318	389	501	624	247	311	531	943
TEŠ-proga tč.: 39	sm		354	378	463	488	157	284	792	964
TEŠ-proga tč.: 39	sm	P	336	384	482	556	202	298	662	954

** Objekt: TEŠ-proga tč.: 40

TEŠ-proga tč.: 40	sm		476	598	647	647	533	946	1324	1213
TEŠ-proga tč.: 40	sm		360	738	785	818	300	807	1018	1248
TEŠ-proga tč.: 40	sm	P	418	668	716	732	416	876	1171	1230

** Objekt: TEŠ-proga tč.: 41

TEŠ-proga tč.: 41	sm		359	570	361	513	634	794	743	726
TEŠ-proga tč.: 41	sm		278	553	471	660	455	1267	1189	1362
TEŠ-proga tč.: 41	sm	P	318	562	416	586	544	1030	966	1044

** Objekt: TEŠ-proga tč.: 42

TEŠ-proga tč.: 42	sm		538	266	636	601	815	415	1216	1218
TEŠ-proga tč.: 42	sm		434	526	456	454	471	469	701	506
TEŠ-proga tč.: 42	sm	P	486	396	546	528	643	442	958	862

** Objekt: TEŠ-proga tč.: 43

TEŠ-proga tč.: 43	sm		927	1473	492	995	2022	3452	2951	2600
TEŠ-proga tč.: 43	sm		333	283	304	358	682	1059	957	1043
TEŠ-proga tč.: 43	sm	P	630	878	398	676	1352	2260	1954	1822

** Objekt: TEŠ-proga tč.: 44

TEŠ-proga tč.: 44	sm		219	270	228	349	128	287	123	646
TEŠ-proga tč.: 44	sm		353	287	470	268	390	574	511	489
TEŠ-proga tč.: 44	sm	P	286	278	349	308	259	430	517	568

** Objekt: TEŠ-proga tč.: 45

TEŠ-proga tč.: 45	sm		271	357	351	309	741	900	870	902
TEŠ-proga tč.: 45	sm		424	261	479	255	802	664	1148	753
TEŠ-proga tč.: 45	sm	P	348	309	415	282	772	782	1009	828

** Objekt: TEŠ-proga tč.: 46

TEŠ-proga tč.: 46	sm		314	512	431	540	295	922	763	1167
TEŠ-proga tč.: 46	sm		519	450	548	509	811	795	1122	1101
TEŠ-proga tč.: 46	sm	P	416	481	490	524	553	858	942	1134

** Objekt: TEŠ-proga tč.: 47

TEŠ-proga tč.: 47	sm		464	385	480	321	885	854	960	883
TEŠ-proga tč.: 47	sm		367	357	464	369	734	688	899	766
TEŠ-proga tč.: 47	sm	P	416	371	472	345	810	771	930	824

** Objekt: TEŠ-proga tč.: 48

TEŠ-proga tč.: 48	sm		456	452	542	309	456	724	735	508
TEŠ-proga tč.: 48	sm		743	650	486	742	743	941	882	1105
TEŠ-proga tč.: 48	sm	P	600	551	514	526	600	832	808	806

** Objekt: TEŠ-proga tč.: 49

TEŠ-proga tč.: 49	sm		245	274	449	620	204	420	772	1183
TEŠ-proga tč.: 49	sm		377	475	345	447	1100	2689	2963	3049
TEŠ-proga tč.: 49	sm	P	311	374	397	534	652	1554	1868	2116

** Objekt: TEŠ-proga tč.: 50

TEŠ-proga tč.: 50	sm		197	327	283	415	118	580	372	665
TEŠ-proga tč.: 50	sm		266	507	243	192	123	598	187	192
TEŠ-proga tč.: 50	sm	P	232	417	263	304	120	589	280	428

** Objekt: TEŠ-proga tč.: 51

TEŠ-proga tč.: 51	sm		448	380	381	445	584	285	381	298
TEŠ-proga tč.: 51	sm		288	378	302	322	226	434	227	250
TEŠ-proga tč.: 51	sm	P	368	379	342	384	405	360	304	274

** Objekt: TEŠ-proga tč.: 52

TEŠ-proga tč.: 52	sm		301	373	293	356	863	746	657	1231

TEŠ-proga tč.: 52	sm		348	186	312	306	1063	323	2125	1456
TEŠ-proga tč.: 52	sm	P	324	280	302	331	963	784	1396	1344
** Objekt: TEŠ-proga tč.: 53										
TEŠ-proga tč.: 53	sm		397	355	326	286	179	160	212	202
TEŠ-proga tč.: 53	sm		529	434	365	0	1519	2665	2592	0
TEŠ-proga tč.: 53	sm	P	463	394	346	286	849	1412	1402	202
** Objekt: TEŠ-proga tč.: 54										
TEŠ-proga tč.: 54	sm		152	289	155	198	133	173	77	180
TEŠ-proga tč.: 54	sm		143	182	249	266	61	219	365	984
TEŠ-proga tč.: 54	sm	P	148	236	202	232	97	196	221	582
** Objekt: TEŠ-proga tč.: 55										
TEŠ-proga tč.: 55	sm		215	244	356	311	176	558	712	735
TEŠ-proga tč.: 55	sm		359	335	473	333	341	419	631	333
TEŠ-proga tč.: 55	sm	P	287	290	414	322	258	488	672	534
** Objekt: TEŠ-proga tč.: 56										
TEŠ-proga tč.: 56	sm		202	228	177	217	183	245	158	318
TEŠ-proga tč.: 56	sm		353	415	290	428	424	398	256	398
TEŠ-proga tč.: 56	sm	P	278	322	234	322	304	322	207	358
** Objekt: TEŠ-proga tč.: 57										
TEŠ-proga tč.: 57	sm		342	262	237	0	386	306	237	0
TEŠ-proga tč.: 57	sm		279	236	336	228	239	315	247	171
TEŠ-proga tč.: 57	sm	P	310	249	286	228	312	310	242	171
** Objekt: TEŠ-proga tč.: 58										
TEŠ-proga tč.: 58	sm		349	342	398	126	175	428	382	54
TEŠ-proga tč.: 58	sm		379	148	153	277	260	148	134	185
TEŠ-proga tč.: 58	sm	P	364	245	276	202	218	288	258	120
** Objekt: TEŠ-proga tč.: 59										
TEŠ-proga tč.: 59	sm		160	422	319	215	96	332	217	243
TEŠ-proga tč.: 59	sm		317	321	441	240	503	755	899	515
TEŠ-proga tč.: 59	sm	P	238	372	380	228	300	544	558	379
** Objekt: TEŠ-proga tč.: 60										
TEŠ-proga tč.: 60	sm		411	308	340	325	477	292	563	355
TEŠ-proga tč.: 60	sm		564	608	761	525	889	1034	1133	828
TEŠ-proga tč.: 60	sm	P	488	458	550	425	683	663	848	592
** Objekt: TEŠ-proga tč.: 61										
TEŠ-proga tč.: 61	sm		201	266	227	262	165	475	653	441
TEŠ-proga tč.: 61	sm		335	361	263	225	265	635	429	544
TEŠ-proga tč.: 61	sm	P	268	314	245	244	215	555	541	492
** Objekt: TEŠ-proga tč.: 62										
TEŠ-proga tč.: 62	sm		133	86	102	133	57	120	119	322
TEŠ-proga tč.: 62	sm		155	103	145	129	58	137	145	162
TEŠ-proga tč.: 62	sm	P	144	94	124	131	58	128	132	242

** Objekt: Graška gora

Graška gora	sm		254	183	160	171	390	122	160	137
Graška gora	sm		205	162	143	123	82	162	161	106
Graška gora	sm	P	230	172	152	147	236	142	160	122

** Objekt: Pirešica (Krošelj)

Pirešica (Krošelj)	sm		174	180	202	358	131	280	313	1021
Pirešica (Krošelj)	sm		390	456	377	511	415	505	596	665
Pirešica (Krošelj)	sm	P	282	318	290	434	273	392	454	843

** Objekt: Široko pri Lajšah

Široko pri Lajšah	sm		205	242	291	324	137	593	336	908
Široko pri Lajšah	sm		382	328	446	486	318	328	689	844
Široko pri Lajšah	sm	P	294	285	368	405	228	460	512	876

** Objekt: Topolšica

Topolšica	sm		196	290	386	448	274	341	244	847
Topolšica	sm		159	276	282	179	377	530	722	805
Topolšica	sm	P	178	283	334	314	326	436	483	826

** Objekt: Zavodnje (Prednji vrh)

Zavodnje (Prednji vrh)	sm		275	212	247	192	118	245	123	335
Zavodnje (Prednji vrh)	sm		225	329	******	288	374	986	******	1135
Zavodnje (Prednji vrh)	sm	P	250	270	******	240	246	616	******	735

** The same remarks as at pH measurements

II. Data of Norway spruce needle analysis, sampling in the profile SMREKOVC-ŠOŠTANJ POHORJE in 1991.

VSEBNOST KLOROFILA a+b V IGLICAH SMREKE, 1991

CHLOROPHYLL a+b CONTENT IN SPRUCE NEEDLES, 1991

VZ. MESTO SAMPL. PLOT	LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse 1	1991	0.78	0.74	0.63	1.39	1.24	0.96	0.06	1.39	0.63
	1990	1.62	1.04	0.76	1.47	1.04	1.19	0.36	1.62	0.76
	1989	1.81	1.23	0.83	1.57	1.27	1.34	0.40	1.81	0.83
	1988	2.02	1.30	0.92	1.53	0.87	1.33	0.46	2.02	0.87
Topolsica 2	1991	1.09	1.11	1.64	1.36	1.21	1.28	0.26	1.64	1.09
	1990	1.13	1.34	1.57	1.55	1.31	1.38	0.18	1.57	1.13
	1989	1.74	1.22	1.87	1.84	0.99	1.53	0.28	1.87	0.99
	1988	1.40	1.80	1.82	1.04	2.16	1.64	0.19	2.16	1.04
Laze 3	1991	1.21	1.08	1.40	1.25	1.06	1.20	0.13	1.40	1.06
	1990	1.53	1.48	1.51	1.70	1.14	1.47	0.02	1.70	1.14
	1989	2.30	1.51	2.22	2.00	1.13	1.83	0.36	2.30	1.13
	1988	1.64	2.00	1.64	2.00	1.56	1.77	0.17	2.00	1.56
Veliki vrh 4	1991	1.21		1.15	1.24	0.77	1.09	0.03	1.24	0.77
	1990	1.32		1.25	1.05	0.96	1.15	0.04	1.32	0.96
	1989	1.47		1.34	1.25	1.21	1.32	0.07	1.47	1.21
	1988	1.03		1.48	1.09	1.21	1.20	0.23	1.48	1.03
Graska gora 5	1991	0.58	0.87	0.84	1.31	1.34	0.99	0.13	1.34	0.58
	1990	1.41	1.20	2.21	0.88	2.79	1.70	0.43	2.79	0.88
	1989	1.51	1.40	2.01	1.50	2.50	1.79	0.26	2.50	1.40
	1988	1.34		2.11	1.50	2.84	1.95	0.38	2.84	1.34
Zavodnje 6	1991	0.81	0.93	1.40	0.84	1.10	1.02	0.25	1.40	0.81
	1990	1.55	1.22	1.61	1.03	0.95	1.27	0.17	1.61	0.95
	1989	1.11	1.19	1.55	0.78	1.00	1.12	0.19	1.55	0.78
	1988	1.58	1.38	1.67	0.80	1.08	1.30	0.12	1.67	0.80
Brnesko sedlo 7	1991	1.30	0.80	1.58	0.81	1.26	1.15	0.32	1.58	0.80
	1990	1.29	1.34	1.41	1.42	1.25	1.34	0.05	1.42	1.25
	1989	1.44	1.03	1.64	1.33	2.08	1.50	0.25	2.08	1.03
	1988	1.47	1.97	1.70	1.50	1.61	1.65	0.20	1.97	1.47
Kramarica 8	1991	0.74	1.23	0.81	1.30	1.12	1.04	0.21	1.30	0.74
	1990	1.54	1.92	1.52	1.27	1.93	1.64	0.18	1.93	1.27
	1989	1.64	1.63	1.45	1.06	1.99	1.55	0.09	1.99	1.06
	1988	2.02	1.95	2.59	2.40	2.32	2.26	0.29	2.59	1.95
Kope 9	1991	0.58	0.70	0.78	0.67	1.01	0.75	0.08	1.01	0.58
	1990	0.98		1.22	1.30	1.35	1.21	0.12	1.35	0.98
	1989	2.20	1.34	1.78	1.59	1.46	1.67	0.35	2.20	1.34
	1988	2.62	1.88	2.13	1.79	1.97	2.08	0.31	2.62	1.79
Smrekovec 10	1991	0.64	0.51	1.07		0.60	0.56	0.24	1.07	0.00
	1990	1.25	0.95	1.10	1.06	1.07	1.08	0.12	1.25	0.95
	1989	1.27	1.17	1.61	1.38	1.69	1.42	0.19	1.69	1.17
	1988	1.59	0.93	1.64	1.40	1.17	1.34	0.32	1.64	0.93

VSEBNOST KLOROFILA a V IGLICAH SMREKE, 1991
CHLOROPHYLL a CONTENT IN SPRUCE NEEDLES, 1991

VZ. MESTO SAMPL. PLOT	LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse	1991	0.57	0.55	0.45	0.74	0.94	0.65	0.05	0.94	0.45
1	1990	1.13	0.68	0.52	1.08	0.64	0.81	0.26	1.13	0.52
	1989	1.27	0.88	0.57	1.19	0.86	0.95	0.29	1.27	0.57
	1988	1.41	0.91	0.60	1.08	0.67	0.93	0.33	1.41	0.60
Topolsica	1991	0.80	0.74	1.17	1.02	0.87	0.92	0.19	1.17	0.74
2	1990	0.58	0.65	1.10	1.13	0.93	0.88	0.23	1.13	0.58
	1989	1.19	0.64	1.34	1.37	0.64	1.03	0.30	1.37	0.64
	1988	1.00	1.30	1.32	0.86	1.99	1.29	0.15	1.99	0.86
Laze	1991	0.88	0.82	1.05	0.93	0.78	0.89	0.10	1.05	0.78
3	1990	1.11	1.10	1.05	1.26	0.87	1.08	0.03	1.26	0.87
	1989	1.63	0.97	1.22	1.71	0.86	1.28	0.27	1.71	0.86
	1988	1.16	1.54	1.20	1.45	1.13	1.30	0.17	1.54	1.13
Veliki vrh	1991	0.93		0.84	0.89	0.59	0.81	0.04	0.93	0.59
4	1990	0.97		0.91	0.77	0.72	0.84	0.03	0.97	0.72
	1989	1.06		0.97	0.92	0.87	0.96	0.05	1.06	0.87
	1988	0.78		1.03	0.78	0.87	0.86	0.12	1.03	0.78
Graska gora	1991	0.46	0.59	0.62	1.09	0.99	0.75	0.07	1.09	0.46
5	1990	1.05	0.84	1.57	0.75	2.01	1.25	0.31	2.01	0.75
	1989	1.02	1.02	1.76	1.16	1.83	1.36	0.35	1.83	1.02
	1988	0.99		1.53	1.11	2.02	1.41	0.27	2.02	0.99
Zavodnje	1991	0.59	0.58	1.01	0.62	0.81	0.72	0.20	1.01	0.58
6	1990	1.13	0.86	1.15	0.75	0.69	0.92	0.13	1.15	0.69
	1989	0.80	0.87	1.10	0.55	0.72	0.81	0.13	1.10	0.55
	1988	1.14	0.97	1.20	0.59	0.73	0.92	0.10	1.20	0.59
Brnesko sedlo	1991	0.96	0.57	1.17	0.57	0.95	0.84	0.25	1.17	0.57
7	1990	0.94	0.98	0.99	0.74	0.94	0.92	0.03	0.99	0.74
	1989	1.08	0.70	1.17	0.92	1.66	1.11	0.21	1.66	0.70
	1988	1.10	1.38	1.25	1.07	1.19	1.20	0.11	1.38	1.07
Kramarica	1991	0.54	0.85	0.61	0.95	0.86	0.76	0.13	0.95	0.54
8	1990	1.14	1.42	1.08	0.93	1.42	1.20	0.15	1.42	0.93
	1989	1.19	1.16	1.01	0.60	1.41	1.08	0.08	1.41	0.60
	1988	1.41	1.39	1.82	1.71	1.63	1.59	0.20	1.82	1.39
Kope	1991	0.62	0.49	0.56	0.48	0.76	0.58	0.06	0.76	0.48
9	1990	0.69		0.91	0.94	0.97	0.88	0.11	0.97	0.69
	1989	1.57	0.93	1.28	1.15	1.03	1.19	0.26	1.57	0.93
	1988	1.81	1.39	1.52	1.30	1.38	1.48	0.18	1.81	1.30
Smrekovec	1991	0.48	0.39	0.75	0.49	0.43	0.51	0.16	0.75	0.39
10	1990	0.84	0.67	0.82	0.77	0.77	0.77	0.08	0.84	0.67
	1989	0.89	0.83	1.15	0.97	1.17	1.00	0.14	1.17	0.83
	1988	1.16	0.75	1.17	1.01	0.85	0.99	0.20	1.17	0.75

VSEBNOST KLOROFILA b V IGLICAH SMREKE, 1991
CHLOROPHYLL b CONTENT IN SPRUCE NEEDLES, 1991

VZ. MESTC SAMPL. PLOT	LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse 1	1991	0.21	0.20	0.18	0.65	0.30	0.31	0.01	0.65	0.18
	1990	0.49	0.37	0.24	0.39	0.40	0.38	0.10	0.49	0.24
	1989	0.53	0.35	0.27	0.37	0.41	0.39	0.11	0.53	0.27
	1988	0.61	0.38	0.32	0.45	0.20	0.39	0.12	0.61	0.20
Topolsica 2	1991	0.29	0.37	0.47	0.34	0.34	0.36	0.08	0.47	0.29
	1990	0.55	0.68	0.46	0.42	0.39	0.50	0.09	0.68	0.39
	1989	0.55	0.58	0.54	0.47	0.36	0.50	0.02	0.58	0.36
	1988	0.40	0.50	0.50	0.18	0.17	0.35	0.05	0.50	0.17
Laze 3	1991	0.34	0.26	0.35	0.32	0.28	0.31	0.04	0.35	0.26
	1990	0.42	0.38	0.36	0.44	0.27	0.37	0.02	0.44	0.27
	1989	0.67	0.54	0.29	0.69	0.27	0.49	0.16	0.69	0.27
	1988	0.49	0.46	0.44	0.56	0.43	0.47	0.02	0.56	0.43
Veliki vrh 4	1991	0.29		0.30	0.34	0.18	0.22	0.14	0.34	0.00
	1990	0.36		0.34	0.27	0.24	0.24	0.16	0.36	0.00
	1989	0.40		0.37	0.33	0.34	0.29	0.18	0.40	0.00
	1988	0.25		0.45	0.32	0.34	0.27	0.18	0.45	0.00
Graska gora 5	1991	0.12	0.28	0.22	0.22	0.35	0.24	0.07	0.35	0.12
	1990	0.36	0.37	0.64	0.13	0.78	0.45	0.13	0.78	0.13
	1989	0.49	0.38	0.25	0.34	0.68	0.43	0.10	0.68	0.25
	1988	0.35		0.58	0.39	0.83	0.54	0.11	0.83	0.35
Zavodnje 6	1991	0.22	0.21	0.39	0.22	0.29	0.27	0.08	0.39	0.21
	1990	0.42	0.36	0.46	0.28	0.26	0.36	0.04	0.46	0.26
	1989	0.31	0.32	0.45	0.22	0.28	0.32	0.06	0.45	0.22
	1988	0.45	0.41	0.47	0.21	0.35	0.38	0.02	0.47	0.21
Brnesko sedlo 7	1991	0.34	0.23	0.41	0.24	0.31	0.31	0.07	0.41	0.23
	1990	0.35	0.36	0.42	0.68	0.31	0.43	0.03	0.68	0.31
	1989	0.36	0.33	0.46	0.41	0.42	0.40	0.06	0.46	0.33
	1988	0.37	0.59	0.45	0.43	0.42	0.45	0.09	0.59	0.37
Kramarica 8	1991	0.21	0.38	0.20	0.34	0.27	0.28	0.08	0.38	0.20
	1990	0.40	0.50	0.44	0.34	0.51	0.44	0.04	0.51	0.34
	1989	0.45	0.47	0.44	0.46	0.58	0.48	0.01	0.58	0.44
	1988	0.61	0.57	0.77	0.69	0.69	0.67	0.09	0.77	0.57
Kope 9	1991	0.23	0.21	0.22	0.19	0.25	0.22	0.01	0.25	0.19
	1990	0.25		0.32	0.36	0.37	0.33	0.04	0.37	0.25
	1989	0.62	0.41	0.51	0.44	0.43	0.48	0.09	0.62	0.41
	1988	0.81	0.49	0.61	0.50	0.59	0.60	0.13	0.81	0.49
Smrekovec 10	1991	0.64	0.13	0.32	0.16	0.17	0.28	0.21	0.64	0.13
	1990	0.40	0.28	0.28	0.30	0.30	0.31	0.06	0.40	0.28
	1989	0.38	0.34	0.46	0.41	0.52	0.42	0.05	0.52	0.34
	1988	0.42	0.18	0.47	0.39	0.32	0.36	0.13	0.47	0.18

RAZMERJE KLOROFILA a/b V IGLICAH SMREKE, 1991
RATIO OF CHLOROPHYLL a/b IN SPRUCE NEEDLES, 1991

VZ. MESTO SAMPL. PLOT	LETNIK YEAR	SMREKA 1	2	TREE 3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse	1991	2.713	2.801	2.600	1.130	3.084	2.466	0.082	3.084	1.130
1	1990	2.313	1.864	2.211	2.792	1.584	2.153	0.192	2.792	1.584
	1989	2.396	2.544	2.136	3.195	2.068	2.468	0.169	3.195	2.068
	1988	2.303	2.373	1.857	2.379	3.427	2.468	0.229	3.427	1.857
Topolsica	1991	2.808	2.002	2.479	3.008	2.578	2.575	0.331	3.008	2.002
2	1990	1.062	0.958	2.378	2.668	2.398	1.893	0.646	2.668	0.958
	1989	2.176	1.101	2.493	2.921	1.777	2.094	0.596	2.921	1.101
	1988	2.469	2.590	2.645	4.798	******	4.862	0.074	******	2.469
Laze	1991	2.603	3.142	2.996	2.923	2.762	2.885	0.228	3.142	2.603
3	1990	2.675	2.907	2.947	2.893	3.242	2.933	0.120	3.242	2.675
	1989	2.435	1.806	4.190	2.495	3.247	2.835	1.009	4.190	1.806
	1988	2.386	3.318	2.731	2.608	2.634	2.735	0.385	3.318	2.386
Veliki vrh	1991	3.246	2.781	2.596	3.234	3.871	3.146	0.273	3.871	2.596
4	1990	2.730	2.701	2.824	2.942	2.906	2.821	0.052	2.942	2.701
	1989	2.630	2.635	2.771	2.587	2.090	2.543	0.065	2.771	2.090
	1988	3.183	2.293	2.465	2.546	2.815	2.660	0.385	3.183	2.293
Graska gora	1991	3.871	2.112	2.798	4.896	2.852	3.306	0.724	4.896	2.112
5	1990	2.906	2.286	2.474	5.802	2.596	3.213	0.260	5.802	2.286
	1989	2.090	2.656	6.981	3.368	2.699	3.559	2.184	6.981	2.090
	1988	2.815		2.646	2.858	2.436	2.689	0.085	2.858	2.436
Zavodnje	1991	2.715	2.746	2.608	2.876	2.782	2.745	0.059	2.876	2.608
6	1990	2.692	2.384	2.479	2.739	2.654	2.590	0.129	2.739	2.384
	1989	2.620	2.727	2.437	2.481	2.559	2.565	0.120	2.727	2.437
	1988	2.559	2.360	2.550	2.810	2.087	2.473	0.092	2.810	2.087
Brnesko sedlo	1991	2.855	2.444	2.839	2.408	3.011	2.711	0.190	3.011	2.408
7	1990	2.655	2.699	2.362	1.084	3.056	2.371	0.150	3.056	1.084
	1989	2.990	2.121	2.546	2.247	3.928	2.766	0.355	3.928	2.121
	1988	2.975	2.330	2.760	2.506	2.819	2.682	0.270	2.975	2.330
Kramarica	1991	2.620	2.224	2.993	2.783	3.225	2.769	0.314	3.225	2.224
8	1990	2.870	2.848	2.435	2.776	2.775	2.741	0.200	2.870	2.435
	1989	2.623	2.467	2.333	1.310	2.458	2.238	0.119	2.623	1.310
	1988	2.300	2.444	2.349	2.481	2.372	2.389	0.060	2.481	2.300
Kope	1991	2.688	2.304	2.537	2.499	2.987	2.603	0.158	2.987	2.304
9	1990	2.770		2.841	2.621	2.600	2.708	0.036	2.841	2.600
	1989	2.521	2.282	2.528	2.632	2.404	2.473	0.114	2.632	2.282
	1988	2.244	2.861	2.516	2.623	2.332	2.515	0.252	2.861	2.244
Smrekovec	1991	2.923	3.075	2.381	2.995	2.527	2.780	0.298	3.075	2.381
10	1990	2.101	2.362	2.989	2.586	2.617	2.531	0.373	2.989	2.101
	1989	2.358	2.412	2.517	2.362	2.246	2.379	0.066	2.517	2.246
	1988	2.766	4.239	2.509	2.594	2.623	2.946	0.762	4.239	2.509

VSEBNOST KAROTENOIDOV V IGLICAH SMREKE, 1991

TOTAL CAROTENOID CONTENT IN SPRUCE NEEDLES, 1991

VZ. MESTO SAMPL. PLOT	LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse	1991	0.256	0.165	0.161	0.153	0.299	0.207	0.044	0.299	0.153
1	1990	0.367	0.183	0.182	0.357	0.243	0.266	0.087	0.367	0.182
	1989	0.398	0.246	0.207	0.357	0.331	0.308	0.082	0.398	0.207
	1988	0.442	0.236	0.185	0.346	0.300	0.302	0.111	0.442	0.185
Topolsica	1991	0.185	0.201	0.343	0.310	0.272	0.262	0.071	0.343	0.185
2	1990	0.237	0.274	0.313	0.294	0.267	0.277	0.031	0.313	0.237
	1989	0.309	0.287	0.396	0.423	0.208	0.325	0.047	0.423	0.208
	1988	0.273	0.396	0.407	0.276	0.505	0.371	0.061	0.505	0.273
Laze	1991	0.296	0.258	0.291	0.318	0.251	0.283	0.017	0.318	0.251
3	1990	0.370	0.372	0.363	0.357	0.264	0.345	0.004	0.372	0.264
	1989	0.495	0.399	0.307	0.490	0.269	0.392	0.077	0.495	0.269
	1988	0.373	0.397	0.361	0.446	0.334	0.382	0.015	0.446	0.334
Veliki vrh	1991	0.285		0.251	0.289	0.215	0.208	0.127	0.289	0.000
4	1990	0.313		0.307	0.228	0.231	0.216	0.146	0.313	0.000
	1989	0.316		0.340	0.299	0.269	0.245	0.155	0.340	0.000
	1988	0.261		0.344	0.243	0.266	0.223	0.147	0.344	0.000
Graska gora	1991	0.142	0.220	0.197	0.270	0.298	0.225	0.033	0.298	0.142
5	1990	0.318	0.284	0.465	0.238	0.572	0.375	0.079	0.572	0.238
	1989	0.310	0.326	0.427	0.390	0.518	0.394	0.052	0.518	0.310
	1988	0.299		0.523	0.342	0.553	0.429	0.112	0.553	0.299
Zavodnje	1991	0.199	0.204	0.325	0.203	0.266	0.239	0.058	0.325	0.199
6	1990	0.327	0.272	0.351	0.269	0.218	0.287	0.033	0.351	0.218
	1989	0.258	0.269	0.343	0.203	0.225	0.260	0.038	0.343	0.203
	1988	0.344	0.269	0.348	0.209	0.211	0.276	0.036	0.348	0.209
Brnesko sedlo	1991	0.262	0.214	0.317	0.205	0.306	0.261	0.042	0.317	0.205
7	1990	0.336	0.287	0.318	0.152	0.325	0.284	0.020	0.336	0.152
	1989	0.339	0.251	0.370	0.291	0.472	0.345	0.050	0.472	0.251
	1988	0.379	0.479	0.389	0.350	0.423	0.404	0.045	0.479	0.350
Kramarica	1991	0.185	0.226	0.212	0.285	0.260	0.234	0.017	0.285	0.185
8	1990	0.320	0.413	0.314	0.291	0.402	0.348	0.045	0.413	0.291
	1989	0.389	0.402	0.333	0.495	0.429	0.410	0.030	0.495	0.333
	1988	0.418	0.456	0.525	0.489	0.468	0.471	0.044	0.525	0.418
Kope	1991	0.228	0.156	0.199	0.166	0.272	0.204	0.030	0.272	0.156
9	1990	0.257		0.341	0.293	0.326	0.304	0.042	0.341	0.257
	1989	0.510	0.365	0.431	0.354	0.345	0.401	0.059	0.510	0.345
	1988	0.565	0.418	0.515	0.370	0.424	0.458	0.061	0.565	0.370
Smrekovec	1991	0.158	0.110	0.232	0.053	0.155	0.142	0.050	0.232	0.053
10	1990	0.281	0.258	0.267	0.239	0.251	0.259	0.009	0.281	0.239
	1989	0.313	0.304	0.353	0.324	0.334	0.326	0.021	0.353	0.304
	1988	0.387	0.255	0.384	0.347	0.306	0.336	0.062	0.387	0.255

RAZMERJE MED KLOROFILI IN KAROTENOIDI V IGLICAH SMREKE, 1991
RATIO BETWEEN TOTAL CHLOROPHYLLS AND CAROTENOIDS IN SPRUCE NEEDLES, 1991

VZ. MESTO SAMPL. PLOT	LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse	1991	3.049	4.513	3.901	9.065	4.145	4.935	0.600	9.065	3.049
1	1990	4.431	5.713	4.158	4.118	4.271	4.538	0.678	5.713	4.118
	1989	4.540	4.998	4.016	4.398	3.838	4.358	0.401	4.998	3.838
	1988	4.569	5.484	4.968	4.422	2.895	4.468	0.375	5.484	2.895
Topolsica	1991	5.877	5.540	4.788	4.394	4.436	5.007	0.455	5.877	4.394
2	1990	4.784	4.878	5.006	5.277	4.922	4.973	0.091	5.277	4.784
	1989	5.621	4.233	4.731	4.338	4.769	4.738	0.574	5.621	4.233
	1988	5.131	4.544	4.460	3.783	4.278	4.439	0.298	5.131	3.783
Laze	1991	4.101	4.183	4.830	3.926	4.223	4.253	0.326	4.830	3.926
3	1990	4.125	3.991	3.884	4.766	4.330	4.219	0.099	4.766	3.884
	1989	4.648	3.785	4.904	4.891	4.190	4.484	0.479	4.904	3.785
	1988	4.401	5.040	4.541	4.494	4.661	4.627	0.274	5.040	4.401
Veliki vrh	1991	4.255		4.554	4.277	3.582	3.334	2.080	4.554	0.000
4	1990	4.230		4.067	4.589	4.150	3.407	1.957	4.589	0.000
	1989	4.638		3.930	4.178	4.501	3.449	2.040	4.638	0.000
	1988	3.928		4.295	4.487	4.536	3.449	1.944	4.536	0.000
Graska gora	1991	4.099	3.964	4.283	4.871	4.486	4.341	0.131	4.871	3.964
5	1990	4.442	4.235	4.750	3.712	4.870	4.402	0.212	4.870	3.712
	1989	4.876	4.309	4.701	3.857	4.828	4.514	0.237	4.876	3.857
	1988	4.491		4.021	4.385	5.145	4.511	0.235	5.145	4.021
Zavodnje	1991	4.071	3.890	4.313	4.150	4.131	4.111	0.173	4.313	3.890
6	1990	4.744	4.500	4.595	3.822	4.331	4.398	0.100	4.744	3.822
	1989	4.314	4.413	4.511	3.825	4.434	4.299	0.080	4.511	3.825
	1988	4.604	5.133	4.796	3.829	5.106	4.694	0.219	5.133	3.829
Brnesko sedlo	1991	4.973	3.732	4.974	3.965	4.122	4.353	0.585	4.974	3.732
7	1990	3.827	4.679	4.441	9.311	3.836	5.219	0.359	9.311	3.827
	1989	4.241	4.090	4.419	4.574	4.403	4.345	0.134	4.574	4.090
	1988	3.892	4.122	4.356	4.277	3.808	4.091	0.189	4.356	3.808
Kramarica	1991	4.001	5.432	3.837	4.540	4.326	4.427	0.716	5.432	3.837
8	1990	4.809	4.654	4.846	4.357	4.803	4.694	0.063	4.846	4.357
	1989	4.219	4.051	4.353	2.145	4.633	3.880	0.124	4.633	2.145
	1988	4.837	4.277	4.932	4.917	4.953	4.783	0.289	4.953	4.277
Kope	1991	3.738	4.478	3.938	4.073	3.722	3.990	0.313	4.478	3.722
9	1990	3.651		3.594	4.440	4.131	3.954	0.028	4.440	3.594
	1989	4.314	3.668	4.136	4.481	4.218	4.163	0.272	4.481	3.668
	1988	4.643	4.503	4.134	4.850	4.652	4.556	0.215	4.850	4.134
Smrekovec	1991	4.061	4.626	4.600	******	3.843	5.887	0.260	******	3.843
10	1990	4.439	3.696	4.105	4.443	4.248	4.186	0.304	4.443	3.696
	1989	4.050	3.831	4.552	4.260	5.048	4.348	0.302	5.048	3.831
	1988	4.100	3.646	4.267	4.043	3.809	3.973	0.262	4.267	3.646

AKTIVNOST PEROKSIDAZE V IGLICAH SMREKE, 1991
PEROXIDASE ACTIVITY IN SPRUCE NEEDLES, 1991

VZ. MESTO SAMPL. PLOT	LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse	1991	8.03	3.00	2.33	3.50	2.17	3.81	2.54	8.03	2.17
1	1990	16.92	8.83	4.25	3.83	10.67	8.90	5.24	16.92	3.83
	1989	22.88	8.75	9.58	11.33	23.42	15.19	6.47	23.42	8.75
	1988	22.33	10.92	6.00	11.75	30.80	16.36	6.84	30.80	6.00
Topolsica	1991	1.42	10.75	5.98	36.17	2.92	11.45	3.81	36.17	1.42
2	1990	1.42	9.17	58.67	88.75	15.17	34.64	25.36	88.75	1.42
	1989	10.08	7.75	54.50	66.66	15.08	30.81	21.51	66.66	7.75
	1988	8.50	8.75	72.92	31.83	9.00	26.20	30.31	72.92	8.50
Laze	1991	7.57	6.25	7.94	20.33	15.01	11.42	0.73	20.33	6.25
3	1990	18.08	21.75	14.67	18.00	17.58	18.02	2.89	21.75	14.67
	1989	33.25	11.00	18.67	17.25	26.08	21.25	9.23	33.25	11.00
	1988	22.82	4.50	14.92	18.08	18.50	15.76	7.50	22.82	4.50
Veliki vrh	1991	9.00		19.16	1.25	12.00	10.35	5.08	19.16	1.25
4	1990	17.58		31.92	11.66	39.00	25.04	7.17	39.00	11.66
	1989	26.08		21.85	10.83	38.17	24.23	2.11	38.17	10.83
	1988	2.08		28.83	8.33	28.33	16.89	13.38	28.83	2.08
Graska gora	1991	14.34	5.33	16.17	14.67	14.25	12.95	4.74	16.17	5.33
5	1990	21.92	9.25	29.64	77.33	15.25	30.68	8.41	77.33	9.25
	1989	29.83	8.25	49.25	67.67	9.58	32.92	16.75	67.67	8.25
	1988	15.08		27.42	44.58	16.00	25.77	6.17	44.58	15.08
Zavodnje	1991	12.50	4.33	12.08	12.92	9.50	10.27	3.76	12.92	4.33
6	1990	19.17	17.17	8.20	21.67	19.61	17.16	4.77	21.67	8.20
	1989	12.75	26.42	9.92	27.83	15.67	18.52	7.20	27.83	9.92
	1988	7.42	12.25	17.25	23.00	13.50	14.68	4.01	23.00	7.42
Brnesko sedlo	1991	14.50	13.83	12.17	7.67	18.83	13.40	0.98	18.83	7.67
7	1990	27.08	6.25	9.17	17.33	39.42	19.85	9.21	39.42	6.25
	1989	12.25	7.00	12.08	4.33	27.25	12.58	2.44	27.25	4.33
	1988	17.08	17.67	9.50	25.58	27.92	19.55	3.72	27.92	9.50
Kramarica	1991	16.50	5.58	20.66	25.42	10.50	15.73	6.36	25.42	5.58
8	1990	9.66	27.25	34.58	37.50	23.58	26.51	10.46	37.50	9.66
	1989	7.17	48.50	23.75	56.50	29.17	33.02	16.98	56.50	7.17
	1988	15.92	40.17	23.25	33.58	19.42	26.47	10.15	40.17	15.92
Kope	1991	47.42	22.17	44.42	14.25	17.75	29.20	11.26	47.42	14.25
9	1990	59.00		40.83	17.75	29.92	36.88	9.09	59.00	17.75
	1989	66.00	59.00	76.66	13.42	32.67	49.55	7.26	76.66	13.42
	1988	38.67	29.92	73.08	1.67	13.67	31.40	18.63	73.08	1.67
Smrekovec	1991	4.51	2.50	8.92	16.17	34.17	13.25	2.68	34.17	2.50
10	1990	7.08	20.46	10.33	47.92	20.50	21.26	5.70	47.92	7.08
	1989	9.92	10.83	11.16	47.92	25.92	21.15	0.52	47.92	9.92
	1988	10.08	17.92	14.00	3.17	28.17	14.67	3.20	28.17	3.17

VSEBNOST VODOTOPNIH TIOLOV V IGLICAH SMREKE, 1992 (mikromolov/g liofil. iglic).
WATERSOLUBLE THIOLS CONTENT IN NEEDLES, 1992 (micromol/g liofil. needles).

VZ. MESTO SAMPL. PLOT		LETNIK YEAR	SMREKA TREE 1	2	3	4	5	AVG	ST. DEV.	MAX.	MIN.
Lajse		1992	0.08	0.09	0.30	0.21	0.10	0.16	0.10	0.30	0.08
	1	1991	0.33	0.21	0.25	0.21	0.16	0.23	0.05	0.33	0.16
Topolsica		1992	0.26	0.39	0.25	0.21	0.35	0.29	0.06	0.39	0.21
	2	1991	0.26	0.28	0.32	0.18	0.37	0.28	0.02	0.37	0.18
Laze		1992	0.24	0.30	0.35	0.20	0.18	0.25	0.04	0.35	0.18
	3	1991	0.18	0.25	0.25	0.27	0.31	0.25	0.03	0.31	0.18
Veliki vrh		1992	0.21	0.23	0.17	0.34	0.23	0.24	0.03	0.34	0.17
	4	1991	0.33	0.34	0.21	0.13	0.16	0.23	0.06	0.34	0.13
Graska gora		1992	0.36	0.24	0.84	0.22	0.07	0.35	0.26	0.84	0.07
	5	1991	0.38	0.29	0.11	0.25	0.01	0.21	0.11	0.38	0.01
Zavodnje		1992	0.24	0.26	0.16	0.17	0.22	0.21	0.05	0.26	0.16
	6	1991	0.28	0.38	0.23	0.17	0.38	0.29	0.06	0.38	0.17
Brnesko sedlo		1992	0.45	0.46	0.58	0.52	0.60	0.52	0.06	0.60	0.45
	7	1991	0.40	0.34	0.38	0.45	0.48	0.41	0.03	0.48	0.34
Kramarica		1992	0.34	0.16	0.36	0.32	0.31	0.30	0.09	0.36	0.16
	8	1991	0.23	0.56	0.68	0.18	0.06	0.34	0.19	0.68	0.06
Kope		1992	0.1	0.2	0.1	0.4	0.5	0.25	0.07	0.48	0.07
	9	1991	0.21	0.20	0.23	0.25	0.32	0.24	0.01	0.32	0.20
Smrekovec		1992	0.18	0.47	0.07	0.10	0.24	0.21	0.17	0.47	0.07
	10	1991	0.45	0.14	0.26	0.09	0.15	0.22	0.13	0.45	0.09

III. Lists of lichens:

Table 1: List of lichens, found on pairs of spruce trees felled in the profile SMREKOVC-VINSKA GORA in 1990.

Table 2: Preliminari list of lichens, found on some chosen plots from Slovenian 16 x 16 km bioindication grid; diploma work of Barbara KRUHAR.

Table 1: List of epiphytic lichens species found on pairs of Norway spruce trees felled in a profile Smrekovc-Vinska gora at needle sampling in October 1990.

Site in profile	Lichen species	Occurence (+) on: a/trunks	b/ in crown	damage of thalli
1	Bryoria subcana		+	
	Cetraria pinastri	+	+	
	Cladonia coniocraea	+		
	Hypogymnia farinacea		+	
	H. physodes	+	+	
	H. tubolosa		+	
	Lecanora pulicaris	+	+	
	L. subintricata	+	+	
	Parmeliopsis ambigua	+	+	
	P. hyperopta	+		
	Pseudevernia furfuracea	+	+	
	Scoliciosporum chlorococcum	+	+	
	Usnea subfloridana	+		
2	Bryoria subcana	+	+	
	Cetraria islandica	+		
	C. pinastri	+		
	Hypogymnia farinacea		+	
	H. physodes	+	+	
	H. tubolosa		+	
	Lecanora pulicaris		+	
	Parmeliopsis ambigua	+		
	P. hyperopta	+		
	Platismatia glauca		+	
	Pseudevernia furfuracea		+	*
	Scoliciosporum chlcrococcum	+	+	
3	Bryoria subcana	+	+	
	Cetraria chlorophylla	+		
	C. pinastri	+		
	Chaenotheca sp.	+		
	Cladonia digitata	+		
	Cl. macilenta	+		
	Hypogymnia farinacea		+	
	H. physodes	+	+	
	H. tubolosa		+	
	Lecanora pulicaris		+	
	L. subintricata		+	
	Parmeliopsis ambigua	+		
	P. hyperopta	+		
	Platismatia glauca	+		
	Pseudevernia furfuracea		+	
	Scoliciosporum chlorococcum	+	+	
	Usnea barbata s. str.		+	**

	Usnea subfloridana	+		+		
4	Bryoria subcana	+		+		
	Cetraria chlorophylla	+		+		
	C. pinastri	+		+		
	Evernia prunastri	+				
	Hypogymnia farinacea			+		
	H. physodes	+		+		
	H. tubulosa			+		
	Lecanora subfusca s. l.			+		
	Ochrolechia turneri	+				
	Parmeliopsis ambigua	+		+		
	P. hyperopta			+		
	Platismatia glauca			+		**
	Pseudevernia furfuracea			+	*	
	Scoliciosporum chlorococcum			+		
	Usnea barbata s. str.			+	**	
5	Bryoria subcana	+		+		
	Cetraria chlorophylla	+		+		
	C. pinastri	+				
	Hypogymnia farinacea			+		
	H. physodes	+		+		
	H. tubulosa			+		
	Lecanora pulicaris			+		
	Lepraria sp.	+				
	Parmelia saxatilis			+		
	Parmeliopsis ambigua	+				
	P. hyperopta	+				
	Platismatia glauca	+		+		
	Pseudevernia furfuracea	+		+		
	Scoliciosporum chlorococcum			+		
	Usnea barbata s. str.					
6	Bryoria subcana	+		+		
	Cetraria chlorophylla	+		+	*	
	C. pinastri	+				
	Hypogymnia farinacea			+		
	H. physodes	+		+		
	Parmeliopsis ambigua	+				
	P. hyperopta	+				
	Pseudevernia furfuracea	+		+	**	
	Scoliciosporum chlorococcum			+		
	Usnea sp.	+	**			
	U. filipendula s. l.			+	*	
	U. subfloridana			+		
7	Bryoria subcana	+				
	Cetraria chlorophylla	+				
	C. pinastri	+				
	Cladonia digitata	+				

	Hypogymnia farinacea			+	
	H. physodes	+		+	
	Lecanora pulicaris			+	
	Parmeliopsis ambigua	+			
	Platismatia glauca			+	
	Pseudevernia furfuracea	+		+	**
	Scoliciosporum chlorococcum	+		+	
	Usnea barbata s. str.			+	**
8	Hypogymnia physodes	+		+	
	Pseudevernia furfuracea			+	**
	Scoliciosporum chlorococcum	+		+	
	Bryoria subcana			+	
9	Hypogymnia physodes	+		+	*
	Parmeliopsis hyperopta	+			
	Pseudevernia furfuracea			+	*
	Scoliciosporum chlorococcum	+			
	Usnea barbata s. ampl.			+	**
	U. florida			+	****
10	Hypogymnia physodes	+		+	
	Platismatia glauca			+	**
	Pleurococcus sp.	+			
	Pseudevernia furfuracea			+	**
	Scoliciosporum chlorococcum	+		+	
11	Hypogymnia physodes			+	
	Pseudevernia furfuracea			+	**
12	Scoliciosporum chlorococcum	+			
13	Scoliciosporum chlorococcum	+			
14	Hypogymnia farinacea			+	*
	H. physodes			+	*
	Pseudevernia furfuracea			+	***
	Pleurococcus sp.			+	
	Scoliciosporum chlorococcum	+		+	
	Usnea subfloridana			+	**
	Cetraria pinastri	+			
15	Hypogymnia farinacea			+	*
	H. physodes	+	*	+	**
	Parmeliopsis ambigua	+			
	Pseudevernia furfuracea			+	***
	Scoliciosporum chlorococcum	+		+	
16	Scoliciosporum chlorococcum			+	
17	Scoliciosporum chlorococccum	+		+	
18	Cladonia digitata	+			

	Hypogymnia physodes			+	*
	Lecanora pulicaris			+	
	Lepraria sp.	+			
	Pseudevernia furfuracea			+	****
	Scoliciosporum chlorococcum	+		+	
19	Hypogymnia physodes	+			
	Parmeliopsis ambigua			+	**
	Scoliciosporum chlorococcum	+		+	
21	Cetraria pinastri	+	***		
	Hypogymnia physodes	+	****		
	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+			
22	Hypogymnia physodes			+	**
	Pseudevernia furfuracea			+	***
	Scoliciosporum chlorococcum			+	
23	Cetraria pinastri	+			
	Cladonia chlorophaea	+			
	Cl. coniocraea	+			
	Dimerella pineti	+			
	Lepraria sp.	+			
	Parmeliopsis ambigua	+			
	P. hyperopta	+			
	Scoliciosporum chlorococcum	+			
25	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
26	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
27	Parmelia saxatilis	+			
	Scoliciosporum chlorococcum	+		+	
28	Scoliciosporum chlorococcum	+		+	
29	Parmeliopsis hyperopta			+	
	Scoliciosporum chlorococcum	+		+	
30	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
31	Scoliciosporum chlorococcum	+		+	
32	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+		+	
33	Lecanora conizaeoides	+			
	Parmeliopsis ambigua	+	***		
	Pleurococcus sp.	+		+	

	Scoliciosporum chlorococcum			+	
34	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
35	Lecanora conizaeoides	+			
	Parmeliopsis ambigua	+	***		
	Scoliciosporum chlorococcum	+		+	
36	Scoliciosporum chlorococcum	+		+	
37	Lecanora conizaeoides	+			
	Lepraria sp.	+			
	Scoliciosporum chlorococcum	+		+	
38	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
39	Scoliciosporum chlorococcum	+		+	
40	Chaenotheca ferruginea			+	
	Hypogymnia physodes	+	****		
	Lecanora conizaeoides	+			
	Parmeliopsis hyperopta	+	***		
	Scoliciosporum chlorococcum	+		+	
41	Scoliciosporum chlorococcum	+		+	
42	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
43	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
44	Hypogymnia physodes			+	****
	Lecanora conizaeoides	+		+	
	Scoliciosporum chlorococcum	+		+	
45	Chaenotheca ferruginea	+			
	Lecanora conizaeoides			+	
	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+		+	
46	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
47	Hypogymnia physodes			+	***
	Lecanora conizaeoides	+		+	
	Parmelia saxatilis	+	****		
	Scoliciosporum chlorococcum			+	
48	Pleurococcccus sp.	+		+	
	Scoliciosporum chlorococcum	+		+	

49	Scoliciosporum chlorococcum	+		+	
50	Lepraria sp.			+	
	Scoliciosporum chlorococcum	+		+	
51	**Lecanora conizaeoides**	+		+	
	Scoliciosporum chlorococcum	+		+	
52	Hypogymnia physodes			+	***
	Scoliciosporum chlorococcum	+		+	
53	Hypogymnia physodes			+	***
	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
54	Scoliciosporum chlorococcum	+		+	
55	Hypogymnia physodes			+	***
	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+		+	
56	Hypogymnia physodes			+	
	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+		+	
57	Cetraria pinastri	+	***		
	Lepraria sp.	+			
	Scoliciosporum chlorococcum	+		+	
58	Cladonia sp.	+			
	Scoliciosporum chlorococcum	+		+	
59	Hypogymnia physodes			+	*
	Lepraria incana	+			
	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+		+	
60	Hypogymnia physodes			+	***
	Pleurococcus sp.	+			
	Scoliciosporum chlorococcum	+		+	
61	Hypogymnia physodes			+	***
	Scoliciosporum chlorococcum			+	
62	Hypogymnia physodes			+	***
	Lepraria incana	+			
	Parmeliopsis ambigua	+			
	P. hyperopta	+			
	Pleurococcus sp.			+	
	Scoliciosporum chlorococcum			+	
Top.	Dimerella pineti	+			

	Pleurococcus sp.			+	
	Scoliciosporum chlorococcum			+	
Sir.	Cetraria pinastri	+	***		
	Hypogymnia physodes	+	***		
	Hypocenomyce scalaris	+	***		
	Parmeliopsis ambigua	+	***		
	P. hyperopta	+	***		
	Scoliciosporum chlorococcum			+	
P.v.	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	
G.g.	Scoliciosporum chlorococcum	+		+	
Pir.	Cladonia coniocraea	+			
	Dimerella pineti	+			
	Hypogymnia physodes	+	**	+	***
	Scoliciosporum chlorococcum	+		+	
V.v.	Lecanora conizaeoides	+			
	Scoliciosporum chlorococcum	+		+	

+ - presence of species; * - undamaged thallus; ** - slightly damaged thallus (bleaching on the lobe tips and thallus ridges); *** - moderatly damaged thallus (appart from bleaching also reddish coluor appear and few necrotic and regeneration lobes); **** - very damaged thallus (strong necrosis and numerous regeneration lobes, staunted appearance of thallus); ***** - appearently dead thalli.

Table 2: List of epiphytic lichens on some chosen plots of 16x16 km bioindication grid of Slovenia. 1. Snežnik - Mašun (Dinaric Carst), 2. Jezersko (Karawanken), 3. Smrečno na Pohorju (Pohorje), 4. Remšnik, Sv. Duh (Kobansko - Slovenian- Austrian border)

Locality:
1.Mašun, 13.10.1992; 1021 m n.v., x 5451000 y 5054000

Tree species:
smrekov les /wood of Norway spruce/

Bacidia sp.
Bryoria fuscescens
Chaenothecopsis pusilla
Evernia prunastri
Hypogymnia physodes
Hypogymnia tubulosa
Lecanora sp.
Lecanora subrugosa
Parmelia exasperatula
Parmelia glabratula
Parmelia laciniatula
Parmelia sulcata
Phaeophyscia orbicularis
Physcia adscendens
Pseudevernia furfuracea
Ramalina farinacea
Scoliciosporum chlorococum
Usnea hirta
Xanthoria parietina

Tree species:
Picea abies

Arthonia sp.
Bryoria fuscescens
Chaenotheca ferruginea
Cladonia caespiticia
Evernia prunastri
Hypogymnia physodes
Hypogymnia tubulosa
Lecidella sp.
Lepraria incana
Ochrolechia turneri
Parmelia glabratula
Parmelia saxatilis
Parmelia sulcata
Parmeliopsis ambigua
Pertusaria amara

Phlyctis argena
Platismatia glauca
Pseudevernia furfuracea
Ramalina farinacea
Scoliciosporum chlorococum
Usnea filipendula
Usnea subfloridana

Tree species:
Abies alba

Bacidia sp.
Bryoria fuscescens
Buellia punctata
Caloplaca herbidella
Candelariella reflexa
Candelariella xanthostigma
Cetraria chlorophylla
Cladonia coniocraea
Cladonia fimbriata
Evernia prunastri
Hypogymnia farinacea
Hypogymnia physodes
Hypogymnia tubulosa
Lecanora leptyrodes
Lecanora subfuscata
Lecidella euphorea
Lepraria incana
Menegazzia terebrata
Ochrolechia turneri
Parmelia glabratula
Parmelia laciniatula
Parmelia pastillifera
Parmelia saxatilis
Parmelia sulcata
Parmelia tiliacea
Pertusaria albescens
Pertusaria coccodes
Pertusaria coronata
Pertusaria hemisphaerica
Pertusaria pertusa
Phlyctis argena
Platismatia glauca
Pseudevernia furfuracea
Ramalina farinacea
Rinodina colobina
Scoliciosporum chlorococcum
Usnea filipendula
Usnea florida
Usnea hirta

Tree species:
Fagus

Anaptychia ciliaris
Bacidia sp.
Buellia griseovirens
Caloplaca cerinea
Caloplaca herbidella
Candelariela xanthostigma
Candelariella reflexa
Evernia prunastri
Fuscidia cyathoides
Graphis scripta
Hypogymnia physodes
Hypogymnia tubulosa
Lecanora chlarotera
Lecanora circumborealis ?
Lecanora intumescens
Lecanora subfuscata
Lecidella euphorea
Ochrolechia arborea
Parmelia contorta
Parmelia exasperata
Parmelia exasperatula
Parmelia glabratula
Parmelia laciniatula
Parmelia pastillifera
Parmelia sulcata
Pertusaria albescens
Pertusaria pertusa
Phlyctis argena
Physcia adscendens
Physcia orbicularis
Physciopsis adglutinata
Physconia perisidiosa
Platismatia glauca
Pseudevernia furfuracea
Scoliciosporum chlorococcum
Usnea florida
Xanthoria parietina

Tree species:
Ulmus glabra

Arthonia radiata
Candelariella reflexa
Candelariella xanthostigma
Cladonia pyxidata
Lecanora carpinea
Lecanora chloropolia
Lecanora intumescens
Lecanora subrugosa
Lecidella elaeochroma
Lecidella euphorea
Lepraria incana

Parmelia glabratula
Parmelia sulcata
Parmelia tiliacea
Phlyctis argena
Physcia adscendens
Physconia distorta

Tree species:
Acer pseudoplatanus

Arthonia radiata
Buellia griseovirens
Caloplaca herbidella
Cladonia caespiticia
Evernia prunastri
Graphis scripta
Hypogymnia physodes
Lecanora carpinea
Lecanora chlarotera
Lecanora subrugosa
Lecidella euphorea
Lepraria incana
Lobaria pulmonaria
Parmelia contorta
Parmelia glabratula
Parmelia pastillifera
Parmelia sulcata
Parmelia tiliacea
Pertusaria pertusa
Pertusaria albescens
Pertusaria amara
Phlyctis argena
Physcia endophoenicea
Physcia orbicularis
Porina sp.
Pseudevernia furfuracea
Ramalina farinacea
Ramalina fastigiata
Ramalina pollinaria
Scoliciosporum chlorococcum

Tree species:
Tilia sp.

Acrocordia gemmata
Anaptychia ciliaris
Caloplaca cerina
Candelariella reflexa
Candelariella xanthostigma
Collema auriculatum

Collema flaccidium
Evernia prunastri
Lecanora cadubriae
Lecanora carpinea
Lecanora chlarotera
Lecidela euphorea
Lecidella elaeochromma
Lepraria incana
Lobaria pulmonaria
Parmelia acetabulum
Parmelia exasperatula
Parmelia glabratula
Parmelia pastillifera
Parmelia sulcata
Parmelia tiliacea
Peltigera collina
Pertusaria albescens
Phlyctis argena
Physcia tenella
Physconia perisidiosa
Ramalina farinacea
Ramalina fastigiata
Ramalina fraxinea
Rinodina sp.
Usnea florida
Xanthoria parietina

Tree species:
Tilia platyphyllos, 15.9.1987

Candelariella reflexa
Cladonia sp.
Evernia prunastri
Hypogymnia farinacea
Hypogymnia physodes
Lecanora carpinea
Lecanora chlarotera
Lecanora intumescens
Lecanora leptyrodes
Lecanora subrugosa
Lecidella euphorea
Ochrolechia szatalaensis
Parmelia contorta
Parmelia exasprerata
Parmelia pastillifera
Parmelia saxatilis
Parmelia tiliacea
Peltigera collina
Pertusaria leprarioides
Phlyctis argena
Pseudevernia furfuracea
Ramalina farinacea

Ramalina fastigiata
Ramalina fraxinea
Ramalina roesleri
Scoliciosporum chlorococcum
Usnea filipendula
Usnea florida

Locality:
2. Jezersko, Zg. Jezersko, Močnik, BIO 16 X 16, 19.10.1990,
1300 m n.v., x 5458800, y 5131000
Štori

Cladonia coniocraea
Cladonia digitata
Cladonia polydactyla
Icmadophila ericetorum
Parmeliopsis ambigua

Tree species:
Fraxinus excelsior

Anaptychia ciliaris
Bryoria fuscescens
Caloplaca sp.
Candelariella reflexa
Evernia divaricata
Evernia prunasrti
Hypogymnia physodes
Lecanora allophana
Lecanora carpinea
Lecanora chlarotera
Lecanora subfuscata
Lecidella elaeochroma
Lobaria pulmonaria
Parmelia acetabulum
Parmelia exasperatula
Parmelia glabra
Parmelia glabratula
Parmelia sulcata
Parmelia tiliacea
Pertusaria albescens
Pertusaria coccodes
Physcia adscendens
Physcia aipolia
Physcia orbicularis
Physconia distorta
Psevdevernia furfuracea
Ramalina fastigiata
Ramalina fraxinea
Ramalina roesleri
Scoliciosporum chlorococcum

Usnea filipendula
Usnea hirta
Usnea subfloridana
Xanthoria parietuna

Locality:
3. Pohorje, V od Kurje vasi, 500m pred odcepom za Sv. Tri Kralje
Smrečno, 11.6.1991
988m n.v., x 5536000, y 5147000

Tree species:
Acer

Acrocordia gemmata
Bacidia sp.
Bryoria fuscescens
Cetrelia olivetotum
Evernia prunastri
Graphis scripta
Hypogymnia physodes
Lecanora carpinea
Lecanora chlarotera
Lecanora chloropolia
Lecanora impudens
Lecanora nemoralis
Lecanora subrugosa
Lepraria incana
Menegazzia terebrata
Ochrolechia androgyna
Opegrapha viridis
Parmelia glabratula
Parmelia saxatilis
Parmelia sulcata
Pertusaria amara
Pertusaria coccodes
Pertusaria coronata
Pertusaria hemisphaerica
Pertusaria leucostoma
Phlyctis argena
Platismatia glauca
Pseudevernia furfuracea
Ramalina farinacea
Ramalina roesleri
Usnea subfloridana

Tree species:

Picea

Haematomma elatinum
Hypogymnia physodes
Ochrolechia arborea
Ochrolechia turneri
Parmelia saxatilis
Platismatia glauca
Pseudevernia furfurace
Scoliciosporum chlorococcum

Tree species:
Abies

Bacidia sp.
Buellia erubescens
Cetraria pinastri
Chaenotheca ferruginea
Evernia prunastri
Graphis scripta
Hypogymnia physodes
Lepraria incana
Ochrolechia arborea
Opegrapha atricolor
Parmelia glabratula
Parmelia saxatilis
Parmeliopsis ambigua
Pertusaria amara
Phlyctis argena
Platismatia glauca
Pseudevernia furfuracea
Scoliciosporum chlorococum
Thelotrema lepadinum

Tree species:
Fagus

Cetraria oakesiana
Evernia prunasrti
Graphis scripta
Hypogymnia physodes
Hypogymnia tubulosa
Lecanora carpinea
Lecanora pallida
Lecanora subfuscata
Lepraria incana
Menegazzia terebrata
Ochrolechia arborea
Parmelia glabratula
Parmelia sulcata

Pertusaria albescens
Pertusaria amara
Pertusaria cocodes
Phlyctis argena
Platismatia glauca
Ramalina roesleri
Scoliciosporum chlorococcum
Strigula stigmatella
Usnea sp.

Locality:
3. Pohorje, Smrečno, Močnik, BIO 16X16, 19.10.1987
800 m n.v., x 5539000, y 5147000

Tree species:
Picea

Cetraria pinastri
Chaenotheca ferruginea
Cladonia coniocraea
Cladonia digitata
Evernia prunastri
Hypogymnia physodes
Lepraria incana
Parmelia saxatilis
Parmeliopsis ambigua
Pertusaria coronata
Pertusaria sp.
Platismatia glauca
Pseudevernia furfuracea
Ramalina farinacea

Tree species:
Acer pseudoplatanus

Cetraria pinastri
Cetraria pinastri
Hypogymnia physodes
Lecanora intumescens
Lepraria incana
Parmelia glabratula
Parmelia saxatilis
Parmelia sulcata
Platismatia glauca
Pseudevernia furfuracea
Pseudevernia furfuracea
Scoliciosporum chlorococcum
Usnea subfloridana

Tree species:
Q. petraea

Lecanora subrugosa
Lecidella euphorea
Parmelia glabratula
Pertusaria leprarioides
Phlyctis argena

Tree species:
Picea, Larix

Bryoria fuscescens
Hypogymnia physpdes
Ochrolechia turneri
Parmelia saxatilis
Pertusaria amara
Platismatia glauca
Usnea subfloridana

Tree species:
Fagus

Cetraria pinastri
Hypogymnia physodes
Lepraria incana
Parmelia glabratula
Parmelia saxatilis
Parmeliopsis ambigua
Pertusaria albescens
Pertusaria amara
Phlyctis argena
Platismatia glauca
Scoliciosporum chlorococcum

Locality:
3. Smrečno na Pohorju, Sv. Uršula, BIO 16 X 16, K3, 13.12.1989, 920 m n.v., x 5539000, y 5147000

Tree species:
Acer

Buellia disciformis
Evernia prunastri
Haematomma ochroleucum
Hypogymnia physodes
Lecanora carpinea
Lecanora chlarotera

Lecanora intumescens
Lecanora leptyrodes
Lecidella elaeochroma
Lecidella euphorea
Lepraria incana
Nephroma parile
Parmelia contorta
Parmelia glabratula
Parmelia sulcata
Parmeliopsis ambigua
Pertusaria albescens
Pertusaria amara
Phlyctis argena
Ramalina roesleri
Scoliciosporun chlorococcum

Tree species:
Picea, Pinus

Bryoria fuscescens
Cetraria pinastri
Cladonia coniocraea
Evernia prunastri
Haematomma elatinum
Hypogymnia farinacea
Hypogymnia physodes
Lecanora sp.
Lepraria incana
Parmeliopsis ambigua
Platismatia glauca
Pseudevernia furfuracea
Scoliciosporum chlorococcum
Usnea filipendula
Usnea subfloridana

Tree species:
Q. petrea, Castanea sativa

Bacidia sp.
Buellia disciformis
Cetraria pinastri
Cladonia coniocraea
Evernia prunastri
Hypogymnia physodes
Lecanora carpinea
Lecanora chlarotera
Lecanora leptyrodes
Lecanora subrugosa
Lecidella elaeochroma

Lepraria incana
Parmelia glabratula
Parmelia saxatilis
Parmelia sulcata
Pertusaria albescens
Pertusaria amara
Phlyctis argena
Platismatia glauca
Scoliciosporum chlorococcum
Usnea glabrata

Tree species:
Sadno drevje

Bryoria fuscescens
Caloplaca herbidella
Candelariella reflexa
Candelariella xanthostigma
Evernia prunastri
Hypogymnia physodes
Hypogymnia tubulosa
Lepraria incana
Parmelia exasperata
Parmelia exasperatula
Parmelia glabra
Parmelia glabratula
Parmelia sulcata
Parmelia tiliacea
Phlyctis argena
Physcia adscendens
Physcia stellaris
Physcia tenella
Platismatia glauca
Pseudevernia furfuracea
Ramalina fastigiata
Scoliciosporum chlorococcum
Usnea florida
Usnea subfloridana
Xanthoria parietina

Tree species:
Abies

Bryoria fuscescens
Bryoria subcana
Cetraria chlorohylla
Cetraria pinastri
Evernia prunastri
Haematomma elatinum
Hypogymnia farinacea
Hypogymnia physodes

Lecidea pullata
Lecidella euphorea
Parmelia saxatilia
Pertusaria coccodes
Phlyctis argena
Platismatia glauca
Usnea filipendula
Usnea subfloridana

Tree species:
Fagus

Evernia prunastri
Lecanora carpinea
Lecidella euphorea
Parmelia sulcata

Locality:
3. Šmartno na Pohorju, december 91,
920 m n.v., x 5539000, y 5147000

Tree species:
Picea

Hypogymnia farinacea
Hypogymnia physodes
Parmelia glabratula
Pseudevernia furfuracea
Scoliciosporum chlorococcum

Locality:
4. Remšnik BIO 16X16, 13.12.1989
570m n. v., x 5523000, y 5163100

Tree species:
Abies

Candelariella xanthostigma
Cladonia coniocraea
Cladonia digitata
Cladonia squamosa
Haematomma elatinum
Haematomma ochroleucum
Hypogymnia physodes
Lecanora symmicta
Lepraria incana
Parmeliopsis ambigua
Pertusaria coronata
Platismatia glauca
Scoliciosporum chlorococcum

Tree species:
Fagus

Cladonia furcata
Hypogymnia sp.
Lepraria incana
Scoliciosporum chlorococcum

Tree species:
Sadno drevje

Candelariella xanthostigma
Evernia prunastri
Hypogymnia physodes
Lepraria incana
Parmelia caperata
Parmelia exasperatula
Parmelia saxatilis
Parmelia sp.
Parmelia sulcata
Pertusaria albescens
Pertusaria amara
Phlyctis argena
Physcia adscendens
Physcia aipolia
Physconia distorta
Rinodina sp.
Scoliciosporum chlorococcum

Tree species:
Pinus, Picea

Bryoria fuscescens
Cetraria chlorophylla
Cladonia caespiticia
Cladonia digitata
Hypocenomyce scalaris
Hypogymnia physodes
Lecanora symmicta
Lepraria incana
Parmeliopsis ambigua
Parmeliopsis hyperopta
Platismatia glauca
Psevdevernia furfuracea
Scoliciosporum chlorococcum
Usnea hirta

Usnea subfloridana

Tree species:
Qercus

Cetraria pinastri
Cladonia coniocraea
Hypogymnia physodes
Lecanora pallida
Lepraria incana
Parmelia glabratula
Parmelia saxatilis
Pertusaria coccodes
Scoliciosporum chlorooccum
Usnea hirta
Usnea subfloridana

Locality:
4. Kobansko, Sv. Duh, (Ropič, Adam), BIO 16 X 16, 13.12.1989, 730 m n.v., x 5538350, y 5163500

Tree species:
Sadno drevje

Candelariella reflexa
Candelariella xanthostigma
Evernia prunastri
Hypogymnia physodes
Lecanora chlarotera
Lecidella euphorea
Lepraria incana
Parmalia sulcata
Parmelia caperata
Parmelia glabra
Parmelia glabratula
Parmelia saxatilis
Parmelia tiliacea
Pertusaria albescens
Physcia nigricans
Physcia orbicularis
Physconia distorta
Scoliciosporum chlorococcum

Tree species:
Castanea

Buellia disciformis
Candelariela reflexa
Lecanora chlarotera

Lecanora intumescens
Parmelia glabratula
Parmelia sulcata
Parmeliopsis ambigua
Phlyctis argena
Rinodina sp.
Scoliciosporum chlorococcum

Tree species:
Populus tremula

Buellia punctata
Candelariella xanthostigma
Hypogymnia physodes
Lecanora chlarotera
Lecidella euphorea

Tree species:
Pinus, Picea

Hypogymnia farinacea
Hypogymnia physodes
Scoliciosporum chlorococcum

** Nomenclature of lichens is according to POELT (1969), POELT & VEZDA (1977, 1981) and WIRTH (1980).