SCRIPTA FAC. SCI. NAT. UNIV. PURK. BRUN.
Vol. 11 (1981), No. 7—8 (Geographia), p. 301—308

CARTOGRAPHIC ASPECTS OF THE MAPS OF ENVIRONMENT

M. V. Drápela

Department of Geography, Faculty of Science, J. E. Purkyně University,
Kotlářská 2, Brno, Czechoslovakia

Received for publication: February 1980

SUMMARY

The analysis of the hitherto state shows that maps of environment are exceptionally varied and that they are made considerably in an uncontrolled way.

This paper deals with drawing up a specimen map of air pollution at 1/10,000, presenting partial results from work on theme of Cartography of environment.

In a specimen map sheet there is a graphical solution of cartographical approaches suggested in this paper concerning the formulation of the legend according to groups of elements (actively degrading the environment, passively degrading it and restoring the environment), arrangement of symbol systems and solving the colority of the map according to the groups of elements.

It is feasible to generalize these approaches for further types of maps of environment, as well. That might lead to the unification and standardization of the cartographic form of maps of environment. At the same time this suggestion forms a basis for further discussion. In this way we should like to contribute to the specialists and map-makers in facilitating their work in making maps and preventing them from making possible mistakes of theoretical and methodological character.

INTRODUCTION

At present there is enough information and data concerning the environment that can be transformed for cartographic information. An important source of information in the future will be the interpretation of different types of photographs which are nowadays used to a negligible extent. The effort at the maximum utilization of the information capacity of those photographs will be reflected in processing new types of thematic maps, namely computer special thematic maps.

The advantages of these new types of maps are nowadays undisputed. After elaborating an algorithm for the respective surveyed element it will be relatively easy to issue the thematic map of that element from any territory, a quick modernization of maps will become possible, the working methods will result in further objectivization in plotting map elements, in their analysis, synthesis, etc. A number of specialists are convinced that computer maps will become the only type of thematic maps.

To make it possible to issue only these new types of maps it would be necessary to fulfil some assumptions for carrying out the automation of map making, the most important ones being:

— processing of entry data — information (from a sufficiently detailed minor network of observation points, from different kinds of photographs, and from other sources),

— unification of information notation (in a unified formalized and computer language; according to chorical, chronological and other points of view),

— the possibility of coding and decoding information,

— making information accessible (mainly from aerial, satellite and other photographs),

— elaborating algorithms for solving the respective tasks,

— equipping map-maker workplaces with suitable computer equipment with additional equipment (for rationalized utilization of entry data, algorithms, etc.),

— radical reduction of preparatory work and reduction of costs of computer processing of thematic maps,

— training of map-makers and map users in different spheres of human activity,

— equipping map users with possible necessary devices for deciphering and decoding maps.

Although computer processing of thematic maps will play a very important part in the future, the present condition in the equipment of most workplaces make us develop also "classical" methods of making thematic maps on a gradually higher and higher theoretical, professional and technical levels.

Since the problems of the environment are becoming more and more topical and the development of computing cartography (chiefly in computer equipment and making data available) cannot keep pace with the requirements for solving problems of environment, this contribution is oriented at the so-called "classical" special thematic maps of environment.

This paper evaluates selected elements of the environment and their interpretation in large-scale maps. The paper informs about partial results of the chapter "Content of the maps of environment and the methods of its representation" of the work entitled "Cartography of environment" which is being solved. It starts from the experience of some workplaces abroad (above all in Poland and in France) as well as in Czechoslovakia.

In analyzing the maps it was found that the suggestions of systems of map symbols and methodological instructions for making most maps of environment did not fully respect the theoretical knowledge of cartographical semiology, a number of map symbols were suggested so that they did not correspond to the principles of isomorphism. This is a source of trouble in the graphical interpretation of the map content and a source of methodological error.

The main drawback of the maps evaluated consists in the fact that the symbols depicting the perturbations and degradations of the environment are not distinguished from the base, they are not conspicuous, they are difficult to find and do not guarantee a quick evaluation of the degree of danger and devastation of the environment.

CARTOGRAPHIC APPROACHES TO THE HANDLING AND MAKING OF MAPS OF ENVIRONMENT

As a basis for this paper, discussion and conclusion and their generalization the author of this paper prepared a specimen sheet of air pollution at 1/10,000 in September, 1979.

The mapped territory of 18.5 km² from the point of view of land use is constituted by agricultural land (mostly arable land), about 6/10 of the area, more than 2/10 of the area are built-up places, 1/10 of the area is covered with woods, the remainder serves for recreation and small patches are areas under protection.

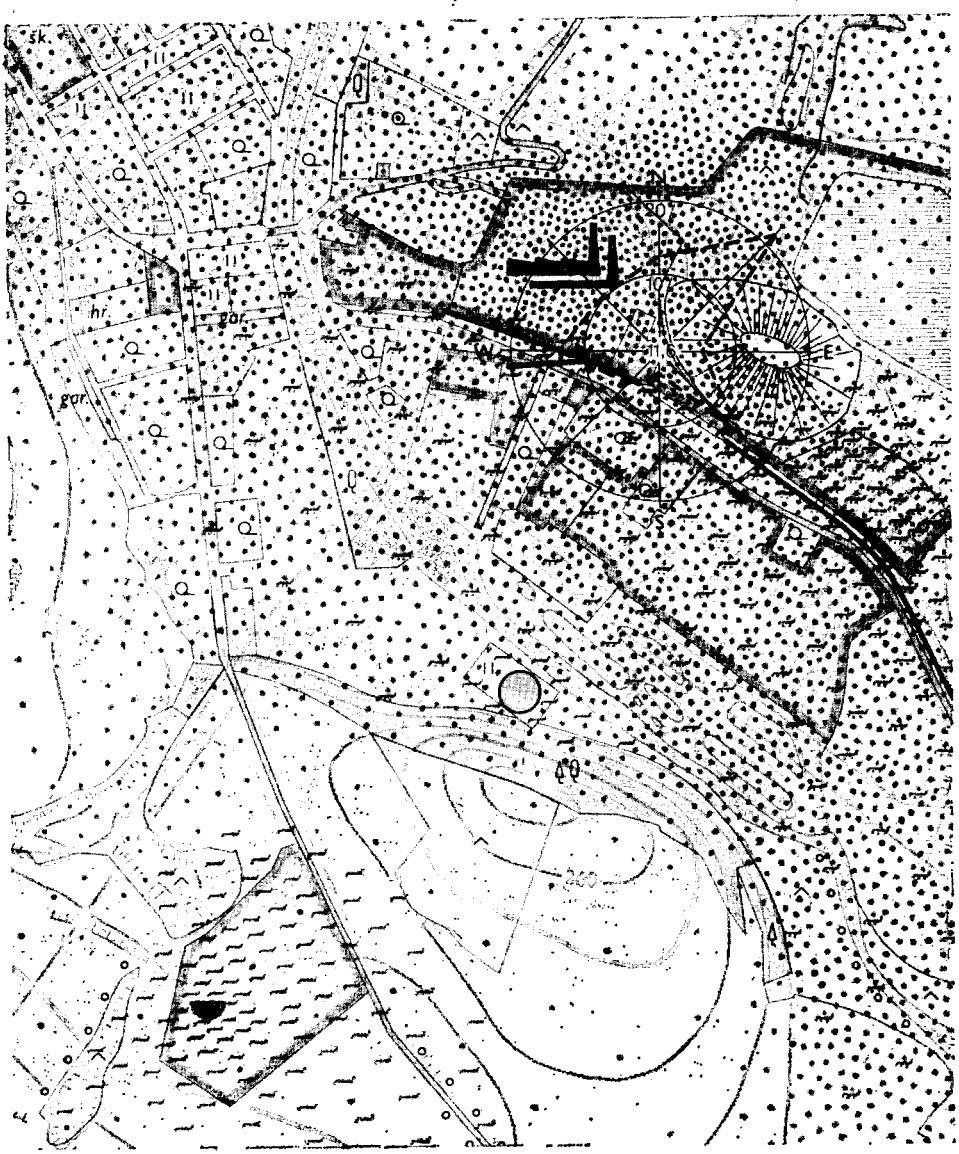

Fig. 1. The part of the survey sheet (manuscript) of air pollution at 1/10.000

The territory with elevations between 201 and 402 m lies in a geomorphologically interesting part of Brněnská vrchovina (the Brno Highlands). The prevailing part of the mapped territory is taken up by the southernmost part of Oslavanská brázda (the Oslavany Trench) — Ivančická kotlina (the Ivančice Basin). It is constituted by the basin proper and shallow depressions filled with Neogene sediments, sometimes overridden with loess deposits. In the surroudings of Ivančice accumulation relief prevails, edges are formed by the erosion bottom of the basin. The eastern margin of the basin in the map sheet is limited by a fault slope of Bobravská vrchovina (the Bobrava Highland). At the town of Ivančice there is also a hydrographic node of the rivers Oslava, Jihlava, and Rokytná. The average annual precipitation sum is 530 mm, in the vegetation period 335 mm. Winds from NW and SE prevail.

In the map sheet there are two settlements — small country towns. Ivančice, with 7,303 inhabitants (1970), includes numerous industrial and agricultural objects, a good equipment in the tertiary sphere, houses and blocks of flats of one to eight storeys. As for Oslavany (4,534 inhabitants in 1970), only the SE part of the town is included in the map sheet, but this part includes the most significant emitor of solid and gaseous exhalations — the December Strike Power Station in whose surroundings the fall-out of solid particles from greatly polluted air exceeds the value of 1,000 t . km^{-2} per year. In this part of the mapped territory there is also an important emitor of industrial odours.

Map sheet enables us to follow, study, and evaluate different objects polluting the air exhalation concentrations and their effect on the surroundings from different aspects, in different connections and relations on a relatively small territory.

Conception and contents of the map of environment

As for the concept, the map of air pollution is a *descriptive map*, i.e. a map documenting (registering) the state of selected elements of the environment on the territory as on 30 June, 1979 data concerning exhalations as on 31 December, 1978.

The suggested descriptive map of environment could be completed on the basis of plotting quantitative or qualitative characteristics. A map based on plotting quantitative characteristics can only be made under the assumption of a sufficiently dense network of observation stations and data about air pollution. These assumptions in turn make it possible to use proportional or value-scales, interpolation in minor control, etc. Individual elements of environment can be analyzed in great detail. A good example of such a map is the analytic map of "opadu pyłu" (i.e. fall-out of fly-ash) and "zanieczyszczenia powietrza" (air pollution), scale 1/10,000, included in the methodological atlas (Pawlak W., ed. 1976).

In our case, due to insufficient amount of directly measured data the map of air pollution was based on plotting *qualitative characteristics*. Obtaining quantitative values is only possible by adding the objects, measuring the length or area of objects, etc. The concentrations of emissions are represented only provisionally on the basis of mobile measurements in the field and of derived values by a different intensity of the colour shade. In the class of *special maps of environment* this analytic map is conceived as *multi-thematic*, i.e. that the map represents several individual phenomena and individual uncomposite characteristics of one phenomenon.

The topographical base of the map is derived from "Základní mapa ČSSR" (the Basic Map of the CSSR). It consists of a reduced location of settlements, communications, border lines of plant covers are drawn to full extent, waters to full extent

without generalization, contour lines are reduced, symbolized symbols relating to a relief and man-made form of relief to full extent.

Special thematic map contents are in essence divided into *three groups of elements:*

— elements degrading the environment actively (different emitors of perturbation, emissions and immissions, industrial and agricultural objects, etc.),

— elements degrading the environment passively (objects changing natural environment into man-made environment which, in a planned economy can be little harmful, but in ruthless activity strongly degrading; examples are building of flats, areas of the tertiary sphere and office buildings, communications, etc.),

— elements restoring the environment (e.g. woods, public green, clean streams, water treatment plants, etc.).

Legend on the map of air pollution

The legend on the style sheet at 1/10,000 contains 31 symbols of specifically thematic content in three groups and two sub-groups. Within groups and sub-groups the order is kept according to the meaning of the element. The legend contains:

1. Elements degrading the environment:

1.1. Objects and built-up areas: industrial emitor, boiler-room, industrial or agricultural object, store-area, school and hospital, other public buildings, shops and services, sports ground, house building up to 2 storeys and family houses, 3 to 5 storeys, 6 and more storeys (built-up areas are distinguished according to the kind of heating to objects with steam plant heating and those with local heating), busy roads;

1. 2. Emissions and immissions: emission of fly-ash, emission of SO_2, emission of technogene gases, odours (of agricultural or industrial origin); theoretical boundary of immission range: minimum and maximum SO_2 affection, minimum fly-ash fall-out;

2. Other environment-degrading elements: colliery tip and refuse pile, sump tank, dumping place (of organic garbage, silage), sewage farm, electro-grid of higher order;

3. Environment-restoring elements: lawn, a garden or orchard belonging to a house, public green, wood (coniferous, mixed, deciduous), areas under protection (declared, suggested), recreational area (allotted gardens, weekend-house colony) water-work area fo the 1st order.

Besides the reduced topographic base, elements listed in the map legend, there are also windroses and areas devoted to growing special plants.

The map and legend can be completed for special purposes by scales of exhalation concentrations, names of objects, quantitative data and/or further elements, specific of the respective map sheet.

Representation of map contents of air pollution

Making map symbols is based on the *isomorphism of contents* (function of object) and the *isomorphism of position*, the isomorphism of form being a secondary criterion. Elements and components in which it is possible to represent the ground plan dimension in the scale of the map are depicted by the areal representation. Individually managed objects are depicted with areal colour and/or shading, objects in socialist property are depicted with a border-tape in different colour tones and shades. This depiction of the areas enables the localization of further elements (such

as emitors — factory stacks, boiler-rooms, industrial sewage-farms, municipal discarded durables, etc.) by means of the symbolized map symbol method (symbols out of map scale) in the respective area. In designing the symbols, relations in symbol groups, gradation of the phenomenon, graphical and reproduction possibilities were taken into account.

The main plotting intermedium for this special thematic map contents in the *colour*. The colour fulfils both its esthetic and distinguishing but above all its classifying tasks.

The group of actively environment-degrading elements is represented in different shades of violet. This colour is well visible on the base of other symbols. Only for oil products there is also reserved dark-red colour. Thus the most endangered or destroyed territories are optically most conspicuously marked.

Passively environment-degrading elements are represented by symbols in warm colours — from yellow over orange to red and in grey colour (unfertile soils, sports grounds, etc.).

For environment-restoring elements green and blue are used. The shades of green have been chosen so that the less the element restores the environment, the more it approaches the yellow-green colour, until finally it passes to colours representing passively environment-degrading elements.

For elements of anthropogenian transformation of relief shades of brown colour are reserved. Objects most intensely degrading the environment are represented in dark-brown colour.

Besides the choice of colour tones and shades also other colour properties are used, viz. the brightness and intensity. Dominating elements are represented in intense colours, secondary elements and complementary ones in pale tones and shades. Concentrations are expressed by different intensities of the colour shade, using point and half-tone shadings.

At the same time problems of graphical and numerical fillings of the map were solved, as well as the choice of colour pigments and the use of suitable shadings, their combination, sequence of prints, etc. Those are, however, problems of technical characters, solution of technological methods, etc., and are not the subject of this paper.

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