

EDUARD KRIPPEL

MAP OF VEGETATION DEGREES AS A FOUNDATION FOR THE
PHYSICAL-GEOGRAPHICAL REGIONALIZATION
(ON THE EXAMPLE OF SOUTH-WESTERN SLOVAKIA)

Dans son travail, l'auteur décrit la carte des degrés de végétation de la région de la Slovaquie Sud-Ouest qui représente une carte partielle pour la régionalisation physico-géographique du territoire en question.

Dans la carte, il a différencié 5 degrés de végétation contenant 15 groupes des types forestiers (14). Il caractérise les types individuels, rangés en degrés de végétation, par l'état de choses à l'habitat, qu'il a reconstruit basant sur les peuplements actuels et sur les analyses paléobotaniques (analyses de pollen et de carbone). A la fin de l'oeuvre, il présente un essai de lier les degrés de végétation individuels à l'échelonnement typologique du territoire (10). A l'aide de la méthode décrite dans l'oeuvre, le territoire est traité de la Slovaquie entière, à l'échelle 1:200 000.

The vegetation map also belongs to the complex of foundations for the physical-geographical regionalization. The vegetation cover as a very sensitive indicator responds to all the changes in the other physical-geographical constituents of nature, such as climate, soil, geological structure of the substrate, geomorphology and animal kingdom. A suitably elaborated map of the vegetation can thus serve for making precise the boundaries of the units of other maps of the physical-geographical environment.

Several types of vegetation maps may be constructed according to what units are put on the map — real units or potential units. In mapping real units we map the vegetation as it really exists. Such may be for instance maps of forest vegetation (associations), meadow vegetation, agricultural cultivation and the like. In mapping potential vegetation we have recourse to reconstruction (in the widest sense) and we map even units which do not exist in the given territory at the present time.

From the territory of Slovakia we know so far a few types of maps of the vegetation cover of which not a single one satisfied the requirements of the physical-geographical regionalization. Perhaps the reconstruction geobotanical map satisfied these requirements most, but it has not been completed up to the present.

Maps of the phytogeographical division of our territory, several of which have been elaborated, are not suitable for this purpose on the one hand for their large scale (1:500 000 and more) and on the other for their overall conception. Although the authors of some of them took into account in their preparation all the stand-conditions (3), in controversial cases they favour the spreading of the so called remarkable species, so that it happens that some territories which have equal physical-geographical conditions are mapped differently.

Maps of the contemporary vegetation, whether forest or agricultural do not suit our purpose for the reason that the forest and agricultural cultures do not reflect the natural conditions of the environment. Man has planted, for instance, spruce cultures in such places where spruce never grew, or he grows such crops in fields which for him are economically more advantageous and not those which would grow better in the given territory, i. e. they would reflect the conditions of the environment. Also maps of agricultural production types (geomorphic maps) which we have on a detailed scale enough of the whole territory of Slovakia, do not suit our purpose, since they were elaborated on the basis of percental composition of the crops grown in such or such a territory and not according to the factors mentioned in the preceding paragraph.

Under present conditions for physical-geographical regionalization the most suitable map seems to be that of vegetation degrees drawn according to typological forest maps (14).

The given method (l. c.) distinguishes in the territory of Slovakia 9 vegetation degrees and the flood-plain.

1. oak degree
2. beech-oak degree
3. oak-beech degree
4. beech degree
5. fir-beech degree
6. spruce-beech-fir degree
7. spruce degree
8. dwarfed pine degree
9. alpine degree

Flood-plain.

It divides all the degrees into 4 orders: A with an acid substrate; B with a neutral substrate up to moderately acid; C substrate with a good formation of humus; D strongly limy substrate.

In the territory of Slovakia there have been elaborated forest-typological maps on the scale 1 : 200 000 by a group of authors from the Forest University at Zvolen (13). The individual forest types reflect the stand-conditions of the localities where they occur with regard to soil, climate and position. Each mapped unit is characterized not only by plant association but also with reference to the soil, climate and position conditions, where the association grows.

In the territory of Slovakia forests occupy 37.6 % of the area. The remainder which belongs to field cultures, meadows, pasture-lands and habitation had to be reconstructed for the map of vegetation degrees according to other physical-geographical criteria. For this purpose various maps were used, soil maps, geological and geomorphological maps, climatic maps and in the largest measure the reconstruction of the vegetation cover by means of paleo-botanical methods (pollen analysis, and analysis of woods-carbons).

The use of the map of vegetation degrees for the physical-geographical regionalization in this paper is shown on the example of the territory of south-western Slovakia (sheets 1:200 000 Wien, Bratislava, Čalovo).

In the territory on the map, 5 vegetation degrees are illustrated and a flood plain with the following groups of forest types:

Degree	Order	Group of forest types
1	A	1a <i>Querceta pinea inferiora</i>
	B	11 <i>Carpini-querceta</i>
	D	28 <i>Corni-querceta pubescentis</i>
2	B	12 <i>Fagi-querceta</i>
		19 <i>Carpini-querceta fagi</i>
3	B	13 <i>Querci-fageta</i>
	C	20 <i>Tili-acereta inferiora</i>
4	B	14 <i>Fageta paupera superiora</i>
		15 <i>Fageta typica</i>
5	D	30 <i>Fageta dealpina superiora</i>
Flood plain		8 <i>Buleto-querceta</i>
		9 <i>Betuleto-alneta</i>
		23 <i>Salici-alneta</i>
		24 <i>Fraxini-querceta roboris</i>
		25 <i>Ulmi-fraxineta populi et ulmi-fraxinetao carpini.</i>

1st degree: oak degree, order A

1a *querceta pinea inferiora* are a sub-group of pine forest on the wind-borne, limeless sands of the *Záhorská nížina* with a height between 140 and 240 m. above sea level. The present-day vegetation has been planted by man. In the documents of the 17th century we come across the mass planting of *Pinus silvestris* for the first time when foresters from the Garonne region in France were invited to this lowland. These started planting pine monocultures according to the model of the French „LANDES“.

In the original forests of the lowland there was a greater mixture of deciduous trees, especially *Quercus* sp. div. and the whole forest area was not so large as it is at the present (8).

Most of the territory mapped as *Pineto-Quercetum* is today covered by a highly productive forest of *Pinus silvestris* (Fig. 1). Non-forested areas in the neighbourhood of inhabited sites serve agriculture with a relatively small production. Until the present in the territory there are many areas of sandy soils which are not utilized and which have remained after clearings, or the neglect of unproductive agricultural soils. At the present time there are few original, non-forested areas with a typical psammophilous vegetation. They are covered with the associations *Festucetum vaginatae* and *Corynephorretum canescentis*.

Of the agricultural productive types in this unit there are represented the maize type, with maize-rye and maize-barley types and the beet type with the beet-rye and beet barley subtypes.

1st degree: oak, order B.

11 *Carpini-Querceta* are widespread in the lower sites of the Malé Karpaty Mts. in their north-western and south-western slopes and in the whole loess portion of the Dolné Povazie (Lower Váh Valley). Together with the group of alluvial forest types, this type occupies the largest area of the mapped out territory.

The original forests of this part of the territory were formed by oaks, i. e. *Quercus petraea* and *Q. robur*. Along with them were mixed *Quercus cerris*, *Tilia cordata*, *Corylus avellana*, *Cornus mas*, *Ligustrum vulgare*, *Staphylea pinata* and others.

The herbal horizon was characterized by xerophilous kinds of grass such as *Stipa capillata*, *Chrysopogon gryllus*, *Bothriochloa ischaemum* and thermophilous plants, for instance *Dictamnus albus*, *Lithospermum purpureacoeruleum*, *Geranium sanguineum*



Fig. 1. Most of the area A order in the oak degree is covered by artificially planted pine forests. Záhorská nížina (lowland) near Malacky.

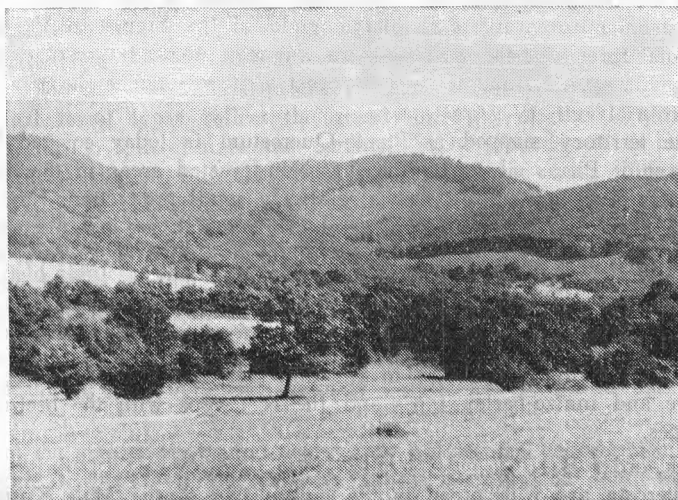


Fig. 2. *Carpini-Querceta* are a member of order B in the oak degree. In the figure shown in the lower parts of the mountain chain. In the higher and peak portions there is *Fagetum dealpinum* from D order, of the fir-beech degree. The group Vysoká in the Malé Karpaty Mts.

and others. On small areas up to the present there have been preserved the remains of such forests, naturally strongly influenced by man (Senec—Pezinok, Šintava—Dvorníky and others).

The original forests of this group were changed by man in one case rejuvenated forests and in the other case to agricultural crops. Very often especially in the lowland area, the oak forests were used on account of the abundance of acorns as pasture lands especially for pigs. For the abundant crop of acorns old and ancient oaks were intentionally left standing. Such husbandry with the forest resulted in a change in the specific constituents in all the components of the forest. In the lowest, flat areas the *Quercus cerris* acquired a predominance over the other species of oaks. In the hills and in the higher positions, above all in the non-loess substrates, the share of the *Carpinus betulus* was increasing and became the chief competitor of the oak (Fig. 2). In some places of the lowland part of the territory where most of the area was changed to agricultural land, forests were planted with *Robinia pseudoacacia*.

The present-day agricultural cultivation in the territory of the group *Carpineto-Quercetum* can be roughly divided into two agricultural types — maize and beet. In them, upon the loess hills we can distinguish within the framework of the maize type, the maize-rye and in a smaller area the maize-barley sub-types. In the neighbourhood of water courses is found the maize-wheat type. The beet type is represented by the beet-rye and on a smaller area by the beet-wheat types. A very small area is taken up by the beet-barley type.

1st degree: oak, order D.

28 *Corni-querceta pubescentis* are represented only in a small area in the limestone districts of the Malé Karpaty Mts. The chief forest vegetation consists of the association with *Quercus pubescens*. Of the wooded plants besides the main species there occur *Quercus robur*, *Quercus cerris*, *Carpinus betulus*, *Tilia parviflora* and others. The forests are little productive and in most cases they form only a defensive forest Fig. 3.

Agriculture is represented only in a small area by the beet producing type.

2nd degree: beech-oak, order B.

12 *Fagi-querceta* are widespread in the areas at the foot of the Malé Karpaty Mts. on both sides and in their entire northern portion. In the original forests of this type the oak prevailed over the beech. The shrubby undergrowth was less abundant than in the group *Carpineto-Quercetum*. At the present time of the original vegetations there are preserved in the northern part of the Malé Karpaty Mts. carefully managed forests. In the eastern slopes of the southern part of this mountain chain the original forests *Fageto-Quercetum* have been felled and changed to vineyards. A smaller area in the north-western side (towards Záhorie a territory) is covered partly with forests and partly serves for agriculture of the beet producing type. In the northern part of the Malé Karpaty Mts. we meet with the beet producing type in the deforested places.

2nd degree: beech-oak, order C.

19 *Carpini-querceta fagi* (higher degree) are represented on small areas in the Malé Karpaty Mts. on soils which arose on debris. The original forests of this forest type had the character of mixed trees with the predominance of the oak with which were abundantly associated *Carpinus betulus*, *Acer campestre*, *A. pseudoplatanus*, *Tilia parviflora*, *Ulmus campestris* and others. The herbal undergrowth is formed at the present time mostly by nitrophile species such as: *Urtica dioica*, *Alliaria officinalis*, *Chelidonium majus*, *Mercurialis perennis* and so on. The total area of this type is very small, agriculture does not come into consideration.

3rd degree: oak-beech, order B.

13 Querci-Fageta are represented in the central portion of the Malé Karpaty Mts. and in two small islands in the southern part of the Považský Inovec. In the original vegetation of this group the beech prevailed over the oak. In the colder positions along with the beech there could be associated the fir. The occurrence of *Pinus silvestris* and especially of *Pinus nigra* has been caused by man. These two woods represent in more favourable stands together with *Larix decidua* a highly productive forest.



Fig. 3. In the oak degree, order D, defensive forests form a vegetation with *Quercus pubescens*. Pohanská hora in the Malé Karpaty Mts.

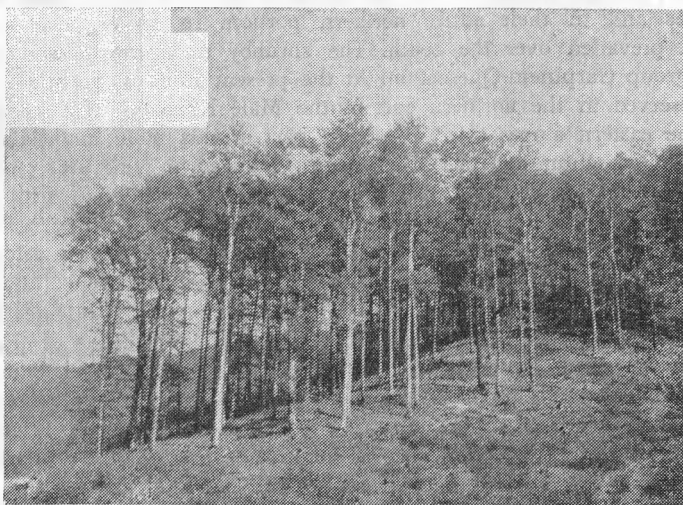


Fig. 4. A typical beech vegetation (*Fageta typica*) is classed into B order of the beech degree. Beech forest in the course of cutting in the group of Raštún in the Malé Karpaty Mts.

Agriculture on the areas of this group is represented only sporadically, namely with the potato productive type.

3rd degree: oak-beech, order C.

20 *Tilia-acerata inferiora* occurs only like small islands in the higher positions of the Malé Karpaty Mts. and the Považský Inovec. In the original vegetation there prevailed the *Fagus* over the other woods. In the present-day vegetation the *Tilia* and *Acer* are found in abundance mixed with the rest. They are in most cases defensive forests on the steeper and scree slopes.

It is not possible to use the areas of this group for agriculture.

4th degree: beech, order B.

14 *Fageta paupera superiora* and

15 *Fageta typica* are represented in the central portion of the Malé Karpaty Mts. In the original forests of both the groups the prevailing wood was *Fagus*. The present-day vegetation is strongly influenced by the forest economic management and it is highly productive (fig. 4).

Agriculture is not represented.

5th degree: fir-beech, order D.

30 *Fageta dealpina superiora* occurs in the highest positions of the limestone district of the Malé Karpaty Mts. (Výsoká, Raštún). The prevailing wood is *Fagus*. The forests of this group have at the present mostly a defensive function. (Figs. 2 and 5).

Agriculture is not represented in the area of this group.

The food plain.

8 *Betuleto-querceta* and

9 *Betuleto-alneta* occur in small areas of the moorlands of the Záhorská nížina. In essence it is question of various stages of the associations in the development cycle of forest vegetation of the moorlands. Originally the associations of this group were represented more abundantly because until lately man had a difficult access to them. At the present time as a consequence of draining the marshy areas and extracting bog peat, they are gradually disappearing. The original structure of these forests of the type *Querceto-Betuletum molinietosum* and *Dryopteridetum crostatae-Alnetum* can be studied even today in some undisturbed localities of the Záhorská nížina (Zelenka, Červený rybník, Bezedné and others) of which some are preserved (9) Fig. 6.

Agriculture in the areas of this group is little represented up to the present, but there is a tendency to change them over to agricultural soils. The yields from them will not, even by far, attain the values which had the original vegetation of alders in regulating the moisture on the sands of the Záhorská nížina.

A single occurrence of the association of this type in the Podunajská nížina is the State natural preserve "Šúr" near Jur.

23. *Salici-Alneta* form an escort of smaller water courses. The present-day representatives of this type are in most cases only sporadic examples of *Alnu glutinosa* and some species of *Salix* which are inconsiderably effaced.

24. *Fraxini-querceta roboris* form forest associations near greater water courses where regular inundations occur. The original forest vegetation was formed by the *Quercus petraea* as the prevailing wood, to which the ash-tree and the poplar were mixed. The unceasing alluviation of the muddy material after inundations conditions, the luxuriant growth of the shrubby and herbal undergrowth. Often especially in vegetation secondarily exchanged there takes place under the influence of a high content of nitrogen compounds in the alluvium soils a mass occurrence of some adventitious species (*Solidago canadensis*, *Eupatorium cannabinum* and others).

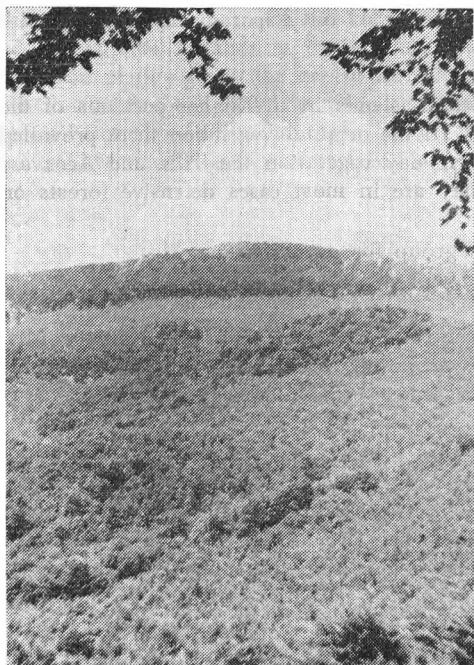


Fig. 5. Fir-beech degree, order D is represented by the group *Fageta dealpina superiora*, Raštún in the Malé Karpaty Mts.



Fig. 6. A significant representative of moorlands in the flood-plain is the group *Betuleto-Alneta*. Bezedné pear Plavecký Štvrtok.

Agriculture is not represented in the areas of this type.

The present-day remains of forests, especially in the area south of Bratislava are strikingly disappearing under the influence of man.

25 *Ulmi-fraxineta populi et Ulmi fraxineta carpini* take up most of the Žitný ostrov and Dolné Považie on uninundated soils. The present-day forests do not take up even 5 % of the original area. The rest of the area consists of agricultural crops which belong to the best of our agricultural productive types (the maize type).

Of the original woods there have been preserved *Acer campestra*, *Quercus petraea* and *Populus tremula*. In many places the original woods have been exchanged for exotic poplars, especially Canadian.

A. Jurko gives details in his work concerning the remains of the forests in the Danubian valley (4). Concerning the development of the forests of this group in the Podunajská nížina details may be found in my palynological study (7).

In the mapped territory several profiles of the moorlands have been evaluated palynologically. Among the most important it is necessary to mention in this place the following localities: Cerová-Lieskové, Pusté Úlany, Tarnoky, Bláhová Dedina and Šúr. All the profiles have been already interpreted (5, 7, 8).

From the archeological findings there have been elaborated many antropotomical analyses from the Palaeolithic period up to the Middle Ages.

From the Palaeolithic settlements were obtained and determined carbons from the following localities:

Banka near Piešťany Pinus (9), Taxus (1), Fagus (1).
 Králová nad Váhom Quercus (1).
 Moravany near Piešťany Acer (3), Taxus (2), Pinus (2), Betula (1), Alnus (1),
 Viburnum (1).
 Prašník Pinus (2).
 Radošiná Alnus (5), Quercus (14), Fagus (1), Corylus (2), Fagus (5), Tilia (2),
 Acer (2), Betula (1), Populus (1), Salix (1), Pinus (8).
 Ružindol near Trnava Pinus (1).
 Sereď Quercus (6), Pinus (1), Rosaceae (1).
 Velké Kostolany Pinus (5).
 Vlčkovce Pinus (76), Quercus (1).
 Zvončín Pinus (1).
 From the Bronze Age:
 Velký Grob Quercus (2).
 From the Hallstatt period:
 Chorvátsky Grob Quercus (1).
 Nové Košariská Alnus (1), Ulmus (5), Populus (10), Quercus (16), Fagus (14),
 Rosa (1), Panicum, A juga, Mercurialis.
 From the Roman period:
 Trakovice Fraxinus (1).
 Trebatice Quercus (1).
 Zohor Quercus.
 From the 4th century:
 Rusovce Triticum monococcum, Panicum sp., Secale sp.
 From the Slavonic period:
 Devín Viburnum (3), Pinus (3), Quercus (4), Corylus (3), Euonymus (1), Fagus
 (2), Prunus (1).
 Kúty Ulmus (1).
 Pobedim Sorbus (3), Quercus (47), Ulmus (19), Euonymus (1), Corylus (1),
 Fagus (5), Tilia (2), Acer (2), Betula (1), Populus? (1), Salix? (1), Pinus (8).
 Senec Quercus (1).
 Siladice Quercus (8), Acer (3), Prunus (3), Fraxinus (1), Salix sp. (1).
 Jur Quercus (1), Crataegus (1).
 Svätý Michal Alnus (1), Quercus (1), Ulmus (1).
 Špačince Quercus (8), Prunus (4), Triticum sp., Secale sp., Hordeum sp., Agro-
 stemma githago.

From the physical-geographical viewpoint of regionalization we can arrange the mapped units into two large typological groups:

1. The intramontane lowland basin of the mild zone and
2. The mountainous country of the mild zone (10).

To the first belong the oak, beech-oak degrees and flood plain. To the second belong the vegetation degrees oak-beech, beech, fir-beech, and the flood plain. In the first group the oak degree characterizes of them the lowlands loess-like and dune-shaped hilly areas dune. The loess-like by order B, duneshaped by order A. The associations of meadow forests reflect the fluvial plains and piedmont swampy depressions with subordinate units, The beech-oak degree corresponds to the divided piedmont.

The oak-beech degree corresponds to the interfluve slopes of uplands and the lower situated relict plateaux of the uplands. The beech degree is mapped in the higher

positions of the core-horst uplands and the fir-beech, at the high backs and crests of the uplands.

A more detailed arrangement of the individual degrees will be possible only after the elaboration of the maps of the other elements of physical geography (geomorphology, pedology, climatology, hydrography and so on).

Translated by Anton Farkaš, B. Sc. (Econ.) Lond.

REFERENCES

1. *Atlas republiky Československé*, mapa č. 113. Česká Akademie věd, Praha 1932. (*Atlas of the Czechoslovak Republic*, map No. 113). — 2. Domin K., *Úvahy a studie o regionálním členění Čech*. Publikace Přírodov. fakulty Univerzity Karlovy č. 9, 1924. (*Considerations and studies concerning the division of Bohemia*). — 3. Dostál J., *Fytogeografické členění ČSR*. Sborník čs. společnosti zeměpisné, 1, 62; 1—18, 1957. (*Phytogeographical division of Czechoslovakia*). — 4. Jurko A., *Pôdne ekologické pomery a lesné spoločenstvá Podunajskej nížiny*, 1958, Bratislava. (*Soil ecological conditions and forest associations of the Podunajská nížina. Danubian lowland.*) — 5. Kintzler O., *Pollenanalytische Untersuchung von Mooren des westlichen pannonischen Beckens*. Beih. Bot. Centralblatt 54, B; 515—546, 1936. — 6. Klášterský J., *Geobotanický přehled*. Čs. vlastivěda sv. 1, Praha 1929. (*Geobotanical survey.*) — 7. Krippel E., *Postglaziale Entwicklung der Vegetation des nördlichen Teils der Donau ebene*. Biológia 18, 10; 730—742, 1936. — 8. Krippel E., *Postglaciálny vývoj lesov Záhorskej nížiny*. Biologické práce 11, 3; 1—99, 1965. (*Postglacial development of the forests in the Záhorská nížina.*) — 9. Krippel E., *Slatinná jelšina (Alnetum glutinosae) na Záhorskej nížine*. Geograf. čas. 19, 2; 93—106, 1967. (*Moorland alder-grove in the Záhorská nížina.*) — 10. Mazúr E., *Typologické členenie*. Rukopis, 1967. (*Typological division, Manuscript.*) — 11. Novacký J. M., *Flóra Slovenskej republiky*. Slovenská vlastiveda, zv. I., Bratislava, 1943. (*Flora of the Slovak Republic.*) — 12. Novák F. A., *Přehled československé květeny s hlediska ochrany přírody a krajiny*. Ochrana čs. přírody a krajiny, 2; 193—400, Praha 1954. (*Survey of stand-conditions of forests in Slovakia.*) — 14. Zlatník A., *Přehled slovenských* — 13. Randuška a kol., *Prehľad stanovištných pomerov lesov Slovenska*. Bratislava 1959. (*Survey of stand-conditions of forests in Slovakia.*) — 14. Zlatník A., *Přehled slovenských lesů podle skupin lesních typů*. (Cyklostyl), Brno 1959. (*Survey of Slovak forests according to the groups of forest types. Cyclostyle.*)