

GEOINFORMATION MAPPING OF CHANGES ADMINISTRATIVE-TERRITORIAL DIVISION OF THE DNIPROPETROVSK REGION

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Keywords: administrative-territorial division, administrative changes, historical GIS, mapping of dynamics.

Formulation of the problem

Changes in administrative and territorial division are unevenly distributed in time and space, and in separate dates touch only one or more objects. In this regard, the discovery of changed objects in analyzing time-varying administrative maps takes a lot of time. This is due to the urgency of the development of a GIS on the history of administrative separation of means for identifying such changes.

An analysis of recent research and publications related to solving this problem

The questions of geoinformation modeling of the history of administrative-territorial division or political map were considered in his writings by I.Gregory. M. Berman, M. Nüssli, M. De Moor, T. Wiedemann, I. Merzliakova, A. Karimov. A. Renolen [1-6]. The most well-developed questions are the representation of the dynamics of changes in databases, less developed are the issues of visualization of changes by means of GIS. However, maps of changes in the administrative-territorial division are available in many printed historical atlases, for example, in the "Historical Atlas of Ukraine" [7, p. 264-265], and accent on changes is also used in some cartographic animations [8].

Unresolved parts of the general problem

Issues of automated mapping, reflecting changes in administrative-territorial division based on time-based databases, are poorly researched.

Problem statement

The purpose of the study is to develop the content and methodology of creating, on the basis of time-varying data, the state of administrative-territorial division of the maps of the localization of administrative changes.

Presentation of the main material of the problem

Analysis of the mapping of changes in the administrative-territorial division (ATP) on different time maps revealed such problematic issues: fixing small spatial changes, changing names, transferring administrative centers, transferring settlements require a significant concentration of attention and time. Therefore, when developing approaches to reflect the course of administrative changes in the GIS history of the ATP of Dnipropetrovsk region, there was a problem of identifying discrepancies between time-varying maps generated on the basis of a time-based database. The solution to this problem may be the creation of maps reflecting changes in ATP. The ATP map for a particular date is created on the basis of two sets of different-time data: the first characterizes the state of the ATP at the time of the

change, the second - after the change. It is possible to distinguish two types of maps of changes of ATP for a specific date: maps providing comprehensive information on the essence of administrative changes and maps, reflecting in the first place the localization of changes. The second one can be displayed in addition to the localization of the changes and some other characteristics. This is useful if their mapping does not overload the map and does not detract from focusing on the localization of the changes. For example, you can restrict yourself to displaying the type of change and not showing specific values before and after the change.

Since the properties of the object before and after the change are presented on two different time maps, and the main problem is to identify the localization of the changes, it is decided to develop maps that do not describe the essence of the changes exhaustively, but transmit their localization and appearance. These cards can be supplemented by a series of time-lapse ATP status cards in GIS, helping to identify the differences between them. You can select multiple scripts for this add-on:

1. Between the two map-frames of the ATP, a map-frame is displayed that reflects the localization of the changes.

2. Introduction of two separate modes of displaying the dynamics of the ATP. The first mode provides for the visualization of only the state cards, the detection of changes in this is carried out by comparing the two states. The second mode is to focus on changes. It only involves mapping maps with localization changes. Switching between modes is done by the user at any time.

3. The layers of the map change are superimposed on the status card

It is expedient to design the mode of accenting on changes after making a database of time-consuming data, defining the content, means of image and methods of creating electronic maps of the state of the ATP for a user-specified date (Fig. 1).

This is due to the need to reconcile the content of the maps in two modes of information output. Any difference between two ATP status cards (before and after the change) must be displayed on the map that transmits the localization of the changes. At the same time, the map of the localization of changes does not transfer the changes of those parameters or objects that are not reflected on the maps of the state of the ATP.

Thus, the development of a mode of accentuation on changes in the GIS of the history of the ATP of the Dnipropetrovsk region was carried out after the termination of the regime for the withdrawal of time-varying state maps and began with the allocation of types of changes.



Fig. 1. The main stages of the study

Types of changes were allocated according to the purpose of the regime - to identify the localization of changes (Fig. 2). Therefore, we distinguish the changes localized in the territories and the changes, localized at the points. Changes in the territories are divided into the following: changes in the territory remaining in the region, changes in the lost area, changes in the territory attached. Changes in the points are divided into those that are localized in one point, and those that cover two points. Only after selecting the types of localization changes we divide them by nature.



Fig. 2. Types of changes on administrative cards

In the territory remaining in the region, there may be a re-subordination, renaming, changing the type of administrative-territorial unit. In annexed or lost territories, apart from the actual re-subordination, we do not consider any other changes because they are not described in the database and are not visualized on time-varying state maps. For example, if the administrative-territorial unit at the moment of accession or separation from the region was renamed, in the database and on the administrative maps it will have only the name under which it was part of the Dnipropetrovsk region.

Changes that are localized at one point: renaming, changing the type of settlement, changing administrative

functions. The latter include: obtaining the status of the administrative center, the loss of the status of the administrative center, the beginning or end of the function of the center of two administrative-territorial units (Novomoskovsk - a city of regional subordination and at the same time the center of the district, which distinguishes it from Mezhoza, which is only the center of the district and Kamensky - the city of regional subordination, which is not a district center). Note that only the fact of changing the administrative functions is transmitted on the map of the localization of the changes.

Changes that are localized at two points: the transfer of the administrative center to another locality and the transfer of the settlement.

Such a classification of changes is significantly different from those in which the study of the history of individual objects. Thus, A. Renolen [6], developing a question of representing the history of states on the historical graph, identifies 7 types of changes: creation, destruction, change, reincarnation, split, merger. In the developed mode of focusing on changes, we do not distinguish the emergence, disappearance, restoration of administrative-territorial units and the exchange of territory between them. All of these changes are combined into one - the re-subdivision of the territory. However, at the same time, we distinguish between internal re-subordination, the loss of territories by the region and their accession.

After the changes were made, questions about their mapping were developed. The correspondences between the graphic means of the image of the current value and the fact of its change are possible, but not obligatory, since the mode of accenting on changes does not aim to pass the old and new values. However, it is desirable that the change of point objects is transmitted by point objects, and the change of polygonal objects - polygonal or closed lines (if these objects are visible on the map in the planned range of scales). In this case, the closed lines should indicate the polygonal, not linear character of the localization of the phenomenon. The mapping of similar events or changes for polygonal and point objects should take place in a similar way to the extent possible for spatial objects of different kinds. When designating symbols, it is important to take into account the relationships between the changes and the cases of their localization in one territory or at one point.

If, as a result of the analysis, it turns out that individual polygonal objects are not noticeable on medium-sized maps that cover the entire region, it is advisable to develop non-scale designations for such scales. These notations must coincide with contours in color, but have a different shape than the designations for point objects (administrative centers).

On the basis of the above principles, the following conventions have been developed (Fig. 3): the reordered territories are designated by the habitat method and have continuous coloring (red for the lost territories, green for the attached, blue for the reordered territory within the region), the boundaries of the administrative units, which changed the name or species, are marked by closed dashed lines of different thickness and structure (in the new borders, if the borders are changed) in purple and brown colors, respectively. Point-to-point changes are denoted by

the pixels of different colors and have small differences in size so that changes to several properties of one administrative center can be shown. The administrative center that changed the name is denoted by the purple color of the polygon, the change of the species populated by the point is the brown Polygon, and the locality where the administrative functions have changed is denoted by the orange Polygon.

Surrounded areas on medium-sized and small-scale maps other than the range are displayed off-scalable symbols - arrows of blue, green, and red. This helps the user to not miss a small adjustment of administrative boundaries.

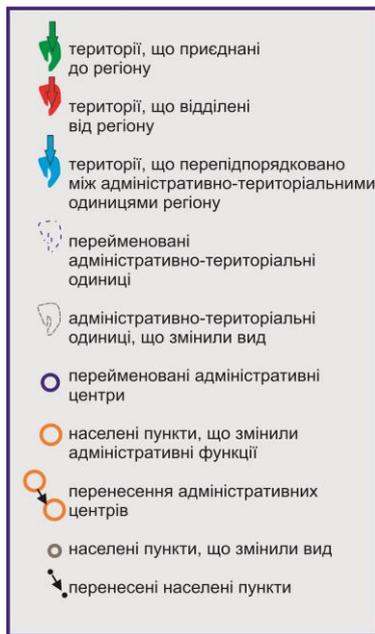


Fig. 3. Symbols

After selecting the types of changes and developing their conditional notation based on time-varying data describing the status of objects for a period, created layers that characterize the changes in the date. To display each type of change, a separate layer or layers have been created: a layer of renamed administrative centers, a layer of administrative centers that have changed status, a layer of administrative centers that have been moved, a layer of internal re-subdivided territories, a layer of lost territories, a layer of associated territories.

Layers containing objects - accents on changes in attributes (names, type of settlement) are created using SQL queries. Based on the original table of status (obj, Code, Attribute, Date_first, Date_final), we create a table of attribute changes (obj, Code, Attribute_to, Attribute_then, Date). So, if the analyzed attribute of the object has changed, there are two lines in the status table, the same code value, different attribute value, and the contents of the End_Date field of one corresponds to the "Start Date" field of the other. Although such a layer contains information not only about the location of the modified objects, but also their attributes before and after the change, the attribute value is not displayed on the map until the user enrolls the layer signature. Signing takes

place with the expression "Attribute_to + ">" + Attribute_after."

Visualization of the transfer of settlements to another place is carried out in three layers: "moved from", "moved to", and a layer containing linear objects (arrows) indicating the direction of movement. These linear objects are created automatically after creating two point layers and connect objects of two layers, which match the value of the code and date. The reflection of the fact of the transfer of administrative centers from one settlement to another is carried out similarly, only the conventional symbols differ (fig. 4).

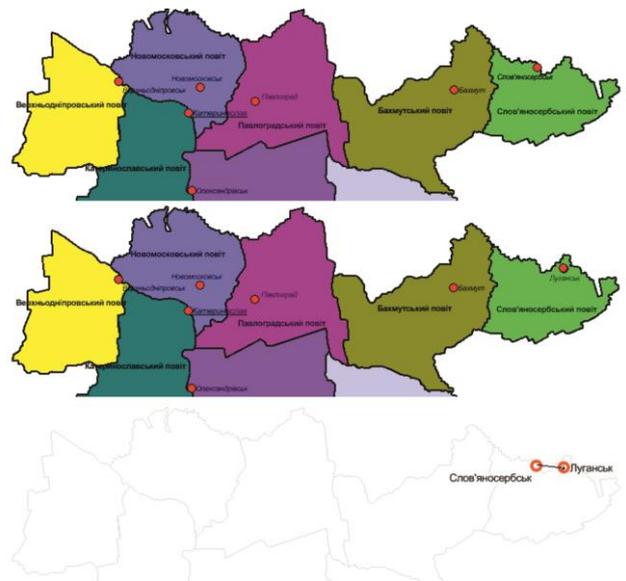


Fig. 4. Fragments of the status maps and map of localization changes

Creation of layers of subordinated territories was complicated by the absence of such objects in the initial layers and required the development of a methodology for their creation. The MapInfo methodology included the following steps. Polygons for internal reordered territories were created as follows: for each change date, select polygons containing such a date in the fields "date-start" or "end-date". Polygons combine the value of the code with the function "Create Object As Union". The "Objects Check" function in the places of overlapping of combined landfills created new landfills - landfills in a reordered area. They were assigned the following attributes: the code and the name of the administrative-territorial unit from which the division was made, the code and the name of the administrative-territorial unit to which the date was attached. These attributes can be used to create signatures on a map by command from a user.

Lodges of lost and connected territories are created on the basis of transformation of polygons representing the whole region before and after the change in polylines, the union of these polylines and the creation of new polygons in enclosed spaces. Among the newly formed areas, those located in a landfill that represents the region prior to the change and are not contained in the landfill representing the region after the change - the landfill of the lost territories. The reverse situation is typical for the areas of the associated territories.

On the basis of polygonal layers of reordered areas, point layers are created. These layers are used to enhance the focus on changing administrative boundaries on medium and small scale maps.

To automate the creation of layers representing administrative changes based on the original layers that describe the state, the program is written in the mapbasic language.

Conclusions

1. To illustrate the differences between time-varying ATP states, maps of the localization of changes generated on the basis of output of different time data by means of GIS can be used.

2. When the types of changes were selected, they were first analyzed by the localization features (where changes occurred, which objects are touched), and after that - their essence (what exactly happened).

3. The development of symbols was made in such a way as to ensure the visualization of changes in several features of an object at the same time (the symbols are different in size (for point objects) and do not overlap if there are several changes to one object at a time), and with that principle, that changes of similar signs of polygonal and point objects were given in one color.

The prospect of research may be the development of automation issues for the creation of ATM changes for the period.

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Geoinformation mapping of changes administrative-territorial division of the Dnipropetrovsk region

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The process of revealing changes on different administrative maps was analyzed. It was proposed to create maps of localization of changes in GIS to illustrate the difference between different administrative maps. Types of changes in administrative-territorial division are identified. Conditional signs for various kinds of administrative changes are developed. The technique of automated creation of map layers for localization of administrative changes is proposed.