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HIERARCHIZATION OF THE COMPONENTS OF THE NATURAL ENVIRONMENT AND THE STUDIES ON RELATIONS BETWEEN NATURE AND MAN

One of the most often applied research approaches concerning natural environmental conditions starts with the classification of the environment into its constituent parts. Since there is a possibility of performing various classifications, according to needs, viewpoints or specificity of research conducted, see e.g. Armand (1975), p. 13 ff. (Polish edition — 1980), Richling (1982), pp. 26—28, Clarke (1971), p. 9, in: Kozłowski, J. K., Kozłowski, S. K., (1983), while their known — up to date — variants give rise to various, but equally strongly justified reservations, it seems correct to adopt the possibly simple, for instance — traditional — division of the earth crust into zones of which almost every one corresponds to a definite component of nature. An exception is constituted by the morphological component, because surface sculpture is in fact only the shape of the earth's surface. In view of this not all scholars agreed to an equal treatment of this component together with the other ones (e. g. Armand, *op. cit.*, p. 13, Dumanowski and Plit 1985, p. 33).

Since not all the components of nature are equally important for human beings, their analysis, at least theoretically, should be preceded by appropriate evaluation. This question, though, as extremely difficult in practical implementation, has not been until nowe adequately solved by geographers. A majority of scholars, who agree that human beings are influenced in a decisive way only by the entire setting of components of nature, indicate one or more of such components, trying to justify their leading significance in each concrete case (see, for instance, Richling, 1982, pp. 59—70, 91). It is fraquent to treat as such components the hydrological and morphological conditions, represented in methodological practice by some of their particular features, like, for instance, the density of river, or valley network, absolute or relative heights, slope angles etc. Let us try, therefore, to approach the solution of this question through the analysis of mutual conditioning of particular com-

ponents of nature, as well as assessment of their influence upon human activity.

In our opinion it is climatic conditions that have the most important position among natural conditions. This particular position results primarily from the fact that all the other components depend in an essential way upon climate, while climate itself depends, to a very limited degree, anyway, only upon a few of them. That is why in the studies of the role of climate in human activity one cannot rely just upon the assessment of these relations in abstraction from the other components, and especially from hydrological conditions, soils and the biosphere. It is namely through these that the indirect influence of climate upon mankind is exerted. It appears that the greatest role with respect to human life was played by the climatic conditions in the early stages of development of mankind (see also Anuchin, 1982, p. 45). This resulted, it seems, from the fact that a primative hunter or gatherer was in general very strongly dependent upon nature, not being able to cope not only with the effects of climate changes, but also with usual climatic cycles. Thus, it is considered that the first human communities remained in a way "imprisoned" within the natural climatic zones of warm and stable climate, and only along with the development of culture, and especially after the inventions of clothes and fire had been made men started to move out to colder zones. Since then the direct influence of climate on human activity appeared in a less perceptible manner, mainly through various limitations on possibilities of economic activities in definite areas which led also to differences in population density. That is why, at present, it is often very difficult to perceive and assess within a given climatic zone the significance for human activity of such a relatively little spatially diversified factor as climate, especially when we consider small areas which are additionally not too diversified as to natural endownment.[1] Within such areas, namely, the factors which are generally less important than climate come to the forefront, since they are more spatially diversified on a local level (see Armand, *op. cit.*, p. 32).

Thus, only when we look at climate on a most general scale we can distinctly see that climate does still limit, to a varying degree, the dimensions of the settlement systems in different climatic areas and that it "influences" the forms of the settlement system. Therefore, it can generally by stated that the influence exerted by climate upon the

[1] Within strongly differentiated areas, such as mountains, there appear, as is known, even over very limited surfaces, great climatic gradients. This makes it possible to track the influence of spatial differentiation of climate on human activity also on a detailed scale.

total pattern of human activity has been and still is very strong and omnipresent, but also, that this influence, differentiating spatially the forms and intensity of settlement, can only be observed — excepting mountains — over adequately vast areas, approaching the scale of solar zones (see, for instance, J. K. Kozłowski and S. K. Kozłowski, 1983, p. 10).

The second component of nature which, similarly as climate, determines to a large degree the other components is the geological one. Hence, the influence of this component upon the human activity is most often also expressed indirectly, through the other, dependent components. Thus, geological structure influences to a great extent the process and extent of erosion, and the permeability of the bedrock, it conditions the mechanical constitution of soils, as well as dynamics of the course of processes within soil, etc. That is why the scholars who emphasize the dominating influence exerted upon the human activity by any of the environment components determined by geology, do in fact also consider the influence of the geological basis "encoded" in the other components. Theoretically one could imagine an area extremly monotonous as to every possible aspect excepting geological structure, so that one could, potentially, perform there an analysis of "pure" differentiating influence of lithology on human activity. A similar analysis, on the example of the neighbourhood of Sydney, was tried by Thomas Griffith Taylor, who explained solely by the differences in lithology the population density differences between two adjacent areas. Distinctly lower settlement density in one of these areas coincides with the Sandstone bedrock, while in the second one loamy and shale base is correlated with higher population density (Taylor 1951 pp. 201—204). When, however, this example is looked at closer, it turns out that there are also distinct differences between the two areas with respect to other nature components, especially those which are to a large extent derivations of geological structure, i.e. surface sculpture, runoff and drainage conditions, as well as soils.

Thus, it is equally difficult to find an appropriate testbed for analysing the direct influence of geological structure upon human activity and to "measure" the contribution of this component to other aspects of nature, with respect to their influence upon man. One can find the most easily measurable direct influence of this component in the role played by mineral deposits extracted by men, displaying an abvious relation with the location of mining settlements.

Importance of surface sculpture for human activity is most visible, and that is why its role in shaping the settlement system is very

often put to the forefront. Surface sculpture remains in a close, genetic dependence upon geological structure and climate, whose "hidden influence" it expresses. Thus, there appears a similar difficulty as in the case of evaluating the role of geological component in human life, but of opposite direction. High importance of surface sculpture results, probably, also from the fact that morphology of an area creates a kind of interface between these components, which are shaped mainly by the internal forces of the earth, and these ones, which are predominantly dependent upon external factors. One should also note that it is in this zone that, essentially, the field of human existence is located.

The influence of morphology on human activity in nature is most often expressed through adaptation of the level of intensity of the settlement network and its forms, as well as of the pattern of transport network to the nature of surface sculpture and orographic structure of a given area. The influence can therefore concern both the individual, distinct morphological forms, and the whole hydro-orographic systems. Thus, for instance, in conditions of an excessive humid climate human settlements have sometimes tendency (e.g. in Africa, see B. Dumanowski, 1968) to be located along the watersheds, in any case away from the valley bottoms. In other areas human settlements are usually concentrated along the negative forms, most often in the direct vicinity of borderlines between river valleys and between-the-river uplands. This is especially typical of the areas of the Northern European Plain (see e.g. Świderski 1948). The above-mentioned regularities undergo, of course, disturbances in high mountains and there, where surface takes especially lively forms (canyons, gills, inselberge, rocks), which usually excludes normal settlement patterns (excepting settlements related in their origins with defensive functions).

It can therefore be stated that morphology, being this component of nature which is the most dependent upon climate and geological structure, directs very strongly the development and structure of the settlement system in geographical space, and its relations with the settlement features are among most readily decipherable from those existing between nature and human activity.

Hydrological conditions, which are in literature treated most often as the component determining the influence of nature on settlement, depends also to a large degree upon the two main leading components, namely climate and geological structure. Besides, owing to the very fact of necessity of considering these conditions within the natural hydro-orographic units, i.e. river basins, they are inseparably connected with morphology.

Irrespective, however, of the magnitude of influence exerted by the other components of nature upon the hydrological conditions, and through them upon human activity, it is beyond doubt that water has had fundamental importance for the settlement process in all the periods of human history. The fact found its expression in the enormously rich appropriate geographical and historical literature. It can only be added here that from among all the forms of appearance of this component on earth the most ubiquitous, in terms of influence and application with regard to the settlement and economic activities of man, seem to be the running freshwater resources, which shape the surface of lands.

Last two links of this chain of connections, i.e. soils and organic life, constitute in a way a result of the action exerted by all the previously mentioned components of nature. Thus, they have from among all the components, the most comprehensive nature. This comprehensiveness, implying large numbers of elements within these two components which enter into multi-facted relations with man, makes it difficult to identify the actually appearing connections. Being separate components of nature, soils and organic life are, however, specific syntheses of mutual influences of all the nature's components and that is why they are often treated as indicative for representing structures and relations within the whole of natural conditions. This constitutes the essential reason for acceptance by some researchers (see e.g. Richling, 1982, pp. 29—30) the view of the leading significance of plant cover for the whole system of natural conditions.

Soils are also, sometimes, ascribed such a leading role as regards their influence upon settlement, but only for a very narrow scope of cases. This concerns, for instance, development of villages on fertile, intensively cultivated areas, especially when other conditions are not limiting for agriculture.

It is much less frequent to expound the view that a setting of more diversified soils, im terms of their quality, is more advantageous for human settlements than uniform soils. Such a suggestion seems to be confirmed by the results of some detailed toponomastic and archeological studies, like e.g. the ones concerning early medieval settlements in Central England (Gelling 1976), or those of E. Kantowicz (1985) on natural conditioning of agriculture and settlements within the boundary zone between the forest and savanna in Africa. It has been indicated that villages usually concentrate on more diversified soils, even if these soils were weaker than more uniform soils located in the vicinity (Gelling, 1976, p. 209, Kantowicz, 1985, pp. 123, 144—150). Causes of such a phenomenon may, however, by quite complex. Advantageous for appearance of this phenomenon had been, undoubtedly, to a certain

degree, the self-sufficiency of the primative village economy, for which greater diversity of soils is better, since it allows cultivation of a greater number of plant species. Thus agriculture is more stable and productive (see Kantowicz, 1985, pp. 144—148). It may also be of importance that because of technical reasons primitive farmers prefer to cultivate soils which are less fertile, but lighter for cultivation, than more fertile but heavier soils such as e.g. loamy ones (see, for instance Godłowski 1983, p. 294).

Assessing altogether the problem of the role played by the soil factor in spatial differentiation of human activity we can state that, especially in the periods during which agriculture has dominating significance in economy, this factor has had an influence upon rural settlements, but the operation of this factor has not been unidirectional. It appears that over time the influence has been increasingly connected with agricultural quality of soils. Soils of good quality, which positively influenced more and more dense rural settlements did only in a few cases, or periods, like e.g. in Middle Ages in Europe, influence location and development of towns. A comprehensive assessment of the role of this component is additionally made difficult by the fact that, as already mentioned, the soil factor constitutes just a result of all the other components of nature, that is it does not act in isolation.

Finally, the significance of the plant and animal world was truly enormous for the pre-agricultural communities. As the higher forms of human economy appeared and developed, and anthropogenic changes in nature got increasingly intensive, the role of tis factor decreased, reaching ultimately the present status, such that in many developed countries this factor is not taken into account in organization of economy. This especially concerns the most destroyed mammal macrofauna, while human economic interest in plant cover is confined practically to cultivated plants and forest plantatory economy.

The influence of plant cover upon human activity in nature is often considered in literature, but rather one-sidedly. Since the works of Hettner the "barrier" nature of forest and boggy areas has been considered with regard to activity of pre-industrial societies. It is not as frequent to encounter analyses concerning other plant formations. An example with regard to steppes may be provided by the concept of Robert Gradmann (1933), previously universally accepted, while now regarded as exagerated.

The organic sphere constitutes the component of nature which grew out of the basis constituted by all the other components, so that it has the most comprehensive character. As the "sum" of the operation of components, and simultaneously a new quality, it has to be assessed

only partially, through the most obvious expressions and direct connections. Likewise, with regard to soils it cannot be presently determined what is the indirect contribution of the other components exerting an influence upon man via plant cover.

In 1975 David Armand presented his genetico-functional scheme of hierarchization of the main components of nature. The leading components in this scheme were climate and geological hasis, while the other components were treated as the "led" (dependent) components, located on various levels of the hierarchical dependence tree, but below the leading ones (1980, p. 34). In the light of the above considerations we do generally agree with Armand's assumptions and propose for our purposes to adopt the following scheme of main connections (and interaction vectors) among the components of nature (Fig. 1). For the sake

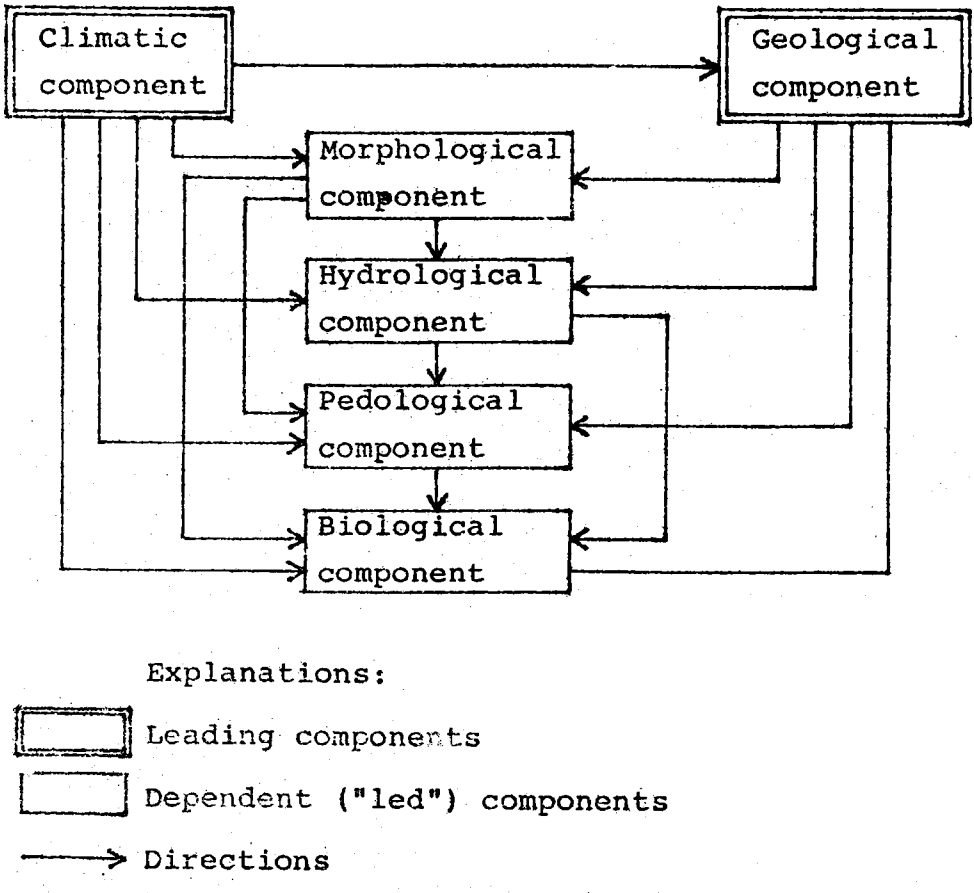

Fig. 1. Hierarchy of main direct interactions among the components of the nature subsystem (partly after the idea of D. Armand, 1975).

of simplicity only direct relations and their resulting directions — in reality always bilateral — were taken into consideration.

Such a hierarchically construed system of nature enters, in turn, into complex relations with the socio-cultural system. Both systems together can be treated as one natural-social macrosystem (see, e.g. Clarke, in: Kozłowski, J. K., Kozłowski, S. K., 1983, pp. 9—10). Then, the socio-cultural subsystem encompasses a number of elements whose alternative distinction should also depend upon the purposes of research (1983, p. 8). It seems, though, that a potential effort at evaluation of the elements of this subsystem is presently bound to fail in view of a great complexity and complication of connections within the subsystem. It can therefore be assumed that it is possible to conduct, first of all, the considerations on the character and functioning of natural linkages between the two subsystems, treated largely (especially the socio-cultural system!) as "black boxes". That is why recognition of a deeperlayer of these relations will ultimately be possible only after the internal structures and relations within each of the macrosystem segments are better identified. Within the framework of existing study capacities one can refer to an interesting concept of Clarke (in: Kozłowski, J. K., Kozłowski, S. K., 1983, p. 10), who introduced the notion of internal equalibrium of the natural-cultural macrosystem, of dynamic character: $E \leqslant k(S)$, where E denotes the nature subsystem, and S — the socio-cultural subsystem. As can be seen, the immanent feature of such an equilibrium is its instability. Thus, it can be concluded that disruption of any of the relations between the segments of the disruption of any of the relationsbet ween the segments of the macrosystem entails a change of the structure as a whole. The formula, therefore, illustrates well the mechanisms of interrelations between mankind and nature and explains the essence of difficulties which appear more and more frequently as the agression of man towards nature increases.

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