JAROSLAV RAUŠER,

Institute of Geography, Brno

TO THE CONTENTS OF THE BIOGEOGRAPHIC MAP

(New Methods of the Biogeographic Cartography)

Nové metody biogeografické kartografie. — S rozvojem poznání prostorového rozšíření organismů a jejich společenstev se rozvíjelo i jejich znázornění na mapovém podkladě. Rozšíření taxonů bylo znázorňováno různými metodami: bodovou jako nejpřesnější, obvodovou, paprsčitou a mřížovou. Zvláštní pozornost zasluhuje metoda A. Jakubskiho pro vymezení počtu taxonomických jednotek (isospecie, isogeny apod.). Rozšíření rostlinných společenstev zachycují u nás dosud pouze geobotanické mapy, vypracované metodou R. Mikyšky. Zvláštní pozornost zasluhuje mapa skupin lesních typů podle Al. Zlatníka (1959) pro území Slovenska. Jeho mapovací jednotky mají již v podstatě biogeocenologický a biogeografický ráz. Naše biogeografické mapy malých měřítek vycházejí z fysiognomicky nápadných forem reliefu. Organická společenstva zachycujeme v sukcessivních diagramech od přirozených možných organokomplexů až po společenstva antropicky podmíněná. U map malých měřítek vycházíme z rekonstrukce přirozené možné vegetace (na subatlantikum) a mapy doplňujeme sukcesivními diagramy celých organokomplexů.

Together with the development of the recognition of the space distribution of organisms and their communities even their drawing on the base of a map developed. To the oldest biogeographic maps belong those which drew the distribution of individual taxons by the dot-method, being used up to his time as the most exact one. By the application of this method the method of district-line and t' e areal one developed which showed the distribution of the taxons either by a district line or by the covering of the area colonized by a taxon, with colour, haching etc. It was possible to draw the distribution of some taxons at the same time. At a higher number of taxons it was necessary to use instead of dots either the symbols or the signs; similarly like at the district-line method, several types of lines and so the map stops to be synoptic. Both methods may be used at the maps of large scales and of the small ones. Besides these methods we meet in the biogeographic maps even with the so called radial method and the grating one. The first type of the map is used frequently for the drawing of the penetrating of the taxons from the area of continuous distribution into new areas which they did not live in up to this time, so for instance the penetrating of the East European taxons to the west or the penetrating of agricultural damagers into new areas, etc. The grating method is as the qualitative and quantitative one used especially in the last

time for the catching of the distribution of two species the areals of which are bordering on each other in the given area. The map is divided by this method into a system of "grates" which limit a certain area. By the statistical method the quantitative representation of both taxons is established in the area of every square, and their number is drawn in % in the middle of every square by a sector. So we get the image of the region, divided by grates into small square areas, in every of them being a circle with the percentual representation of both taxons. This circle method is used frequently even in the economic geography. From the historical point of view the maps of A. Jakubski (1926) in which the author united by isolines the areas with the same number of taxonomic units (the so called isospecies, isogens, isofamilies, etc.) are interesting. The maps of the Polish zoogeographers help to solve the developmental zoogeographic problems.

Another type are the maps of the distribution of whole organic communities. These are practically only the maps of vegetal communities, while the maps of the animal ones have not been compiled up to this time (comp. with Waibel 1913). The maps of vegetal communities became the base of the geobotanic and forestry mapping and they found many applications in climatology, pedology, economic geography and in a series of practical branches. Numerous the so called reconstruction geobotanic maps and forestry maps show the areal distribution not of the real natural vegetation but of the possible one, the reconstruction of the natural vegetation being from the bionomic and chronologic (to a certain period) point of view on the base of the present state very difficult and often impossible practically. To this group even the geobotanic maps of Czechoslovakia belong which have been mapped in the scale 1 : 75.000 (Bohemia and Moravia); of these maps, maps with a scale of 1 : 200.000 were compiled then for the Czech countries and with a scale 1 : 50.000 for Slovakia. But they do not offer the momentary (present) image of the vegetation and they omit quite comprehensibly the animal component of the community. The Al. Zlatník's map of the groups of forestal types, that appeared for the whole territory of Slovakia (1959) occupies a special position. The units used for the purpose of mapping, have in their substance yet a biogeocenologic and biogeographic character. The basic unit of the typology in the biogeocenologic conception is the forestal type as the complex of natural stadia and of stadia changed differently by the human being. All their degrees of development are seized further on a certain type of permanent conditions, which belong to each other from the point of view of development. These relations are attested scientifically with the aid of parallel areas, bordering on each other and of distant areas which belong to the same type of permanent conditions according to all existing biogeocenologic conditions. The base of indication is first of all the vegetal component of the biogeocenosis, that is its synusiae and even the individual important indication vegetal species. The forestal types are united

into complexes indicated as groups of forestal types. The forestal types belonging to the group, belong to a single vegetation degree and to one of the four rows. The row A is indicated by the dominance of oligotrophic vegetal types, the row B with a substancial participation up to dominance of eutrophic species without the presence or with an unimportant participation of nitrophilous and heminitrophilous species and without participation of proper calciphilous resp. calcicolous species. The row C is characterized by the dominance or the abundant participation of nitrophilous and heminitrophilous species, the row D of calciphilous and calcicolous species on humus-carbonate soils. The biogeocenoses influenced by the higher underground water level or caused expressively by alternating moistening are united into groups, belonging to the oligotrophic complex "a" and to the eutrophic complex "c". The groups of forestal types and the superior vegetation degrees and complexes influenced by the special types of the regime of the ground water are according to the composition of the vegetation inductively and indicatively derived units of higher order, which may be mapped in a gross scale and which affect in different areas by a remarkable association. As for the florogenetic and in general the biochorologic point of view different variations of all units of different degrees are indicated as their geographic variations (A. Zlatník in lit.). The classification of the forestal vegetation into 8 high-degrees (the oak, oak-beech, beech, fir-beech, pine-beech-fir, pine and stunted fir-grade) corresponds to the biogeographic conception too. Even these maps omit comprehensibly on the one side the non forestal area, on the other side the animal component.

Contrary to these maps based on the mapping of the individual taxons or their communities and which are biologic maps, it is necessary to base the vegetation-geographic, zoologo-geographic and biogeographic ones on the fundamental structural units of the region. These basic structural units of the geographic region are understood in a single complex, i.e. physically, biologically and anthropically, the attention in biogeographic maps being paid first of all to the organic communities (organokomplexes), which are characteristic as for the space for a certain unit of the region. They differ in this from the phytogeographic, zoogeographic and geobotanic maps showing on their maps the chorologically remarkable taxons or even their communities. The basic biogeographic unit is supposed to be the Sukačev's (1947) biogeocenosis, accomplishing the claims of the complete gographic conception and joins the abiotic factors (relief, soil, clima) with the organic ones (vegetation and fauna). For reasons of the geographic analysis the biogeocenosis is divided into the phytogeocenosis, which is the base of the vegetation-geographic maps and the zoogeocenosis, forming the base of the zoologo-geographic maps. By the synthesis of both geocenoses we got the biogeocenosis, which is the base of biogeographic maps.

At the maps of large scales (1 : 25.000 and 1 : 50.000) we use at the bio-

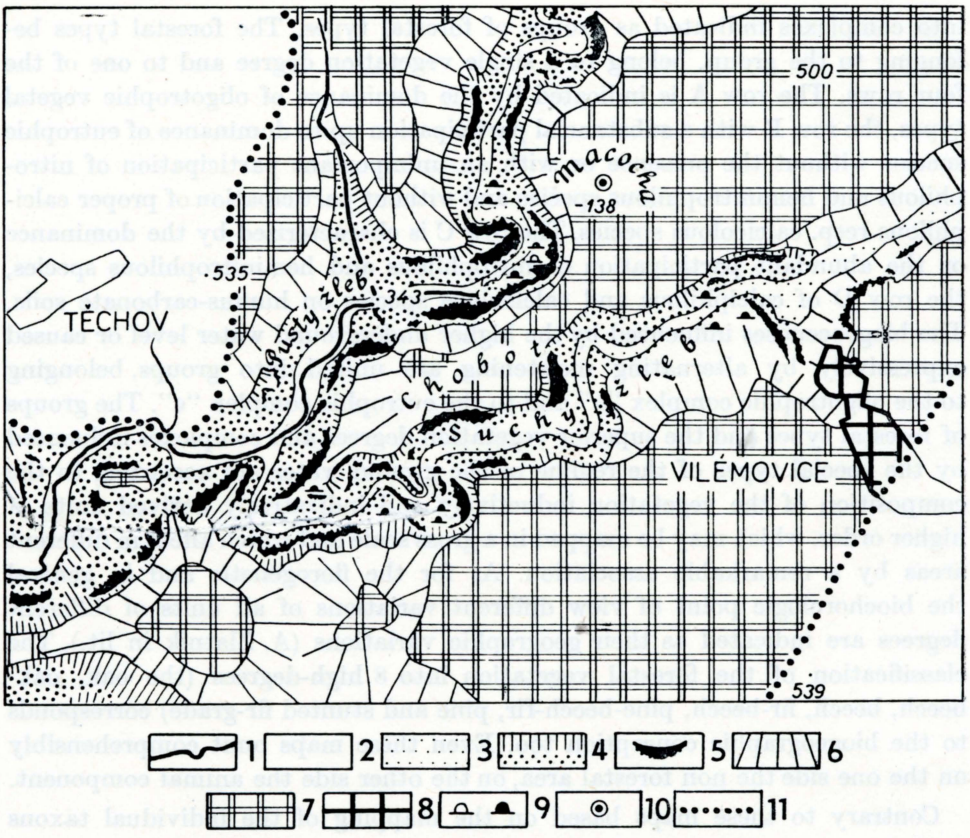

Fig. No. 1. Moravian Karst. Example of biogeographic maps of large scales.
Explanations: Biogeocenoses 1) of a submontaineous torrent in inverse position, 2) of a flood-plain with a water-stream in inverse position, 3) of a flood-plain without a water-stream in inverse position, 4) of steep rocks (vertical slope-lines) partly covered with compacted and uncompacted products of weathering (dotted), 5) of rocks, 6) of loamy gentle slopes, 7) karst plains with deeper soils, 8) of settlement units, 9) of lightened and unlightened caves, 10) of the Macocha chasm, 11) border of the area of Devonian limestones (the area of the Moravian Karst).

geographic mapping of small areas the basic forms of the relief, which are under given conditions of all landscape elements as for the morphologic and physiognomical point of view most striking (rocks, debris slopes, plateaus, canyons, etc.). On these forms of the relief may be shown not only the actual state of the biogeocenosis but even by the reconstruction method the natural state of the organokomplexes to a certain period. Both stadia of reconstruction and the present state of the organokomplexes are as for the genetic point of view closely bound. Besides this, even the anthropic factor influences often in very short-time intervals the features of the organokomplexes of certain relief forms by its activity (cutting down of the forest, clearing, etc.).

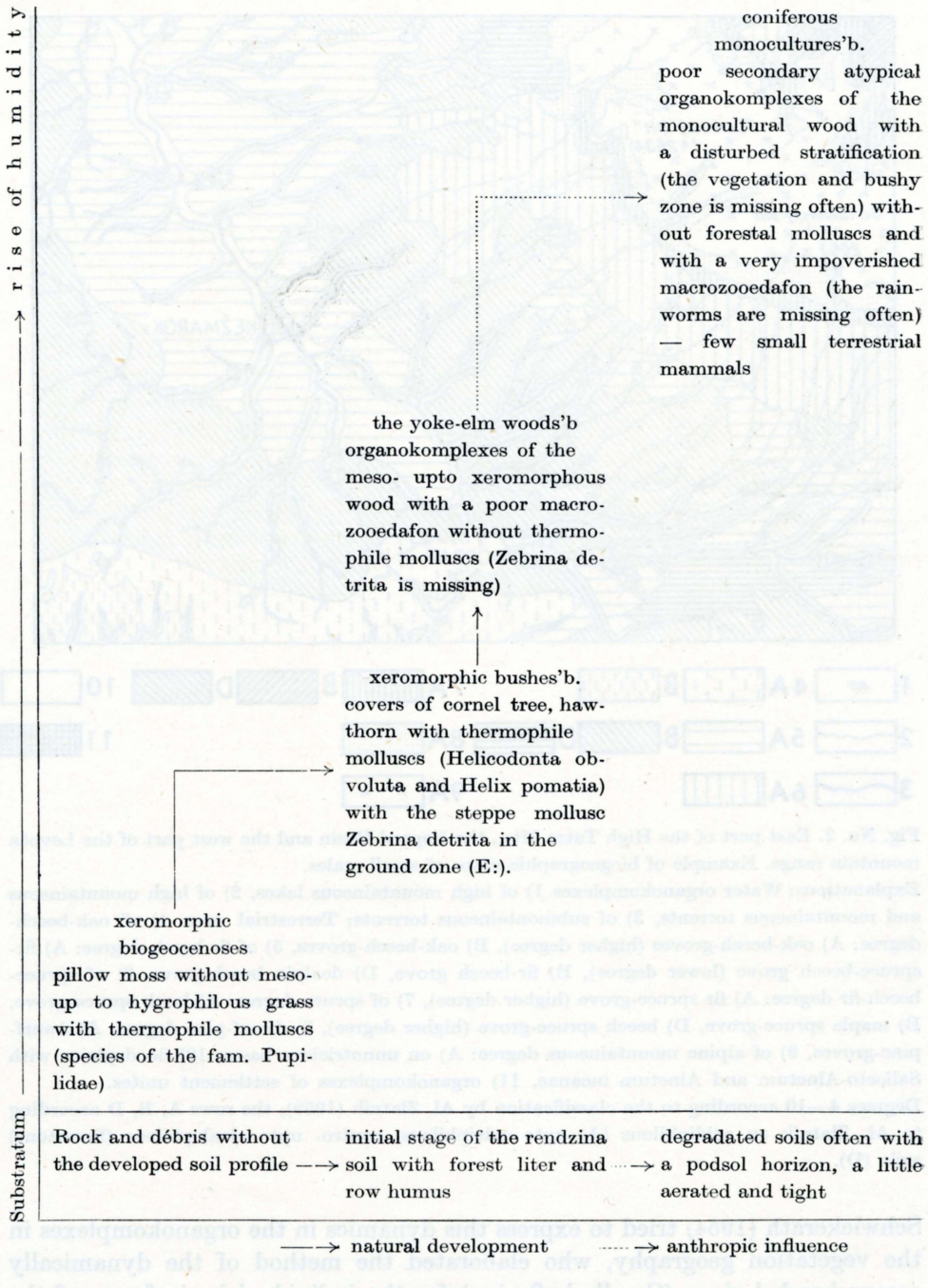

Diagram No. 1. Moravian Karst: scarps partly covered with consolidated or non consolidated débris. Part: sunny débris. (Example of successive diagram of biogeographic maps of large scales). See the map No. 1., explanation No. 4.

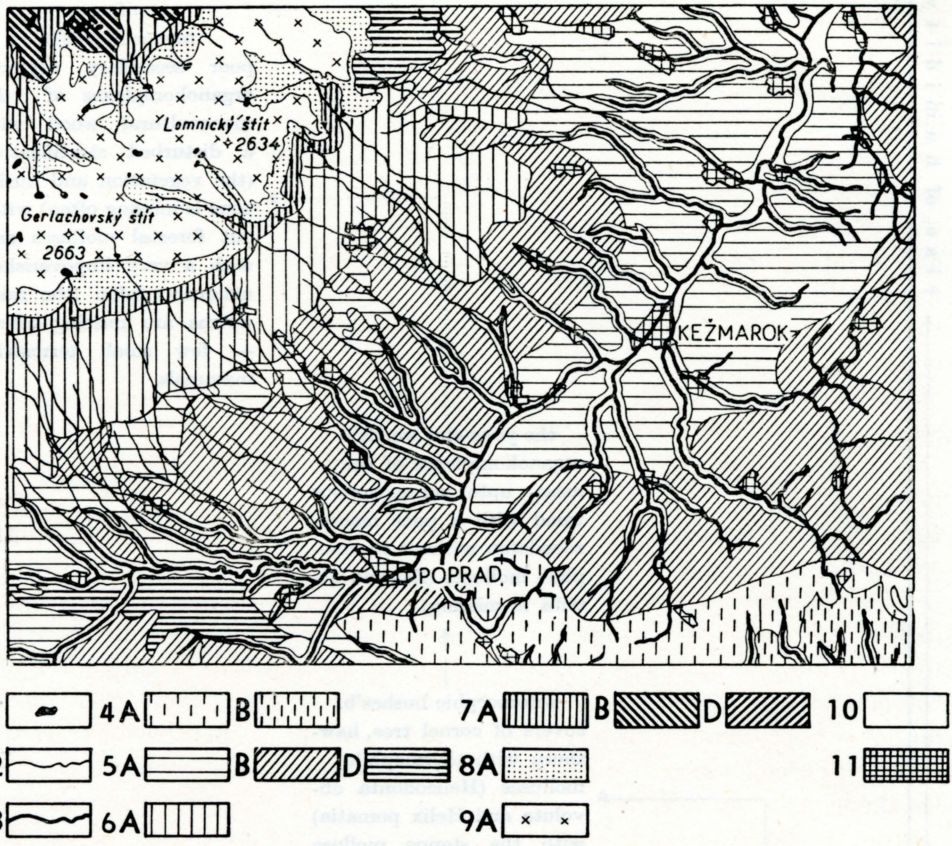

Fig. No. 2. East part of the High Tatra Mts., the Poprad-Basin and the west part of the Levoča mountain range. Example of biogeographic maps of small scales.
Explanations: Water organokomplexes 1) of high mountaineous lakes, 2) of high mountaineous and mountaineous torrents, 3) of submontaineous torrents; Terrestrial ones 4) of oak-beech-degree: A) oak-beech-groves (higher degree), B) oak-beech-groves, 5) of fir-beech degree: A) fir-spruce-beech grove (lower degree), B) fir-beech grove, D) dealpin beech-grove, 6) of spruce-beech-fir degree: A) fir spruce-grove (higher degree), 7) of spruce degree: A) larch spruce-grove, B) maple spruce-grove, D) beech spruce-grove (higher degree), 8) dwarf-pine degree: A) dwarf-pine-groves, 9) of alpine mountaineous degree: A) on unnutricious bases, 10) flood plains with Saliceto-Alnetum and Alnetum incanae, 11) organokomplexes of settlement unites.
Degrees 4—10 according to the classification by Al. Zlatník (1959); the rows A, B, D according to Al. Zlatník on acidiphilous (A) upto calciphilous, neutro- upto alcalophilous (limestone) soils (D).

Schwickerath (1954) tried to express this dynamics in the organokomplexes in the vegetation geography, who elaborated the method of the dynamically comprehended rings (Gesellschaftsring) for the individual basic forms of the relief. The Schwickerath's method has been applied in our biogeographic maps with the difference, that the maps are based instead of on phytocenoses on

whole biogeocenoses, beginning from the basic possible natural biogeographic unit (biogeocenosis) upto the climax stadium of the biogeocenosis of the given form of the relief and of the anthropically conditioned unit (fields, pasture-grounds, monocultures etc.). Besides the organokomplexes even the soil succession is shown here. The solitary although geobiologically important taxons are not shown here therefore, while the vegetation and the fauna in their succession from the lovest biogeocenosis up to the highest possible natural and anthropically conditioned organokomplexes are shown here. This method has not been used yet in the biogeograp' ic maps. This method seems to be the correct one, as this geograp' ic vectorial drawing of the geographic analysis of the community outlines the aim to fix not only the optimum conditions of association, but even its geograp'ic variability on the physiognomically striking form of the relief. By this method the territory of the Moravian Karst (Fig. No. 1) in the scale 1 : 25.000 is mapped, which is geologically homogenous (devonian limestones) and geomorphologically very heterogenous (deep canyons, sink-holes, tors and spurs, etc.), what conditions even the heterogenity of the association rings of the individul basic forms of the relief (diagram No. 1), i.e. from our point of view of the lowest structural units. In the legend and in the description of the map we base on the opinion pointed out correctly by R. Gradmann (1919 : 23) already, that the specification of the individual communities shall be adequate, in the mother-tongue and only then, if we do not subsist on our own terminology, the Latin terms shall be used. At the continental biogeocenoses the primary factor is comprehensibly the vegetation. On the contrary in water streams and in caves (in the karst territory) the first position belongs to the animal component of the biogeocenosis. When elaborating the animal association rings we meet with problems following from the fact, that the animal is not so definite and the zoocenologic methods are in the beginnings only. The biogeographic maps compiled in such a way complete suitably the geomorphologic and pedologic maps of the investigated territory.

The biogeographic maps of small scales (1 : 200.000 and less) are compiled in a similar manner. According to this method even the biogeographic map for the National Atlas of Czechoslovakia has been compiled. The base is the reconstruction map of the possible natural vegetation of the forestal types according to Al. Zlatník, that, as has been shown before, corresponds best to the biogeocenologic and also the biogeographic conception (Fig. No. 2). The basic units are here the vegetation degrees with the rows A—D, reconstructed even on the non forestal area in the Subatlantic period, i.e. in the period, that has not been influenced by the man. The group of the forestal types is given first of all by the qualitative and quantitative combination of the species of woody plants in the main synusiae in the original state of the forest during the actual climate, i.e. for the Subatlantic period. It is attested and proved

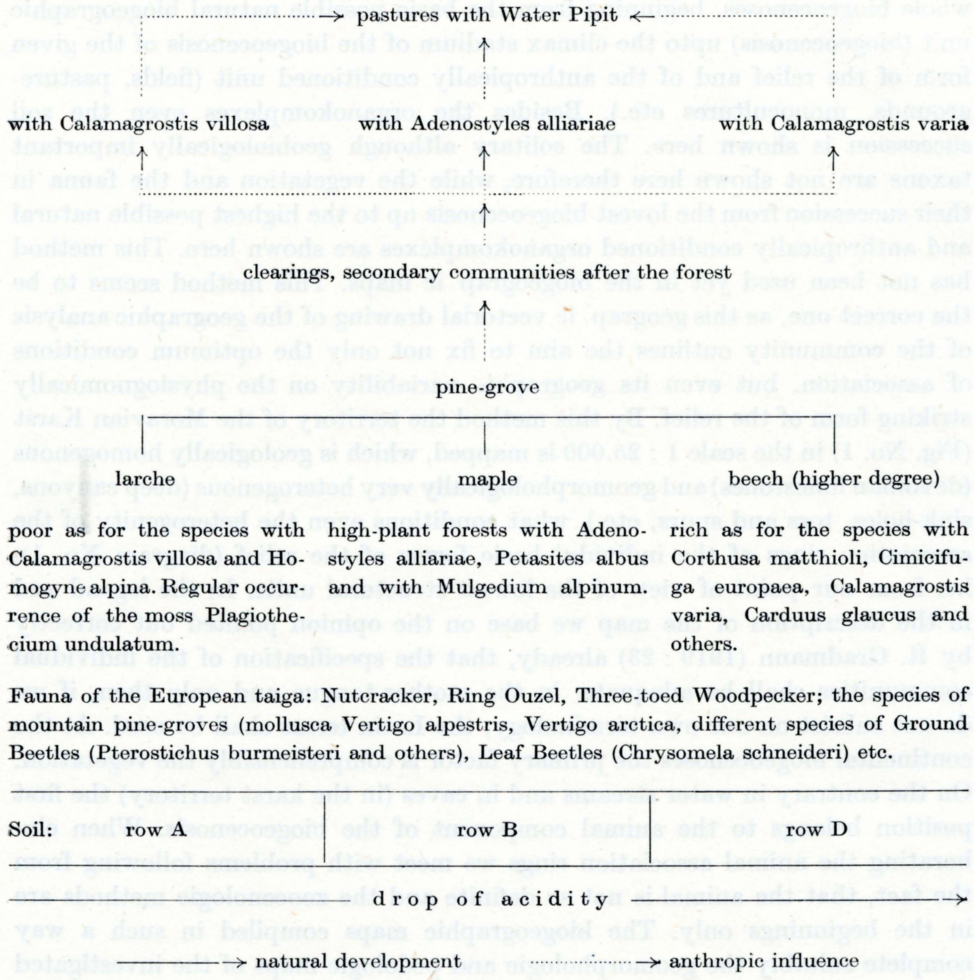

Diagram No. 2. East part of the High Tatra Mts., the Poprad-Basin and the west part of the Levoča mountain range. (Example of the successive diagram of biogeographic maps of small scales). See map No. 2., explanation No. 7.

according to the relicts of the most natural preserved forests and according to the archives documents. The maps are completed with brief succession diagrams (diagram No. 2), showing the complex of the types of the possible and anthropically conditioned biogeocenoses in the given degree. The general character of the map and of the accompanying mark clue represented here by the successive diagrams, has the character of other gographic thematic maps and it differs from them in the dynamic conception of the chained successive processes, which pass constantly in the geographic landscape.

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