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Differentiation of biomass production on the conic hill Oblík in the České středohoří Mountains

Diferenciace produkce biomasy na kuželovitém kopci Oblíku v Českém středohoří

Jiřina Slavíková

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The dependence of biomass production of grassland communities on various exposures (NW., W., SW., S., SE., E.) was investigated. Since there is a uniform parent rock, the ecological differentiation of biotopes is due solely to the differentiated microclimate and its pedogenetical influence. Of the six biotopes under study, the greatest value of the shoot biomass was found in the northwestern and eastern, the lowest one in the southeastern biotope. By means of the regression coefficients a significant dependence of the shoot maximum biomass on the depth of soil horizon A and on the mean annual value of soil moisture in this horizon was confirmed. The root to shoot ratio (R/S) showed the greatest value at the southeastern biotope, where the lowest mean annual soil moisture and the lowest vegetation cover of all biotopes under study were ascertained. On the basis of production analysis at monthly intervals, the dependence of water and solar energy as well as on the seasonal rhythm of plant populations of the communities was proved.

Department of Botany (Higher Plants), Charles University, Benátská 2, 128 01 Praha 2, Czechoslovakia.

Now the biomass production of plant communities is used as one of the important characters of biotope. The basis of this is the fact that both the value and the annual dynamics of biomass production are determined first of all by the properties of habitat and by the degree of adaptation of vegetation to the habitat. At present, there are alreasy numerous data on primary production of some vegetation complexes or phytocenoses at disposal, thanks mainly to the results of the investigations made within the framework of the International Biological Program (IBP); in spite of this, the ecological production data regarding the terrestrial xerothermic vegetation are still not sufficient.

The aim of the present paper is to contribute to the knowledge of the production potential of xerothermic vegetation in ecologically clear-cut ecotopes. The Oblík hill in the Lounské Středohoří (a part of the České středohoří Mountains in the environs of the town Louny) was chosen for the complex ecological investigation. The conic shape of its clearly demonstrated ecologically differentiated habitats showing dependence on their exposures. The uniform parent rock (nephelinic basanite), the relatively small and closed territory of the hill simplified the set of influencing factors, so that the specific location of biotopes in the territory of the Oblík hill could be reduced first of all to the influence of microclimate on dependence on the slope directions, and the consequences of the microclimate could be analysed in detail within the widest ecological context.

The studies of primary production were concentrated only to the hill part covered with grassland vegetation. These stands are convenient for the production analysis, because they are relatively simple in their structure and their succession is often blocked, they are therefore relatively stable, so that they can be assumed to be in dynamic balance with their environ-

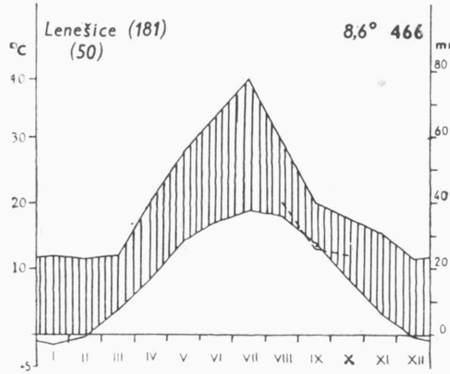

Fig. 1. — Climate diagram for Lenešice meteorological station.

ment. As during the summertime the water on the Oblík hill represents the limiting factor, and hereby it limits and determines the mutual cenotic relations of individual cenotaxa. There arise characteristic, clear-cut plant communities consisting of specific species, which often have the limits of their distribution in our country and their occurrence is therefore confined to localities of this type only.

DESCRIPTION OF THE LOCALITY

The Oblík hill (locally also called Hoblík) is situated about 6 km N. of the town Louny in the southwestern part of the České středohoří Mountains. It consists of nephelinic basanite, which belongs to the group of basalt rocks. It is a laccolith, product of the tertiary volcanic activity, which was gradually exposed by denudation. The basanite is covered with mesozoic upper-Turronic sediments in the form of calcareous loamy soils. The hill top is at an altitude of 508 m. The foot of the denudated laccolith lies at an altitude of 390—400 m, so that it is about 100 m high. The foot of the whole hill lies about 200 m a.s.l. The Oblík hill is solitary in the landscape, which it overtops by about 300 m. The basanite laccolith has steep slopes (angle of inclination about 30—40°).

Of the macroclimatic features, first of all the small amount of annual precipitation and the relatively high mean annual temperatures are of importance. This climatic type is of a more continental character, compared with the more general geographical situation of this landscape. The general macroclimatic character is illustrated by the climatic diagram for the station of Lenešice situated at a distance of about 8 km from the Oblík (Fig. 1).

The mesoclimate of the Oblík, based on our measurements, was found to be more continental in comparison with the macroclimatic values. In contrast with the reference station at Lenešice, lower precipitation and air humidity, higher summer temperature and stronger frosts in winter as well as higher wind speeds were measured here, which results in further negative effects, especially in respect of the water regime on the hill.

It is probable that on the Oblík in the course of the air overflowing as over an orographic barrier (about 300 m in height) during the predominating winds from the western quadrant a foehn effect can arise, which may be regarded as a further cause of the warmer southeastern slope of the whole hill. It is also to be expected that the conic solitary hill can cause the "chimney effect" which manifests itself at noon by the temporary air streaming up the hill slopes and causes the lifting of free airlayers above the hill, as described by GEIGER (1961) in the analogous conditions. By this effect also the reduced frequence of precipitation on the Oblík in comparison with the reference meteorological station at Lenešice could be explained.

At an altitude of 440—460 m, the so-called "warm slope zone" sensu Geiger's "warme Hangzone" was delimited on the Oblík, in which the extreme microclimatic properties of the ecotopes most distinctly manifested themselves. As a result of our measurements, the relatively low amplitude of daily temperatures and the relatively low absolute soil humidity were found at this altitude both by all individual measurements and in the annual mean values on the whole hill.[1])

CHARACTERIZATION OF BIOTOPES UNDER STUDY

At the isohypse of 460 m (in the site of the "warm slope zone") a transect was laid around the hill cone, and 6 grassland biotopes orientated to 6 directions (NW., W., SW., S., SE., E.) were delimited. The northern slope was not investigated because of the woody vegetation growing on it, which was not included in the production analysis. The communities of grassland biotopes can be included into the alliance *Festucion valesiaceae* KLIKA 1931, mostly into as. *Erysimo crepidifolii-Festucetum valesiaceae* KLIKA 1933, the eastern biotope predominantly into as. *Carici humilis-Festucetum sulcatae* KLIKA 1951.

Northwestern biotope. Biomass samplings were localized in a facies with dominant *Geranium sanguineum*. Community cover was 100%, slope inclination 35°.

Phytocoenological relevé in sample plots: E_1: *Geranium sanguineum* 5, *Carex humilis* +, *Koeleria gracilis* +, *Festuca sulcata* +, *Festuca valesiaca* +, *Asperula cynanchica* +, *Euphorbia cyparissias* +, *Fragaria viridis* +, *Anthericum liliago* r, *Muscari tenuiflora* r, *Vicia angustifolia* r, *Lathyrus pannonicus* r.

Western biotope. Biomass samples were taken in the facies with dominant *Linum austriacum*. Community cover was 80%, slope inclination 30°.

Phytocoenological relevé in sample plots: E_1: *Linum austriacum* 4, *Festuca sulcata* 2, *Koeleria gracilis* 2, *Carex humilis* 1, *Asperula cynanchica* +, *Euphorbia cyparissias* +, *Erysimum crepidifolium* +, *Potentilla arenaria* +, *Sesseli hipomarathrum* +, *Thymus praecox* +, *Anthericum liliago* r, *Calamintha acinos* r, *Fragaria viridis* r, *Muscari tenuifolium* r.

Southwestern biotope. Biomass samples were taken in the facies with dominant *Stipa* sp.div. Community cover was 60%, slope inclination 30°.

Phytocoenological relevé in sample plots: E_1: *Stipa dasyphylla* 3, *Stipa smirnovii* +, *Stipa capillata* +, *Stipa pulcherrima* r, *Carex humilis* +, *Festuca sulcata* +, *Koeleria gracilis* +, *Asperula cynanchica* +, *Dianthus carthusianorum* +, *Thymus praecox* +, *Anthericum liliago* r, *Euphorbia cyparissias* r, *Sedum rupestre* subsp. *reflexum* r.

Southern biotope. Biomass samples were taken in the facies with dominant *Festuca valesiaca*. Community cover was 70%, slope inclination 35°.

Phytocoenological relevé in sample plots: E_1: *Festuca valesiaca* 3, *Thalictrum minus* 2, *Stachys recta* 1, *Teucrium chamaedrys* 1, *Koeleria gracilis* 1, *Festuca sulcata* +, *Alyssum montanum* +, *Arenaria serpyllifolia* +, *Asperula cynanchica* +, *Erysimum crepidifolium* +, *Medicago falcata* +, *Myosotis micrantha* +, *Potentilla arenaria* +, *Salvia pratensis* +, *Thlaspi perfoliatum* +, *Dianthus carthusianorum* r, *Euphorbia cyparissias* r, *Stipa capillata* r, *Stipa joannis* r, *Echium vulgare* r, *Agropyron intermedium* r.

Southeastern biotope. Biomass samples were taken in community with *Teucryum chamaedrys*. Community cover was 50%, slope inclination 40°.

Phytocoenological relevé in sample plots: E_1: *Teucryum chamaedrys* 2, *Festuca valesiaca* 1, *Stipa capillata* 1, *Stipa joannis* 1, *Bothriochloa ischaemum* +, *Koeleria gracilis* +, *Melica transilvanica* r, *Carex humilis* +, *Arenaria serpyllifolia* +, *Asperula cynanchica* +, *Eryngium campestre* +, *Euphorbia cyparissias* +, *Potentilla arenaria* +, *Sesseli hipomarathrum* +, *Thymus praecox* +, *Artemisia campestris* r, *Erysimum crepidifolium* r, *Oxytropis pilosa* r, *Salvia pratensis* r, *Sedum rupestre* subsp. *reflexum* r, *Silene otites* r, *Verbascum lychnitis* r.

Eastern biotope. Biomass samples were taken in the community with dominant *Agropyron intermedium*. Community cover was 100%, slope inclination 40°.

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[1]) The habitat characters of the Oblík hill are quoted according to the paper by SLAVÍKOVÁ et al. (in press).

Phytocoenological relevé in sample plots: E_1: *Agropyron intermedium* 4, *Festuca sulcata* 2, *Festuca valesiaca* 1, *Artemisia pontica* +, *Coronilla varia* 1, *Euphorbia cyparissias* +, *Falcaria vulgaris* +, *Medicago falcata* +, *Teucryum chamaedrys* +, *Asperula cynanchica* r, *Fragaria viridis* r, *Koeleria pyramidata* r.[2])

METHODS

For the biomass estimation the destructive method was used. For the biomass sampling it was necessary to delimit an area with relatively homogeneous climatic conditions. The area dimensions on the conic hill therefore were limited, viz. in the direction of the isohypse by an exact orientation to the respective direction; in the vertical direction it was delimited in such way that the microclimatic gradients arisen along the slope line of steep slopes were not too evident. In the destructive method studies it was necessary to take into consideration that the Oblík hill is a protected area so that the samples had to be taken carefully in order to minimize the damage to the areas under study. Furthermore, it was necessary to respect the preservation of stands for other ecological studies which were carried out simultaneously. Owing to these specific conditions, the aboveground biomass was sampled at individual biotopes by destructive method from three plots, each of them of 50 × 50 cm in size. The relatively low number of plots was compensated by the circumstance that the homogeneity of the vegetation was taken into account (localization of plots in the facies) and that so-called paired plots were chosen for sampling (paired-plots method), analogously as given by WIEGERT et EVANS (1964) for the decomposition studies. In the spring time on the western and southern sides, where the vegetation was less homogenous, the samples were taken from 5 plots respectively. The production estimations were made in the course of three seasons at monthly intervals from March to November (1973, 1974, 1975).

As the vegetation on the Oblík hill can be regarded as relatively stable (as blocked succession stages), it was possible to use for the computation of mean biomasses at respective biotopes the biomass data of three vegetation periods (1973, 1974, 1975) and thus to triplicate the data. At the same biotope the biomass value is determined first of all by the weather of the respective year and therefore it changes in dependence on the remarkably different course of weather in individual years; thus, the mean values ascertained in the course of several vegetation periods for a respective biotope were more representative.

The aboveground biomass was divided into living and dead biomass. All material was dried at 80 °C and the dry matter was expressed in g m^{-2}.

For a more illustrative conception of the biomass changes during a certain time interval, the expression of the "biomass duration" (BMD) sensu KVĚT et ONDOK 1971 was used. It is defined as a time integral value of the total biomass (W) during a time interval (t):

$$BMD = \int_{t_1}^{t_2} W dt.$$

The underground biomass was sampled at the same biotopes as the aboveground one. There were taken monoliths of 25 cm^2 in size (repeated three times respectively) at the end of the vegetation periods of the years 1973, 1974, and 1975. The depth of monoliths was chosen in conformity with the depth of the main layer of rhizosphere for all habitats (12 cm). The unearthed root monoliths were dipped for 24 hours in the H_2O_2 solution (SLAVÍKOVÁ 1968). Afterwards they were washed under streaming water in a set of sieves. After drying at 70 °C they were weighed and expressed as g m^{-2}.

The phytocoenological relevés were taken according to the standard Zurich-Montpellier method. The area of individual relevés amounted to 16 m^2; the relevés were located to sites with relatively homogenous stands, where the samplings of biomass also were taken.

The data on the soil moisture, evaporation and on the adaptations of phytometers to the stand moisture were taken from the paper by RYDLO (1973), and the phenological data from the paper by BŘEZINOVÁ (1973).

The thickness of the soil horizon A was measured in the soil profiles at the biotopes under study.

RESULTS

The values of the living aboveground biomass in dependence on the respective directions are illustrated in Fig. 2. They represent the mean

[2]) The names of vascular plant taxa are given according to ROTHMALER (1972).

results of maximum biomasses in the course of three vegetation periods. The highest value was found at the northwestern biotope (498,9 g m^{-2}), a little lower it was at the eastern (381,5 g m^{-2}), and the lowest one at the southeastern biotope (208,2 g m^{-2}); the other three biotopes under study, viz. the western (280,3 g m^{-2}), southwestern (305,1 g m^{-2}) and the southern

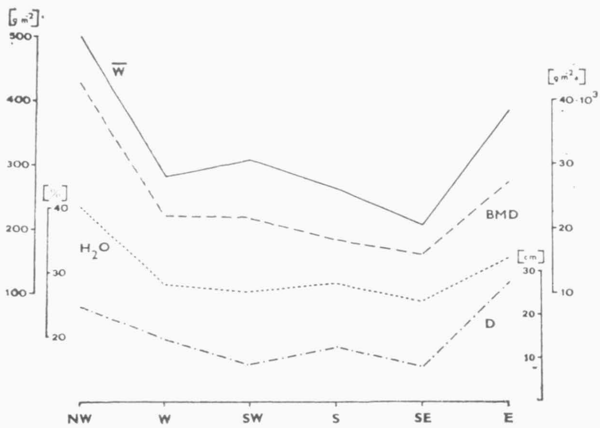

Fig. 2. — Above ground living biomass at the peak of their development (W mean dry mass of three seasons) /g m^{-2}/ and biomass duration (BMD) /g dry mass $m^{-2} \times$ growing season/, mean year soil moisture (H_2O) /% dry mass/ and depth of A soil horizon (D) /cm/ on the isohypse transect 460 m with NW., W., SW., S., SE., E. orientation.

(260,0 g m^{-2}), showed the intermediate values. In the same illustration the values of biomass duration BMD (sensu Květ et Ondok 1971) in the isohypse transect round the hill are shown. It is the integral value of dry biomass during the vegetation period. For a comparison of the dependence of biomass production on several fundamental characters of the habitat, the mean annual value of soil moisture and the thickness of the soil horizon A are added.

Figs. 3 and 4 represent the dependence of the maximum biomass on the thickness of the soil horizon A and on the mean annual value of soil moisture. In both cases the regression coefficient of this dependence is highly significant.

In Fig. 5 the dry masses of the living dry aboveground biomass in individual months at biotopes of various exposures are given. In this graph the changes of the biomass production in dependence on the microclimate of individual habitats and simultaneously also on the phenology of plant populations, i.e. the growth speed and development (or dying) of the biomass, are distinctly evident. In the beginning of the vegetation period (end of March), the greatest aboveground biomass was found on the southern slope, whereas on the northwestern slope the biomass was the lowest. On the eastern slope the biomass was also relatively low at that time. One month later, most biomass was produced in the northwest, and for all the rest of the vegetation period the biomass continued here to be the relatively highest of all directions under measurement, whereas in the southeast the biomass continuously showed itself to be relatively lowest. During May, the biomass in the east and southwest increased distinctly. The biomass in June achieved on the southwestern slope its relative maximum in the set of all southern measuring plots. In the next months (July, August) a distinct decrease of biomass was already obvious in the whole transect. It proved

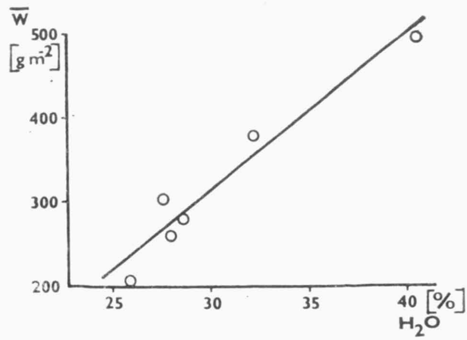

Fig. 3. — Regression curve of the dependence of aboveground living maximum biomass (W mean dry mass of three seasons) /g m^{-2}/ on mean year soil moisture (H_2O) /% dry mass/.

to be relatively most rapid on the southwestern and eastern slopes, whereas the northwestern one still showed its almost absolute maximum value. At the end of August and September the relatively highest biomass within the set of the southern measuring plots was found in the southwest, on the southern slope it showed its relatively minimum values. In October and November the values of the living aboveground biomass became equal, with small maxima in the northwest and east and with a minimum on the southeastern slope.

Fig. 6 illustrates the root to shoot ratio (R/S) in dependence on individual exposures. This ratio in all cases is higher than 1. The highest value of the R/S ratio was found on the southeastern slope, the lowest on on the western slope.

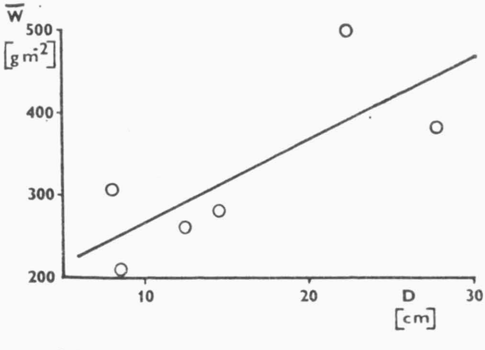

Fig. 4. — Regression curve of the dependence of aboveground living maximum biomass (W mean dry mass of three seasons) /g m^{-2}/ on the depth of A soil horizon (D) /cm/.

At the northwestern and eastern habitats the highest mean values of the aboveground biomass of all directions of slopes under study were ascertained. These two habitats also were the moistest, as regards both their microclimate and their soil space. The habitat on the slope facing the northwest had a microclimate of border communities. The soil had a relatively thicker humus horizon A (20 to 30 cm) and a soil type pointing to the transition to brown earth. The soil moisture all the layer round was above the limit of availability, for the mean annual value significantly higher, and the daily evaporation sum was relatively lower than that for the other grassland biotopes. The water content in the turgescent stage of the phytometer *Teucrium chamaedrys* L., as indication of a long-term adaptation to the habitat moisture, was found here to be the highest of all biotopes under

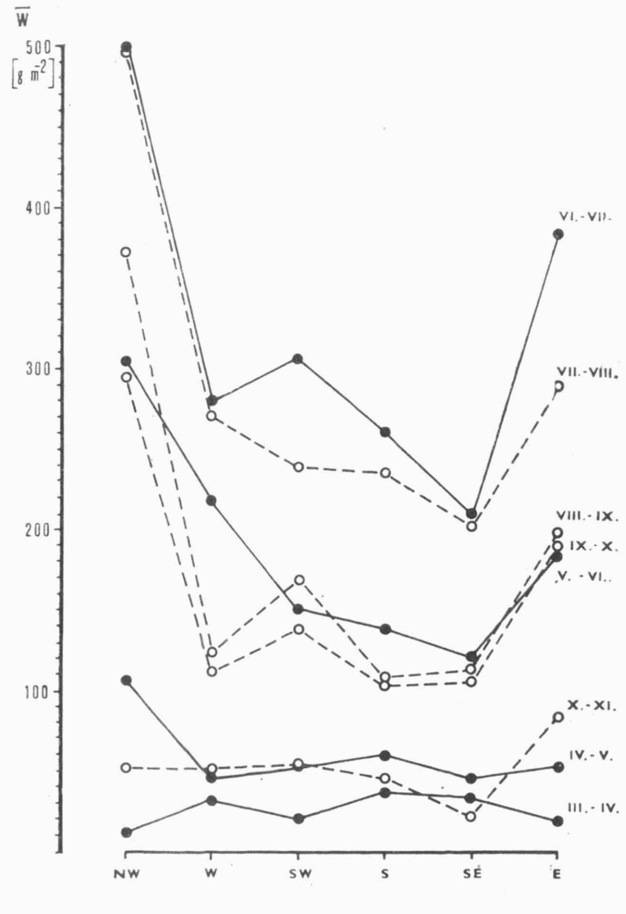

Fig. 5. — Changes in aboveground living biomass (W mean dry mass of three seasons) /g m^{-2}/ on the isohypse transect with NW., W., SW., S, SE., E. orientation in month intervals. Fully line: month intervals from 15. 3. to 15. 6., dashed line: month intervals from 15. 7. to 15. 11.

study. The morphological adaptation of this phytometer also showed the highest values of the characters relating to the leaf area (total, average, and specific leaf area). The regression coefficients of values of these characters of the soil moisture proved to be highly significant (see RYDLO 1973). The eastern habitat was characterized by a relatively thick layer of soil without debris and with little rock as well. The soil type was ranker with a suggestion

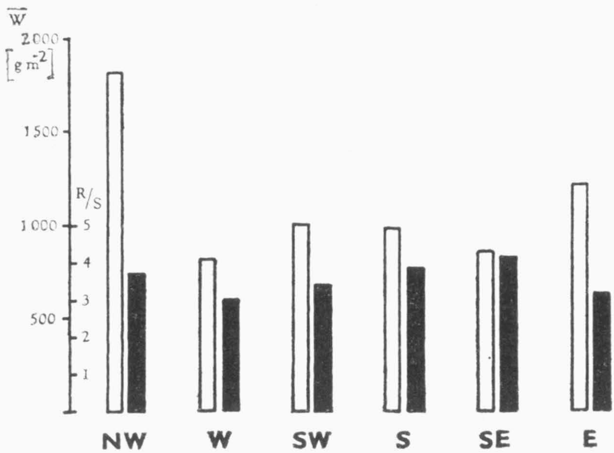

Fig. 6. — Underground biomass (W_r) /g dry mass m^{-2}/ (white columns) and root/shoot ratio (R/S) (black columns) on the isohypse transect with NW., W., SW., S., SE., E. orientation. The values are means of three vegetation seasons.

of development towards the brown earth, with a relatively thick horizon A (22 cm), which at the depth of 50 cm turns into the slightly humose, greyish brown earth of horizon A/B. The eastern biotope belongs to the leeward slope of the hill, where under the influence of overblowing of precipitation from the western quadrant a higher average sum of precipitation was found than on the windward western slope. Thus it is also possible to explain the fact that at this biotope the mean annual value of soil moisture was significantly higher than in the west, with smaller fluctuations of temperature. The daily evaporation sum was also found to be relatively lower than in the west.

Of the morphological adaptations of the phytometer *Teucrium chamaedrys* L., the greater value of the average leaf area, the length-to-thiskness ratio, and the average length of erect stems confirmed the relatively moister conditions of the eastern slope. The latest start of the blooming phenophase of the phytometer *Salvia pratensis* L. of all steppe biotopes under study (BŘEZINOVÁ 1973) is a symptom of a relatively colder character of this slope.

On the other hand, the habitats on the slopes facing the west, southwest and south showed a lower maximum biomass of aboveground parts of the plant.

The western biotope is situated on the windward side of the hill; owing to the predominating winds from the NW and W quadrants, the rain drops were overblown to the leeward side of the hill, so that on the western slope a lower sum of precipitation was ascertained than on the eastern one, which resulted in a lower mean annual value of soil moisture than in the east. The temperature regime at this biotope was only insignificantly lower than on the relatively warmest southern slope. The quantitative evaluation of the blooming phenophase of the phytometer *Saivia pratensis* L. also ranges this biotope in the second place, behind the southern biotope. The soil type was pararendzina rich in gravel and stones and with small rocks penetrating here and there above the soil surface. The soil horizon A was 10—15 cm thick. On the stones the crusts of calcium carbonate are distinctly precipitated, so that here is the highest calcium content of all plots measured.

The southern biotope showed the highest daily maximum of air temperatures; the soil temperatures, however, did not achieve the values of the southwestern stope. The slope angle of 30—40° in the cause of the annual mean value, up to 135 %, of the potential horizontal surface insolation fall here. The annual mean value of soil moisture is very low. The lowest values of the dimensions and stems measured here in the phytometer *Teucrium chamaedrys* L. were a result of a long-term adaptation to the low moisture of the habitat. In the phytometer *Saivia pratensis* L., a rapid seasonal development was noted in the southern quadrant of the hill. The soil type was pararendzina with the horizon A in average about 13 cm thick with gravel scree and stones, on the surface of which calcium carbonate crusts are precipitated.

The southwestern biotope is a site with the highest wind speed — the western and northwestern winds being predominant — in consequence of the by-passing of the conic hill by the air stream along the hill side. Of all the biotopes under study, these were in summer the highest, in winter the lowest soil temperatures were measured here. In consequence of the thin snow layer, soil freezing in depth takes place at this habitat. According to the mean absolute value of soil moisture, this biotope belongs to the driest ones on the Oblík. In dependence on these properties the highest daily sum of evaporation, and the lowest water saturation deficit are stated here. In the phytometer *Saivia pratensis* L. the relatively later start of the blooming phase in comparison with the southern and western quadrants was registered. As the soil type, pararendzina with a very thin (up to 10 cm) and stony horizon A with precipitated crusts occurred here.

This biotope, although belonging — together with the western and southern ones — to the biotopes with a lower soil moisture, showed a relatively higher production in comparison with them. That can be explained by the circumstance that at this biotope the genus *Stipa* sp.d. was distinctly dominant; this genus is evidently in the aboveground as well as in the underground organs which are well-adapted to such a type of habitat both in morphological and in functional respect, so that it is highly productive here. In this case the amount of biomass production is not determined first of all by the properties of the habitat, but it is a result of the productively ecological properties of the plants.

The lowest value of the maximum biomass was ascertained at the southeastern biotope. This biotope represents the relatively warmest habitat. The highest value of the exponential soil temperature and the lowest soil moisture of all habitats were measured here. It is probable that at this habitat a föhn effect can arise. In the phytometer *Salvia pratensis* L. the earliest start, the most rapid development and the course of phenophases among all habitats was noted. The soil type was ranker with a thin (up to 10 cm), decalcified horizon A.

As given above, the Oblík hill is under the influence of the continental mesoclimate type, with a lower annual sum of precipitation, with a lower air humidity, with a greater annual temperature amplitude, and with a higher wind speed in comparison with the macroclimate of the surrounding landscape. Under these conditions, the soil water becomes the limiting factor on the hill slopes in the summer time. The highly significant regression coefficients point to the positive dependence of the biomass production on the thickness of the upper soil layer and on the mean annual values of soil moisture of the respective biotope. A direct correlation between the production of aboveground biomass and the soil water reserve in the semiarid and arid conditions of the Turan Plateau is also mentioned by Bykov (1974) and in the arid regions of the Pamir by Svešnikova (1968). In the course of his studies of the shrub succession stages in the Bohemian Karst under the conditions, when the soil water becomes the limiting factor, Prach (1980) also ascertained a direct dependence of the biomass production on the thickness of the surface soil horizon.

The factors limiting the biomass production at individual biotopes can be evaluated according to the relative biomass production in individual months of the vegetation period. They are first of all the ecological factors of ecotopes (insolation, water, thickness of the soil profile) and the seasonal rhythm of the plants.

In spring, when the soil moisture was still sufficient, the temperature appeared to be the limiting factor for the biomass production: the southern slope with the highest potential insolation produced in the spring time the highest biomass of all directions, whereas on the northwestern slope with the lowest amount of insolation the biomass production was the lowest. In late summer (July, August) the biomass production was evidently limited by the soil moisture, so that in the southern quadrant of the hill, at this time, a relatively low biomass is produced, its minimum being situated in the southeast. The relatively low biomass on the southern slopes in the summer time is also a result of the adaptation of a number of "steppe" plants to the low soil moisture (at this time they are closing their generative and also vegetative phenophases). The distinct biomass peak in June and July at the ecotopes with predominance of grasses (eastern slope with *Agropyron intermedium*, southwestern slope with species of the genus Stipa) and with the dominant *Linum austriacum* on the western slope is a result of their generative phenophase in this time. Within the limits of the southern quadrant, the southwestern ecotope – owing to the extreme microclimatic conditions in early spring (March, April) – showed a low biomass production; since the half of May until the end of the vegetation period, however, it kept the highest biomass of all the southern habitats. This relatively high biomass on the southwestern slope is evidently a result of the higher production ability of the Stipa species.

During September, with more precipitation, the descrease of biomass at all ecotopes was retarded owing to the new regeneration of vegetative organs, first of all as regards the grasses. Bernard (1974) described in a biomass, with *Poa pratensis* as the dominant species, yet another peak of the curve in autumn, which followed after the summer depression. RYCHNOVSKÁ et ÚLEHLOVÁ (1975) recorded in the genus *Stipa* a second phase of biomass production in autumn.

The "steppe" character of habitats on the Oblík hill was manifested by the ascertainment of the root to shoot ratio (R/S). This ratio amounted in all cases to more than 1, in accordance with the data from the arid regions (e.g. BRAY 1963, DAHLMAN et KUCERA 1965, NECHAJEVA 1968, SVEŠNIKOVA 1968). Probably also the dependence on the lower cover value of the aboveground parts of the plants asserts itself. The highest value of the R/S ratio was measured on the southeastern slope of the Oblík, where also the lowest aboveground biomass, the lowest cover and the lowest soil moisture, expressed in the mean annual values, were ascertained, in addition.

SUMMARY

On the conic hill Oblík in the southwestern part of the České Středohoří Mountains, not far from the town of Louny, the dependence of the biomass production on various exposures in each direction was investigated. The uniform parent rock made it possible to connect the specific distribution of biotopes on the conic hill first of all with the influence of microclimate in the same way as it is differentiated by their exposures. Along the isohypse of 460 m a.s.l., six grassland biotopes facing NW., W., SW., S., SE., and E. were delimited.

The relatively highest values of the maximum living aboveground biomass and also the biomass duration (BMD) in mean values of three vegetation periods were ascertained at the northwestern and eastern biotopes. At both biotopes relatively thicker soil horizons A and higher mean values of soil moisture were found than at the other exposures. The lowest maximum aboveground biomass and its duration were ascertained at the southeastern biotope, where a relatively thin soil horizon A (up to 10 cm) and the lowest mean annual value of soil moisture occurred. By the regression coefficients a significant dependence of maximum aboveground biomass production on the thickness of the surface soil horizon and on the mean annual soil moisture were confirmed. The genus *Stipa* sp. div. proved to be a highly productive plant even on the thin horizon A and at low values of soil moisture, apparently owing to its specific morphological and functional adaptations.

On the basis of the production analyses at monthly intervals at biotopes of various exposures it was found that the biomass was produced under the influence of water and solar energy as limiting factors in dependence on the changes of these factors in the course of the vegetation period. Together with them also the seasonal rhythm of the plant population of the respective community asserts itself.

The root to shoot ratio (R/S) showed the highest value in the southeastern biotope, where the lowest aboveground biomass, the lowest mean annual value of the soil moisture and the lowest total cover value of vegetation of all the biotopes under study were ascertained.

SOUHRN

Na kuželovitém kopci Oblíku v Lounském středohoří byla studována závislost tvorby biomasy na různých exposicích ke světovým stranám. Jednotná matečná hornina kopce umožnila, že specifické rozložení biotopů v rámci kuželovitého kopce je možno spojit především s vlivem mikroklimatu tak, jak je diferencován jejich exposicí ke světovým stranám. Na vrstevnici 460 m bylo na kopci vymezeno šest travinných biotopů s exposicí k NW, W, SW, S, SE, E.

Relativně nejvyšší živá nadzemní biomasa a také trvání biomasy (BMD) v průměru za tři vegetační sezony byla stanovena na severozápadním a východním biotopu. Na obou těchto biotopech byl relativně hlubší A horizont půdy a vyšší průměrná půdní vlhkost než na ostatních exposicích. Nejnižší nadzemní maximální biomasa a její trvání bylo stanoveno na jihovýchodním biotopu, kde byl poměrně mělký A horizont půdy (do 10 cm) a nejnižší průměrná roční půdní vlhkost. Regresními koeficienty byla potvrzena průkazná závislost tvorby nadzemní maximální biomasy na hloubce povrchového horizontu půdy a na průměrné roční půdní vlhkosti. Rod Stipa sp. div. se projevil jako vysoce produkční rostlina i na mělkém A horizontu půdy a za nízkých půdních vlhkostí, zřejmě následkem svých specifických morfologických a funkčních adaptací na taková stanoviště.

Na základě produkčních analýz v měsíčních intervalech na biotopech s různou exposicí se ukázalo, že biomasa je utvářena pod vlivem limitujících faktorů vody a sluneční energie tak, jak se na biotopech s různou exposicí mění v průběhu vegetační doby. Spolu s nimi se uplatňuje rovněž sezónní rytmus rostlinných populací příslušného společenstva.

Poměr biomasy podzemních částí rostlin k biomase nadzemní (R/S) měl nejvyšší hodnotu na jihovýchodním biotopu, kde byla zjištěna nejnižší nadzemní biomasa, nejnižší půdní vlhkost v ročním průměru a nejnižší celková pokryvnost vegetace ze všech sledovaných biotopů.

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