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METHODS OF EXAMINING THE NATURE-MAN RELATIONSHIP IN WARSAW REGIONAL GEOGRAPHY

Abstract: Several methods applied in the Department of Regional Geography of Warsaw University in research on the relationship between the natural environment and man were presented: chi-squared test, class diversification method, correlation methods, regression analysis. Their merits and limitations were described. The usefulness for research of different aspects of the nature-man relationship was discussed. New possibilities of applying thus obtained results (e.g. for delimitation of regions of the nature-man relationship) were identified.

Key words: relationship research methods, man–nature relationships, regions of the nature-man relationships.

The Department of Regional Geography exists at Warsaw University for more than fifty years. Initially, area (region) was the main subject of research conducted here, whereas the research objective – synthetic characteristic of this region. At a certain time, this traditional approach was abandoned and research on the relationship between the natural environment and the activity of man moved to the forefront. Majority of the more than 600 master thesis written in the Department concentrated on this issue.

The consequence of accepting relationships as the fundamental subject of regional geography research had to be a reflection on the possibilities and ways of analyzing them. It is, however, an unusual subject; relationship (relation) is a dependent existence, it is solely a reference of one thing to another. Simultaneously, it is the category of cognition without which it is impossible to explain the functioning of mechanisms of phenomena and processes in the world surrounding us. As a certain simplification, relationships may be compared to forces acting in the examined subjects or phenomena, deciding about their features and behavior. In geography, we usually deal with complicated relationships which stem from the impact of many factors. This especially concerns socio-economic issues. A great number of diverse factors creating a complicated system of connections and relations

affects human behavior. Therefore, in research practice, we are most often obliged to apply simplification procedures as well as those which abstract from complex reality (simplifying and limiting the number of the analyzed connections). An important issue is the choice of factors most significant to the examined phenomenon. Of great importance is an in-depth familiarity with the examined phenomena and a researcher's intuition. In applying the above mentioned procedures, we consciously renounce the possibility of obtaining a full picture of the examined relationships because factors which have not been taken under consideration in the analysis may modify them, sometimes in a significant manner.

Among the many kinds of relationships which may be examined, geographers' attention concentrates foremost on spatial relationships because this aspect of the examined phenomena is situated in the center of interest of their discipline. Research on spatial relationships is also induced by an often applied form of presenting different phenomena on maps.

The research on relationships is a means leading to the fundamental objective which is the explanation of phenomena and processes. Co-existence and succession of phenomena lends credence to the existence of a causative relationship among them, according to Mill's principle of eliminating induction (cannon of associated changes). However, not all relationships are characterized by causal nexus. For this reason, research on relationships should be supplemented by an essential analysis of mechanisms of examined connections explaining why these connections take place.

In research on the nature-man relationship, one begins by choice of features representing on the one hand certain traits of the natural environment and on the other, certain aspects of man's activity. These features may be different: qualitative or quantitative, occur as points, lines or surfaces, be expressed on a continuous or leap scale, etc. Depending on the character of the analyzed features and method of their presentation, different approaches and relationship research methods are applied.

A visual analysis consists of a visual comparison of maps of selected features of nature and man's various forms of activity. They may be dichotomic features, e.g. occur or not in a given place (e.g. lakes, farmlands), qualitative (different types of rocks, cultivated plants) or quantitative (temperature level, yields). Despite an obvious lack of precision this approach is useful, especially in the initial phase of research. Its basic value is a great simplicity and quickness in reaching conclusions, allowing to utilize this approach even on the scholastic level. Such a comparison is easiest in the case of dichotomic features. It then comes down to an assessment of the degree of resemblance of patterns of the two phenomena. More difficult is a comparison of maps showing phenomena of different quality or quantity. However, even in the case of a phenomena with quantitative features, an experienced researcher is able to quite precisely visually estimate the correlation between the analyzed variables. Research has shown that a mistake in the visual assessment of the value of the correlation coefficient (compared to numerical calculations) made by an experienced

researcher takes is in the range of 0.2 to 0.4 and the highest level of precision is achieved in the case of a high positive correlation (Siwek, 1989).

The basic drawback of this approach is its subjectivism, which causes that different researches may, on the basis of the same materials, arrive at different conclusions regarding the relationships between the analyzed phenomena.

Nonparametric tests are very useful in some issues in research of the nature-man relationship. The most often applied is the test on the essence of pattern diversification called **the chi-squared test**. By applying it, we can state whether the observed frequency of occurrence of a phenomenon differentiate in any significant manner from the assumed distribution (usually probability distribution). The chi-squared test may be applied to identify relationships between phenomena expressed in two categories (phenomenon occurs or does not occur) as well as in a greater number (e.g. several type categories or intensity of the phenomenon). The achieved result informs us about the probability of the existence of a relationship.

A limitation of the chi-squared test is the necessity of using data expressed in absolute values. It must also be remembered that the number of the examined population has influence on the χ^2 value. As it grows, the χ^2 value increases (while keeping identical proportions in each of the categories of the phenomena).

Much popularity in research on the nature-man relationship conducted in the Department of Regional Geography has been gained by the **class difference method** (a similar procedure is called the rank difference method). Its essence is the division of the area of research into uniform unit areas and reckoning in each unit area the value of comparable phenomena. These values are next grouped into classes (similarly as in a construction of a cartogram). All the unit areas are described by phenomena values (expressed in classes). By comparing these values we obtain for each unit area a result which is the difference in intensity of both phenomena. In the case of identical intensity of phenomena the difference equals zero, when the intensity varies it may be a negative or a positive value. In this simple manner we obtain a map showing differences in intensity of comparable phenomena for n unit areas. This allows to determine the degree of relationship between both phenomena: greater the share of unit areas with small difference values ($0, \pm 1$), and smaller areas with significant differences, the stronger the link of both phenomena. The given picture of intensity similarities and diversifications of comparable phenomena allows not only to determine the general relationship between these phenomena but also to describe its spatial diversification and state where they occur with greater and where with lesser strength. This feature of the method is especially significant for it allows analyzing spatial diversification in relationships between the examined phenomena. Moreover, the sign of the given values (plus, minus) informs about the direction of the occurring variances.

Alongside the indicated advantages, this method also has certain limitations. The given result may be reasonably interpreted only in the case of

positively correlated phenomena. Only then small difference values signify a strong relation of these phenomena. In the case of negatively correlated phenomena, the sense of the scale of one of the variables should be changed.

Another drawback of this method is the difficulty of precisely describing the general degree of interrelationship of phenomena in the entire researched area (for n units). The most commonly used indicator of the share of units with small difference values of both phenomena ($0, \pm 1$), is not a sufficiently precise measure (comparison of results, given by the method of class difference and the correlation method has, on many occasions, shown significant discordance). An indicator comprising all the existing difference values and taking into account their share, would be better to describe the general degree of phenomena relation.

A further difficulty is the necessity of using group data. Alongside an obvious loss of precise data in the grouping procedure, significant influence on the result obtained by the class difference method may also be exerted by the grouping practices. One should aim that the number of fields in corresponding classes of both the compared phenomena be identical. A suggestion for resolving the constraints of the method stemming from lack of realization of the above mentioned demand was presented several years ago (Walewski, 1997).

Among the **correlation methods** applied in research on the nature-man relationship especially useful are those methods which lead towards description not only of force and features of the correlation between the examined phenomena and also allow to state its spatial diversification. Applying the classical approach, we obtain a single value of correlation coefficient for the entire analyzed set (e.g. the whole research area). This does not inform us whether this correlation is identical in this entire area or varies in its particular sections. To obtain such information it is necessary to divide the research area into smaller plots, calculating correlation between the phenomena compared for each of these plots, assign the obtained correlation coefficient values to the central points of the plot and next to delineate, by interpolation, lines of identical correlation (isocorrelates). Thus obtained map shows spatial diversification of correlation in a given area. It should become subject to broader interpretation and an impulse for formulating hypothesis regarding the causes of this diversification.

For cartographic research on relationships between phenomena, a regular density network was used in our Faculty (Siwek, 1982). A comparison of the size of plots having their surface inversely proportional to the intensity of the analyzed phenomena allows to numerically describe the similarity of this intensity in particular parts of the examined area.

Information on the spatial diversification of the examined relationships is also obtained by means of a **regression analysis** and maps of residuals from regression developed with its support. These maps show, strictly speaking, not the relationship but the size and character of deviations from the statistically determined values, describing the analyzed relationship. The

smaller the deviations, the more direct the relationship between the examined phenomena. The principles of interpreting such a map are similar to those described in the class difference method (similar assumptions are at the basis of both these methods).

On the basis of the presented review of relationship research methods, it is evident that we have at our disposal a wide range of techniques allowing to carry out an analysis of relationships occurring between nature and man. Of foremost importance is the choice of such features of nature and man's activity and of factors expressing them, which best express significant characteristics of the compared phenomena.

It should be underlined that some aspects of the relationship research methods still are little known, e.g. the influence of the degree of generalization (scale of research) on the obtained results (Modzelewska, Siwek, 2001). It is worthwhile to broaden the knowledge of these methods, their features, merits and constraints. Mechanical application of research instruments may, however, lead to an incorrect interpretation of the obtained results and consequently be more harmful than beneficial.

The application of the discussed above nature-man relationship research methods, as well as other methods, allows to obtain more precise and objective results and at the same time diminish the danger of excessive subjectivism in analysis of these relationships. It may also show in a new light the question of one of the traditional objectives of regional geography which was the delimitation of regions. From this point of view it could be regions of nature-man relationships. The different character of relationships between the natural environment and man functioning in this environment would be the criterion for regionalisation.

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