Several results of the study in oak forest in periphery of the South Bohemian Basin

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Abstract
An oak ecosystem whose plant community belongs to the association Abieto-Quercetum *was under study. The structure of under-storey was described by help of units called the types of plant microcoenoses (types of PMCs). In the course of five years the herb above-ground biomass raised from 55 to 160 g.m^{-2} as well as the underground biomass. Damage degree of the tree layer became more and more considerable. Its history was described on the basis of ring-increment analysis. It was found out that probably no significant relation exists between the social position of a tree and its damage in the studied ecosystem. Attention was also paid to the accumulation of soil organic matter (litterfall and soil detritus).*

Keywords: Abieto-Quercetum, *biomass, bitumens, defoliation, forest damage, humic substances, plant microcoenosis,* Quercus robur, *soil detritus, tree-ring analysis*

Introduction

Nowadays oak tree and oak ecosystems are strongly endangered (see the results of the monitoring of the condition of forest ecosystems, Matějka, 1993, 1994a). In the Czech Republic this tracheomycotic damage occurs both in *Quercus petraea* and *Q. robur*. Differences in the intensity of damage can be probably explained by the different environmental conditions both the species are found in most frequently. To understand the dynamics of damage to oak ecosystems it is necessary to have maximum data concerning their structure. This knowledge can be obtained on the basis of ecosystem study projects, through a long-term monitoring of selected ecosystems.

The present literature includes a very extensive collection of contributions concerning the forest ecosystem research. A certain approach (more or less unified) to these studies was carried out (e.g. Ellenberg, 1971; Powers; Reichle, 1973; Van Cleve, 1991).

One of the most significant studies dealing with the oak ecosystems of the Central Europe was conducted in Hungary (Jakucs et al., 1985), in Slovakia it was the "Báb" Project (Biskupský, 1975). A series of partial results were obtained - such as the studies of the effect of air pollution on the die-back of forests with oak (Medwecka-Kornas, Gawronski, 1990), bioindication and acidification of forests with Q. robur (Tyler, 1987) or the use of Ellenberg's eco-indices in young stands of *Q. petrea* (Roo-Zelinska, Solon, 1990). Pape, van Breemen, van Oeveren (1989) followed the cycle of calcium in the stands of *Q. robur* and *Betula pendula*. The study of the structure of *Q. cerris* stand (Scarascia-Mugnozza et al., 1989) should be also mentioned.

When studying the succession in abandoned fields in the Southern Bohemia (the name of the project carried out by the Institute of Soil Biology of the Academy of Sciences at České Budějovice was "Biological Structure and Function of the Soil Component of the Ecosystem", see Matějka, 1990) extensive investigation was also performed on a reference forest plot. Research on this plot proceeded from 1985 up to now when this locality is observed within the monitoring of forests of the Czech republic.

Locality

The locality is situated near the road connecting Netolice and Krtely, in 1.7 km from the road and railway junction at Netolice (geographical coordinates are 14°11'E, 49°04'N).

Methods

The basic plant coenological data were obtained by the classic plant coenological method using the Braun-Blanquet's seven -grade combined scale for abundance and dominance extended by intermediate grades. Nomenclature of plant taxa is after Rothmaler et al. (1982). Nomenclature of higher-order syntaxa is after Moravec et al. (1983).

Location of all the trees on the study plot, 15x30 m in size, was measured and plotted on the map of the plot. Basic mensurational parameters (height and diameter at a breast height measured on the basis of girth) were measured in the stand repeatedly. Samples for the annual ring analysis were taken from eleven trees at the end of October 1992 in such a way that all the size classes of trees in the stand were represented proportionally. Defoliation of all the trees was evaluated by three independent judges in June 1993. The mean defoliation values were calculated.

Heterogeneity of the herb layer of the stand was observed on the basis of the analysis of networks of the quadrats 1/4 m2 in size, regularly distributed in 5 m distance. The presence of each species was given in a scale: 1 - the species is present, 2 - dominant species. By analysing the file of data obtained in that way interspecific associations were tested by help of chi-square test.

The above-ground biomass was sampled from randomly selected squares 0.25 m^2 in size by cutting off at the soil surface. Dead plant matter accumulated on the soil surface was taken out parallelly. The samples were taken in the period of the optimal development of herb biomass within the years 1986 up to 1989.

To determine the mass of the total underground biomass, soil monoliths were taken out by a probe 65 mm in diameter to the depth 100 mm. Freezing of the samples was applied to destruct of soil compactness. The samples were dissolved by a stream of water on sieves of 0.25 mm meshes. All the underground organs were taken out subsequently over a sieve of 2 mm meshes (cf. Fiala in Rychnovská et al., 1987, pp. 104-107).

The remaining sample (both parts above both sieves) was used for the determination of soil detritus, i.e. undecomposed or partly decomposed dead plant matter in the soil body. It was determined as a matter able to be flooded out from the remaining sample after its drying. When interpreting the results it is necessary to consider that the organic matter content is lower in the samples prepared in that way because of the admixtures of mineral particles of soil.

For the purposes of the analysis of soil detritus the following procedure was used:
- combustion at 600 °C and determination of the content of total ash;
- undissolved residue with the filter paper is again burned at the same temperature and the so-called content of insoluble ash is determined (content of soluble ash is computed as a difference of total and insoluble ashes);
- content of phosphorus is determined photometrically in the solution as yellow vanadate-molybdate complex;
- content of K, Na and Ca was determined on the basis of flame emission spectrometry;
- heat of combustion was determined via calorimeter, results are computed on ash-free dry-weight of detritus.

Production of litterfall was measured in autumn months of two years by help of litterfall-collectors (polyethylene nets with 1.5 mm meshes, stretched in square frames of the 0.5 m side) placed on the soil surface. The collected material was dried up and weighed.

Organic lipophilic substances in soil are called bitumens. The prevailing part of them comes from the dead plant matter, especially from the leaf litter in forest. The content of bitumens in litterfall was observed as follows:
- dry material was completely extracted by ethanol-benzene mixture (in the volume ratio 1:1);
- total bitumens were determined gravimetrically after evaporating the solvent;
- content of carbon in bitumens was determined oxidometrically by help of potassium dichromate;
- content of polar components in the extract was determined after their extraction into the solution of potassium hydroxide (0.1 $mol.l^{-1}$).

Humic acids (HA) and fulvic acids (FA) were extracted from the material together using the solution of NaOH (0.1 $mol.l^{-1}$), HA was separated by means of the precipitation of sulfuric acid and repeated dissolution. Content of carbon in solutions was determined oxidometrically by means of potassium dichromate. The extinction of samples was determined at 400 and 600 nm (extinction coefficients e_{400}, e_{600}, and colour quotient $Q_{4/6}$ were calculated; Pospíšil, 1980).

Results

Stand description

The cultural broadleaved forest has more or less natural species composition. The age-class composition of stand does not correspond to the condition in a natural stand, however. It follows from the geobotanic reconstruction map that the locality is situated at the border of acidophilous oak forests (*Genisto germanicae-Quercion*) and beech forests (*Eu-Fagion*). The analysed community was classified within the association *Abieto-Quercetum* MRÁZ 1959 of the suballiance *Galio-Abietenion* OBERDORFER 1962. Species *Tilia cordata, Fraxinus excelsior* and *Fagus sylvatica* are admixed in *Quercus robur* stand. *Abies alba* is entirely absent now. In 1989, the stand basal area was 36.7 $m^2.ha^{-1}$, of which 33.4 $m^2.ha^{-1}$ (i.e. 91 %) falls to the oak. The number of trees was 867 per 1 ha. The extremely slant division of trees in relation to diameter at breast height proves the effective stand tending in the past.

The membership of community in the suballiance *Galio-Abietenion* is indicated in species *Sanicula europaea, Galium rotundifolium* and *Luzula pilosa*. Further *Viola reichenbachiana, Ranunculus nemorosus, Festuca altissima, Poa nemoralis, Fragaria moschata* and *Melica nutans* can be considered significant species. Of the characteristic species of alliance *Genisto-Quercion, Luzula luzuloides, Vaccinium myrtillus* and *Melampyrum pratense* occur with a higher degree of constancy and dominance. Due to their occurrence, they generally exceed the borders of this alliance to a great extent. Other significant species are particularly *Oxalis acetosella, Hieracium murorum* and *Veronica chamaedrys*. As far as the plot is concerned, there can be fully quoted the polemics given in the treatise on the cultural forests of the Southern Bohemia which related to the distinguishing of the associations *Luzulo albidae-Quercetum* and *Abieto-Quercetum* (Matějka, 1994b; Neuhäusl, Neuhäuslová-Novotná, 1979).

Herb layer structure

The analysis of interspecific associations in the quadrat net showed the existence of two basic species groups which could be considered "structural groups of species" (see Matějka, 1992):

- group *Galium rotundifolium*: *Sanicula europaea, Veronica chamaedrys, Agrostis tenuis, Campanula persicifolia, Festuca rubra, Rubus* Sect. *Suberecti*;
- group *Fragaria vesca*: *Viola canina, Melica nutans, Euphorbia cyparissias, Calamagrostis epigejos, Luzula pilosa, Viola reichenbachiana, Melampyrum pratense, Vaccinium myrtillus, Fraxinus excelsior* juv., *Sorbus aucuparia* juv.

A separate position was proved in *Oxalis acetosella, Mycelis muralis, Luzula luzuloides, Calamagrostis arundinacea* and *Rubus hirtus*. In these species a lot of negative relations were proved in relation to each other as well as to species of both groups firstly mentioned (Fig. 1).

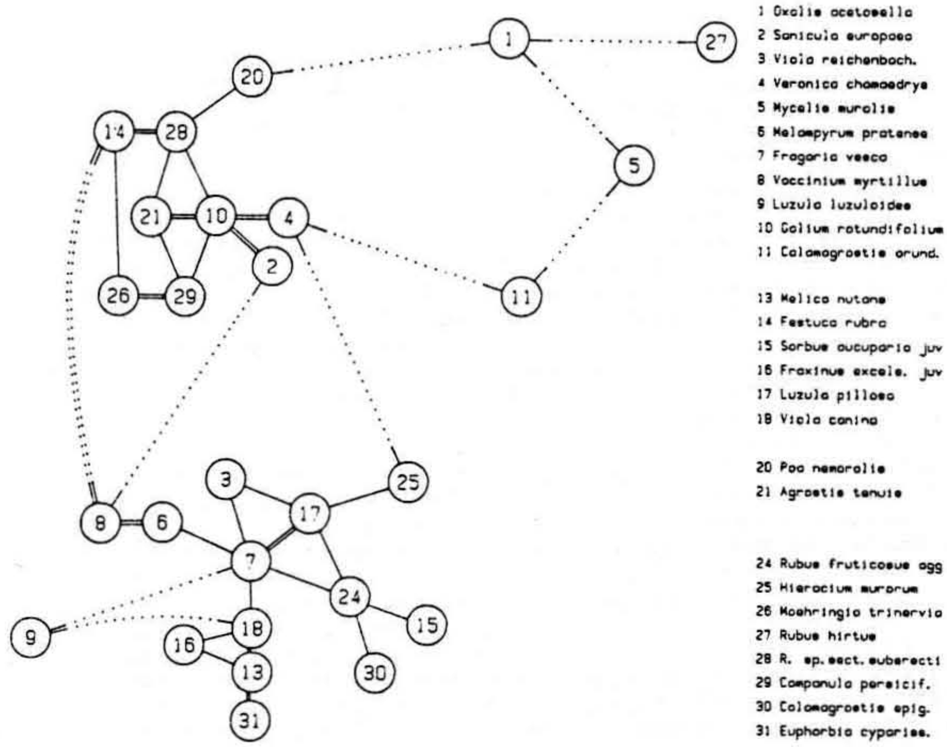

Fig. 1. The interspecific associations among plants of the understorey tested using chi-square of the contingency tables. Continuous lines - positive associations, doted lines - negative ones.

The results are connected also with the following types of plant microcoenoses (PMC) distinguished by help of numerical classification of quadrats arranged in a net (see Figs. 2, 3):

Type of PMC Calamagrostis arundinacea (group of quadrats A in Table 1). In the stand of this dominant species a small number of other species present only, regular occurrence was found by *Oxalis acetosella, Sanicula europaea* or *Viola reichenbachiana*.

Type of PMC Melampyrum pratense-Vaccinium myrtillus (group of quadrats B) is characterized by these species with the absence of indicators of the next type. The central part of the locality

Table 1. Species composition of plant microcoenosis recorded in the oak forest by Netolice in the quadrat network. Constancy of the species in per-cent.

type of PMC number of quadrats	A 9	B1 12	B2 6	C 14	D1 6	D2 10	D3 5	total
Calamagrostis arundinacea	100		17	21	33			24
Melampyrum pratense	11	92	100	93		20		53
Vaccinium myrtillus	11	92	83	36	33	10		40
Melica nutans	33		50	14		20	20	18
Fraxinus excelsior juv.		25	50		17	10	20	15
Viola canina	11		67	14				11
Luzula pilosa		8		43			20	13
Rubus fruticosus agg.				29				6
Oxalis acetosella	100	100	50	100	67	100	100	92
Sanicula europaea	67	58	100	79	67	90	100	77
Viola reichenbachiana	44	25	67	100	83	60	60	63
Veronica chamaedrys	22	67	50	50		100	100	56
Mycelis muralis		67	100	29	100	80	40	55
Fragaria sp.div.	22	42	67	93		20	100	50
Luzula luzuloides	22	75		21	50	80		40
Galium rotundifolium	33	8	33	21		60	40	27
Quercus robur juv.	33	8		43	33	30		24
Festuca rubra agg.	22			21	17	40		16
Sorbus aucuparia juv.		8	17	29	33		20	15
Poa nemoralis	11		33	14		10		10
Anemone nemorosa			17	14		30		10
Rubus idaeus	22	8				10		6
Agrostis tenuis	11		17			20	20	8
Acer pseudoplatanus juv.	11			14	17		20	8
Rubus sect. *Suberecti*	11							3
Euphorbia cyparissias	11			7				3
Maianthemum bifolium		8						2
Ajuga reptans		8						2
Moehringia trinerviva			17			20		5
Rubus hirtus			17			10		3
Hieracium murorum				21	17			6
Calamagrostis epigejos				14				3
Campanula persicifolia				7				3
Carex pilulifera				7				2
Holcus mollis				7				2
Calamintha clinopodium				7				2
Sieglingia decumbens				7				2
Picea abies juv.				7				2
Tilia cordata juv.						10		2
Ranunculus nemorosus							20	2
Rosa subcolina							20	2

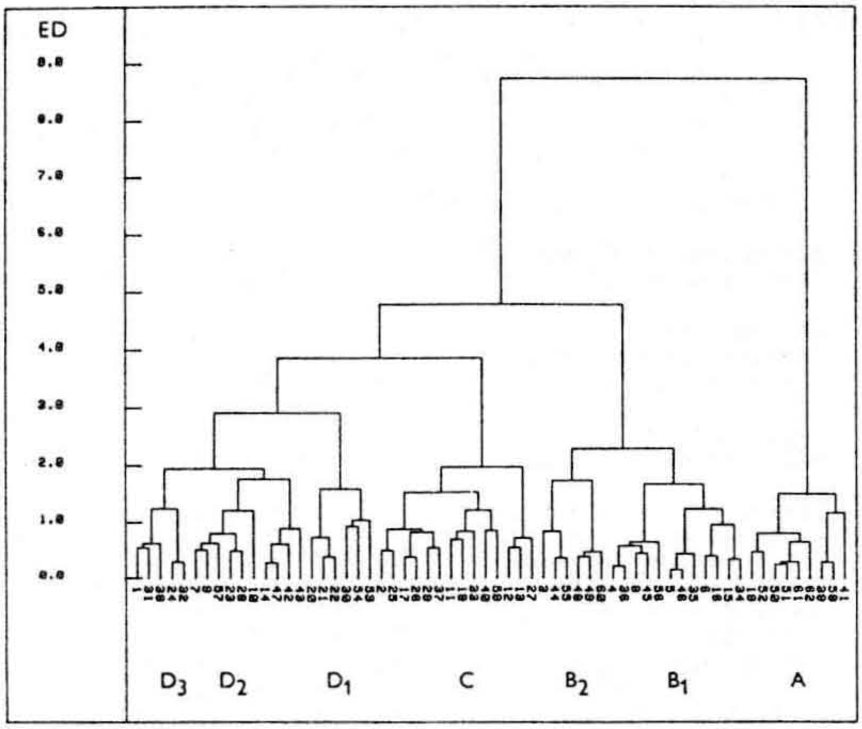

Fig. 2. Numerical classification (Ward's method, the Euclidean distance as a dissimilarity measure) of the quadrats in network (see Table 1). A, B_1, ... , D_3 are distinguished plant microcoenosis.

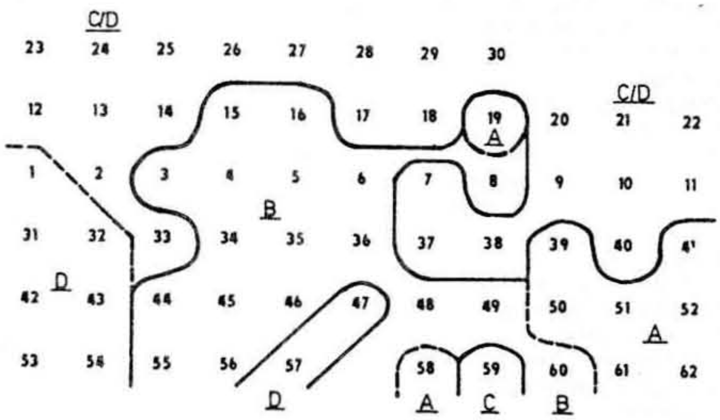

Fig. 3. Spatial distribution of plant microcoenosis in study plot. The description of species composition of the types PMCs is given in Table 1.

represents this type.

Type of PMC *Melampyrum pratense-Luzula pilosa* (group of quadrats C) together with the next type occurs in the mosaic. Differential species combination includes *Luzula pilosa, Rubus fruticosus* excl. both *R. hirtus* and *R.* Sect. *Suberecti*, *Acer pseudoplatanus* juv.

Type of PMC *Sanicula europaea-Oxalis acetosella* (group of quadrats D) is without differential species.

We distinguished various sub-types (marked with a number by letter of the group of quadrats; Table 1) by help of numerical analysis.

Somewhat different view of the structure of herb layer is provided when analysing the data obtained on the basis of the analysis of herb layer biomass. Five basic types of PMCs, very different also from the production aspect, were distinguished by means of the numerical classification of studied samples.

Type of PMC *Calamagrostis arundinacea*: This high grass is dominant. It creates a specific stand with lot of gaps in the herb layer. They are places of growing other species. This structure of stand also reflects in the arrangement of the surface humus horizons of soil which is very irregular in this patch. In comparison with the next types the biomass of stand is medium high. Representation of this type of PMC on the plot makes about 19 % of area.

Type of PMC *Luzula-Veronica chamaedrys*: The composition of species is much more balanced when compared with the first and last types. *Veronica chamaedrys* and *Luzula luzuloides* are dominant species. The occurrence of *L. pilosa* is also important. The total stand biomass is comparatively low. Representation of this type in the locality makes about 33 %.

Type of PMC *Vaccinium myrtillus*: This type is very similar to the foregoing one. It differs only in a higher participation of bilberry. A high dominance is reached by *Sanicula europaea*. The total herb biomass is very low. Its representation in this locality makes about 19 %.

Type of PMC *Rubus fruticosus*: Various species of this species aggregate dominate. It causes high total biomass of the herb layer. The representation of this type is low on the studied plot. Its occurrence is more frequent in the round of plot.

Type of PMC *Poa nemoralis*: This grass is dominant absolutely. Total biomass is high. This type occupies about 24 % of the plot area.

The average biomass of the herb layer markedly increased from 55 up to 160 $g.m^{-2}$ within the years 1985 and 1989.

In September 1989 samples of both above-ground and under-ground biomass and soil were taken to define the traits of three main types of plant microcoenoses and their relations with the environment. The basic differences were already found out when describing the arrangement of surface soil horizons (Fig. 4). The analyses of humus indicate certain differences between the places where the samples were taken (Figs. 5, 6), but with regard to the small number of repetitions these dependencies cannot be evaluated quantitatively.

The investigated values of underground biomass into the depth of 10 cm ranged from 450 up to 700 $g.m^{-2}$. The increment of the average value within the years 1987 and 1989 is considerable

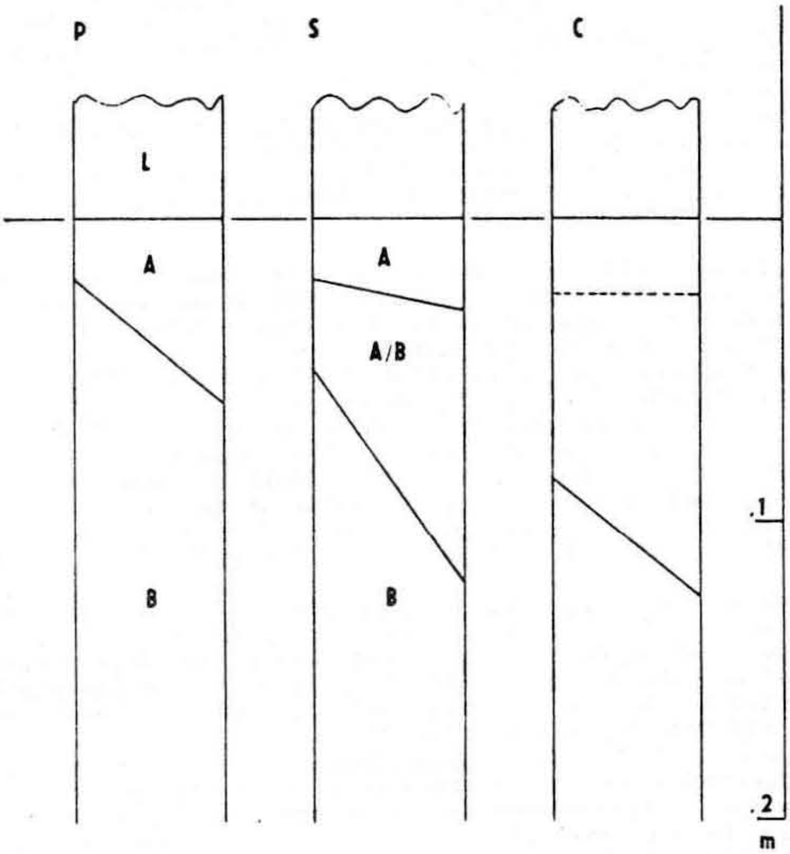

Fig. 4. The stratigraphy scheme of the surface soil horizons in three different types of PMCs (P - *Poa nemoralis* type, S - *Luzula-Veronica chamaedrys* type, C - *Calamagrostis arundinacea*). L - surface litter, A, B - horizons.

and it is probably connected with the increment of the maximum above-ground biomass of under-storey in the studied period.

The annual dynamics of the under-ground biomass is insignificant probably as a result of the high representation of long -time-surviving woody roots (the samples contained all the roots with the diameter to 10 mm). The minimum was reached in the first half of summer. Annual variation was approximately 120 $g.m^{-2}$ (Figs. 7, 8).

Structure of the tree layer

The age of trees in the stand found out on the basis of annual ring analysis (Table 2) was 51 up to 62 years (in 1990, at

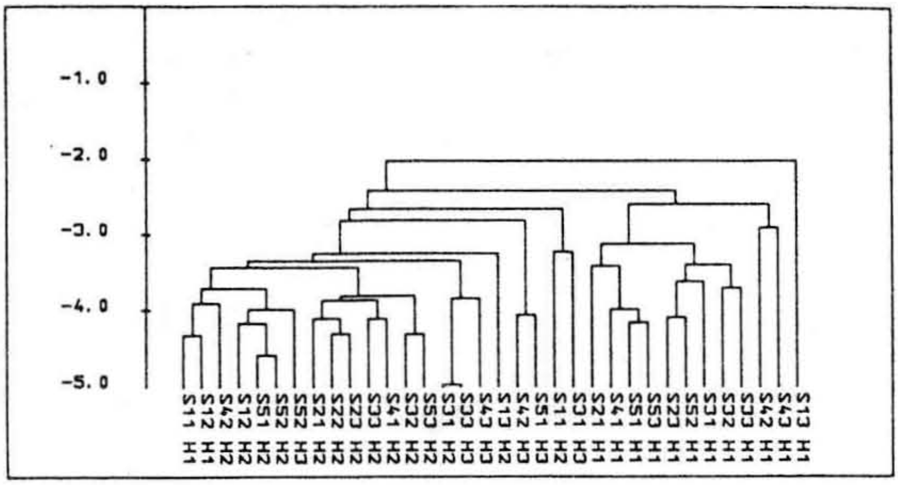

Fig. 5. The hierarchical classification (average linkage clustering method with the Euclidean distance dissimilarity measure) of the soil samples (see Fig. 4) based on the properties of humic substances. Denotation of the samples: S probe number (11 to 23 - the PMC type *Poa nemoralis*, 31 to 43 - the PMC type *Luzula-Veronica chamaedrys*, 51 to 53 - the PMC type *Calamagrostis arundinacea*); H horizon (1 - horizon A, 2 - transition horizon A/B, 3 - horizon B).

the same time we must add the time of growing young tree to the height of 1.3 m).

Table 2. Growth analysis of the separated trees of *Quercus robur*. RATIO = average year increment during 1961-80 / diameter

tree No.	age in 1990	diameter 1992/93 [cm]	defol. 1993 [%]	aver. increment 1961-80 [mm/year]	aver. increment 1985-91 [mm/year]	RATIO [0.001]
14	51	28.8	8	2.09	1.54	7.3
17	62	25.8	17	1.32	.66	5.1
15	57	23.5	18	1.52	.81	6.5
21	58	17.7	20	1.09	.29	6.2
31	54	19.5	22	.88	.61	4.5
36	51	22.5	28	1.46	.62	6.5
29	60	26.9	23	1.72	.89	6.4
10	52	45.8	43	2.65	3.12	5.8
30	58	30.4	53	1.63	1.17	5.4
11	48	15.1	80	.50	.15	3.3
9	52	20.9	100	1.40	-	6.7

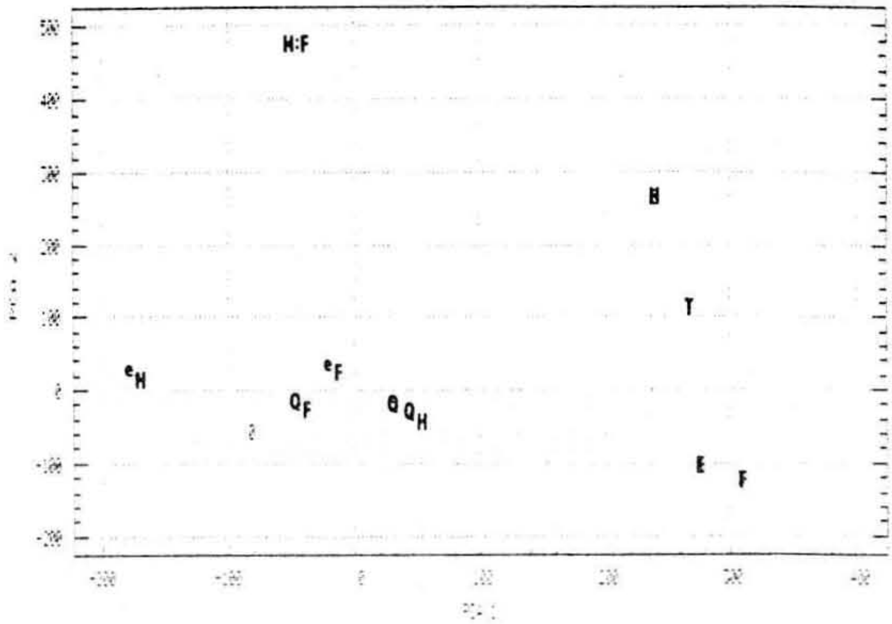

Fig. 6. The first and second ordination axes (principal component method) of the humic substances properties: H - the total carbon content of the humic acids (HA); F - the total carbon content of the fulvic acids (FA); T - the total carbon content of HA+FA; H:F - ratio $C_{HA}:C_{FA}$; E - total extinction coefficient by the wave-length 400 nm of the NaOH extract of soil; e_H, e_F - extinction coefficients by the wave-length 400 nm of HA and FA solution, respectively; Q - colour coefficient $Q_{4/6}$ (extinction by 400nm : extincion by 600nm) of all extracted humic substances; Q_H, Q_F - colour coefficient of HA and FA, respectively.

The history of the oak diameter increment shows approximately three stages of development (Fig. 9):

- till 1960 (time of high increment and its higher variation, period characteristic of very young stands);
- from 1961 till 1981 (time of comparatively balanced and stable increment in mean height, period characteristic of young and younger stands);
- from 1982 up to now (the constant considerable decrease in the increment becomes evident).

The decrease in increment was evaluated in each tree on the basis of the ratio of average ring width in the period 1985-91 and in 1961-80. Nevertheless it became evident that this ratio is higher in those trees which show considerable regeneration at present. The increased present defoliation reflects rather in the low ratio of average increment in the middle period of growth to the present diameter at breast height.

It was concluded from the comparison of measured characteristics and defoliation of individual trees that there was no significant relation between the tree size (or its social status) and degree of damage in the studied stand (Fig. 10).

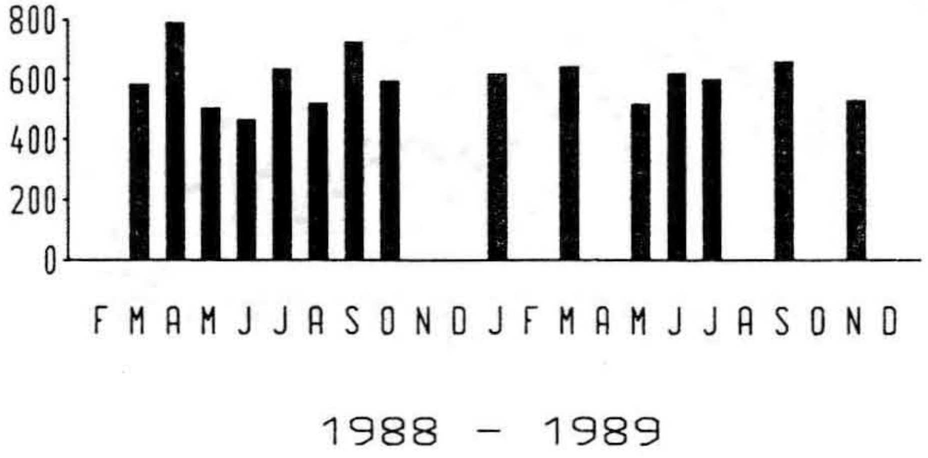

Fig. 7. Development of the root biomass ($g.m^{-2}$) to the depth 10cm during years 1988-9.

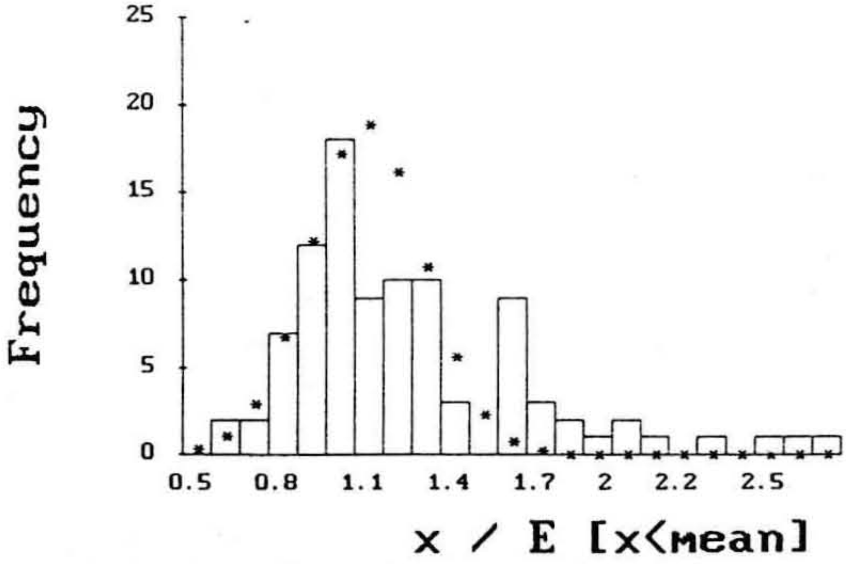

Fig. 8. The frequency distribution of samples according to the relative content of root biomass (the ratio to the average content at the selected sampling date), total 75 samples. Asterisks - possible distribution curve for the normal-distributed data without the above-average contamination.

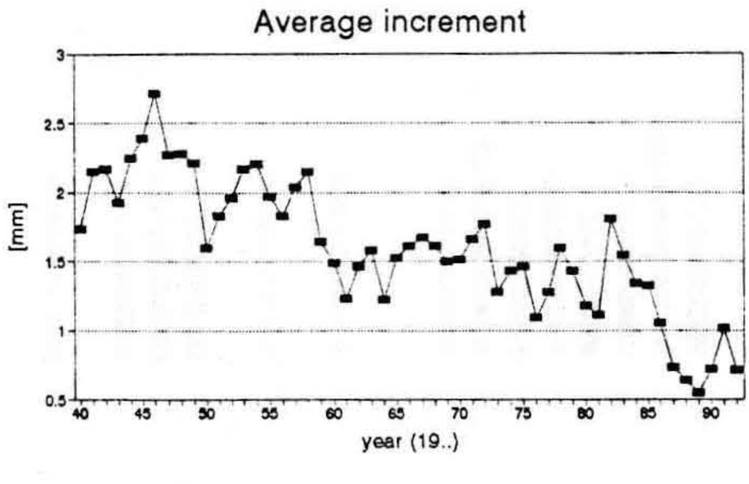

Fig. 9. The average ring increment of oak from 1940.

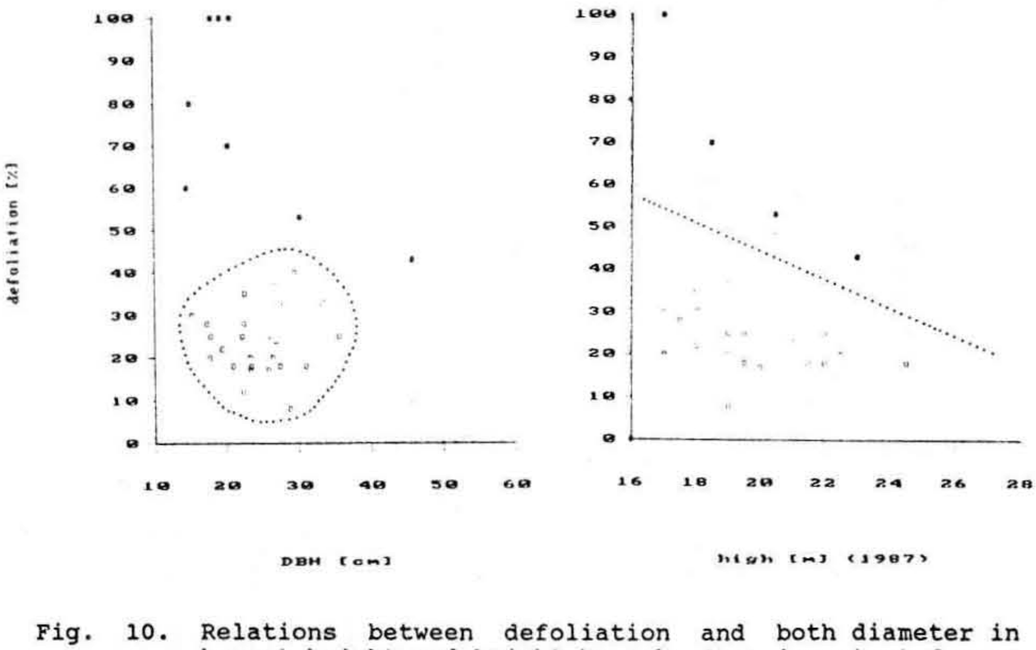

Fig. 10. Relations between defoliation and both diameter in breast height and height by oak. Some important dependence is visible by the most damaged trees only (full rectangles).

Soil and soil organic matter

Dynamics of nitrogen and phosphorus in soil are described by Novák (1993) and Novák, Kalčík (1993).

Distribution of organic matter in the surface layers of soil is visible from the following survey (samples were taken in the spring period of 1990, combustible substances were determined, five repetitions were applied):

depth [cm]	average [%]	standard deviation [%]
0 - 2	25.3	15.6
2 - 4	10.7	3.0
4 - 6	6.8	2.0
6 - 8	6.4	1.2
8 - 10	4.4	1.1

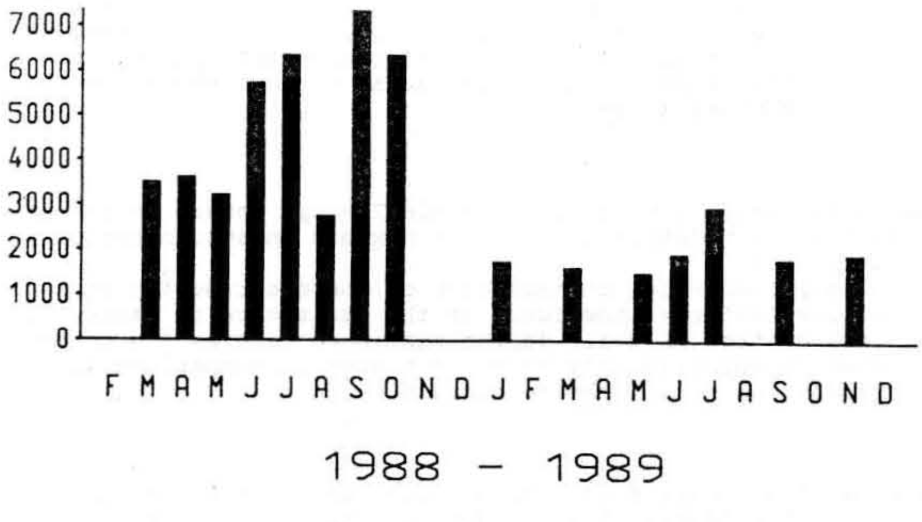

Fig. 11. Development of the content of detritus in soil ($g.m^{-2}$) to the depth 10 cm during years 1988-9.

The obtained data about the content of soil detritus (Fig. 11) are quite heterogeneous. High contamination of normal distribution was proved by high (above-average) values (approximately in 20 % of samples). Differences between the individual years can be substantial, particularly those between the maximum values in autumn. Low pool of soil detritus was found out in 1987 (average of the three autumn months 2.25 $kg.m^{-2}$). In 1988 the average content of soil detritus was 3.66 $kg.m^{-2}$ and in the next year it

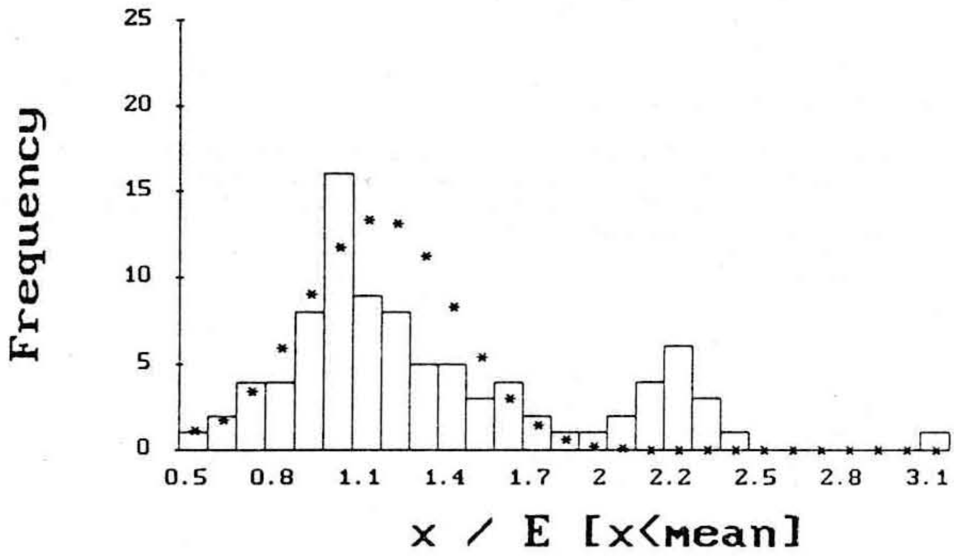

Fig. 12. The frequency distribution of samples according to the relative content of the soil detritus (the ratio to the average content at the selected sampling date), total 75 samples. Asterisks - possible distribution curve for the normal-distributed data without the above-average contamination.

was again only 1.90 kg.m^{-2}. A single-top annual course of the content of soil detritus with its maximum in autumn period seems to be typical.

The proved high contamination of the distribution of measured values confirms the idea of the existence of accumulation detritus centres in soil. In the mentioned centres the content of detritus is approximately by 90 % higher in comparison with that in surrounding soil (compare Fig. 12).

Table 3. The content of some elements in soil detritus and mass of elements loosened during the year period by decomposition (DEC).

	range	DEC
total soluble ash	4.57 - 4.70 %	
phosphorus	0.74 - 0.94 mg.g^{-1}	6.2 g.m^{-2}.y^{-1}
potassium	0.02 - 0.20 mg.g^{-1}	1.3 g.m^{-2}.y^{-1}
sodium	0.07 - 0.16 mg.g^{-1}	1.1 g.m^{-2}.y^{-1}
calcium	2.77 - 7.05 mg.g^{-1}	46.8 g.m^{-2}.y^{-1}
energy content in the ash-free matter	20.30 kJ.g^{-1}	135 MJ.m^{-2}.y^{-1}

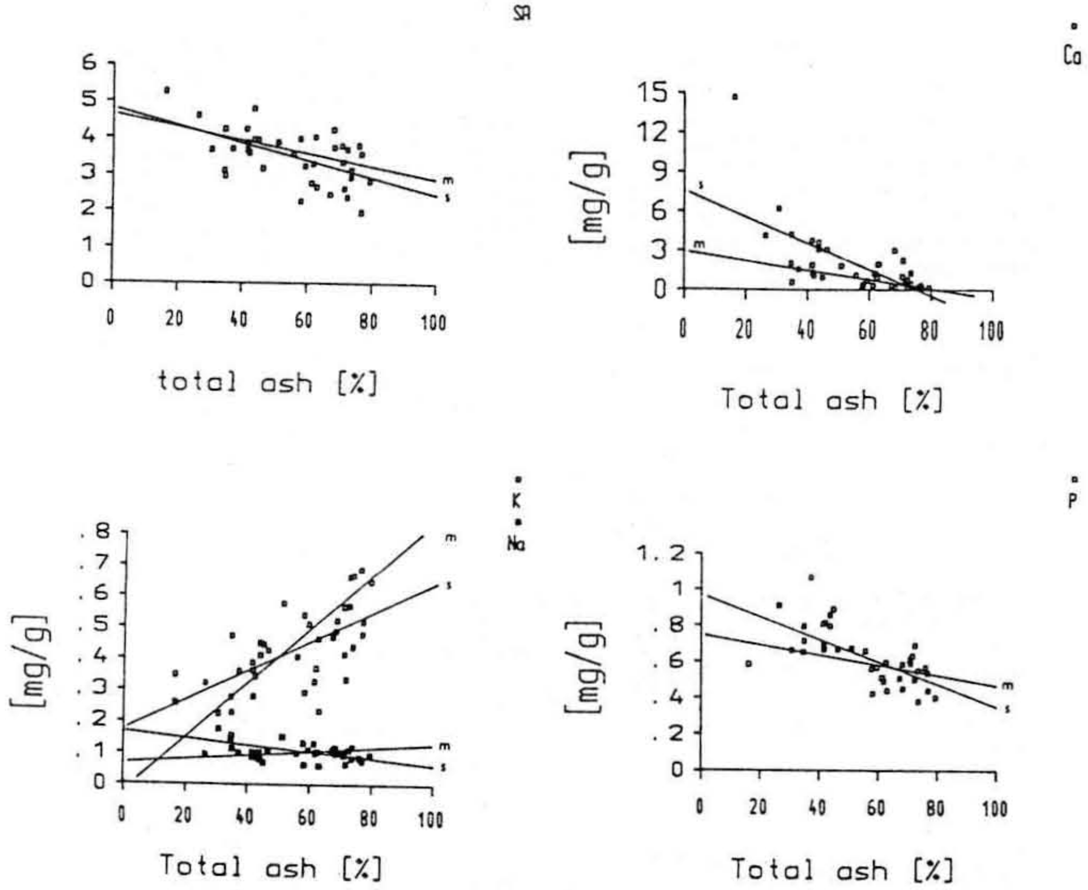

Fig. 13. Relation between the total ash content and some other contents (soluble ash [SA], K, Na, Ca and P respective) in the soil detritus. The regression method: straight line s - less sum of squares, m - less median of squares.

Release of mineral elements from soil detritus in the course of decomposition is significant really for the dynamics of nutrients in the forest soil. In view of this fact it is essential to know the content of these elements in soil detritus. Since the soil detritus cannot be isolated completely free of mineral soil additions and since there is a linear relation between the content of element (P, K, Na, Ca) and total ash content, a linear model was used for the computation of the average content of this element in the own organic matter (Fig. 13). In model we suppose the content of total ash to be equal to the content of soluble ash. The results are stated in Table 3.

The produced litterfall is substantially significant for the formation of the complex of soil organic matter. The content of substances of the leaf litter similar to humic ones from the soil has been in the focus of interest only sporadically. It is the fact that they become the part of the soil humic substances at moment of including of detritus particle into the soil body - the soil and detritus humic (humic-lake) matters become to be inseparable by using common analytical methods.

Since the comparable data are missing in present literature, the litterfall of birch was analysed for the purposes of comparison. Samples were taken out in approximately a thirty-year-old stand of *Betula pendula* in an old field. The locality is situated in the same region as the observed oak forest. The results were summarized in Table 4.

Table 4. The bitumens and humus (humus-like substances) in leaf litter. The increase (+) and decrease (-) during decomposition are marked.

		Quercus robur	*Betula pendula*	
total bitumens	%	15.2 - 20.7	20.1 - 30.3	-
carbon of bitumens	%	6.6 - 8.2	7.8 - 11.2	-
polar:total bitumens	%	34.8 - 36.4	36.8 - 39.9	-
C in bitumens	%	39.7 - 43.5	37.0 - 38.8	+
energy content in bitumens	$kJ.g^{-1}$	27.15	28.78	
C-HA	%	1.9 - 2.3	3.4 - 4.5	
C-FA	%	8.5 - 9.4	7.6 - 10.3	
$Q_{4/6}$		17.9 - 19.2	16.0 - 16.7	-
e_{400}	$cm^2.mg^{-1}$	34.2 - 37.0	21.0 - 21.8	+
HA:FA		0.23 - 0.26	0.38 - 0.45	+

Discussion and conclusion

In the course of the study, oak injury was observed. Development of the tracheomycoses of oak occurred and the feeding of oak leaves by an insect pests repeated regularly in spring months. This resulted in the gradual change of light conditions of the stand which probably caused the increase in the biomass of the herb layer. The annual ring analysis showed that the deterioration of stand condition also reflected in the decreased average increment from 1982. This trend thus manifested itself during the whole period the locality was observed.

The study succeeded to prove that the most damaged trees were those which had a deteriorated dynamics of growth in the history.

The non-existence of relation between the social position of a tree and its degree of damage would be probably a typical phenomenon when a stand is damaged by biotic factors (in the observed case of tracheomycosis).

The spatial structure of oak stand is a very significant element which must be taken into account when arranging a plan for the study of similar ecosystems. The spatial structure of herb layer has an evident relation to this structure of soil properties.

Soil organic matter is mostly concentrated at several surface (micro)horizons, its accumulation in mineral soil proceeds into the depth of about 6 cm.

It was pointed out that litterfall is important for the production of certain organic substances which becomes a part of the complex of soil humus substances. This particularly applies to bitumens the annual production of which reaches a rather high amount (15 up to 20 % of litterfall mass in oak, 20 up to 30 % of litterfall mass in birch).

Annually a large quantity of nutrients is released in the course of soil detritus decomposition (62 $kg.ha^{-1}$ of phosphorus and 470 $kg.ha^{-1}$ of calcium).

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Karel Matějka: Příklad intensivního výzkumu lesního ekosystému (doubrava na okraji Českobudějovické pánve)

Sledován byl dubový ekosystém, jehož rostlinné společenstvo náleží asociaci *Abieto-Quercetum*. Popsána byla struktura podrostu za pomoci jednotek zvaných typy mikrofytocenos. V průběhu pěti let stoupla biomasa podrostu z 55 na 160 g.m^{-2}., rovněž tak podzemní biomasa. Docházelo ke stále výraznějšímu poškozování stromového patra, jehož historie byla popsána na základě letokruhové analýzy. Zjistilo se, že v tomto ekosystému pravděpodobně neexistuje vztah mezi sociálním postavením stromu v porostu a jeho poškozením. Další pozornost byla věnována akumulaci půdní organické hmoty (zvláště listovému opadu a půdnímu detritu).