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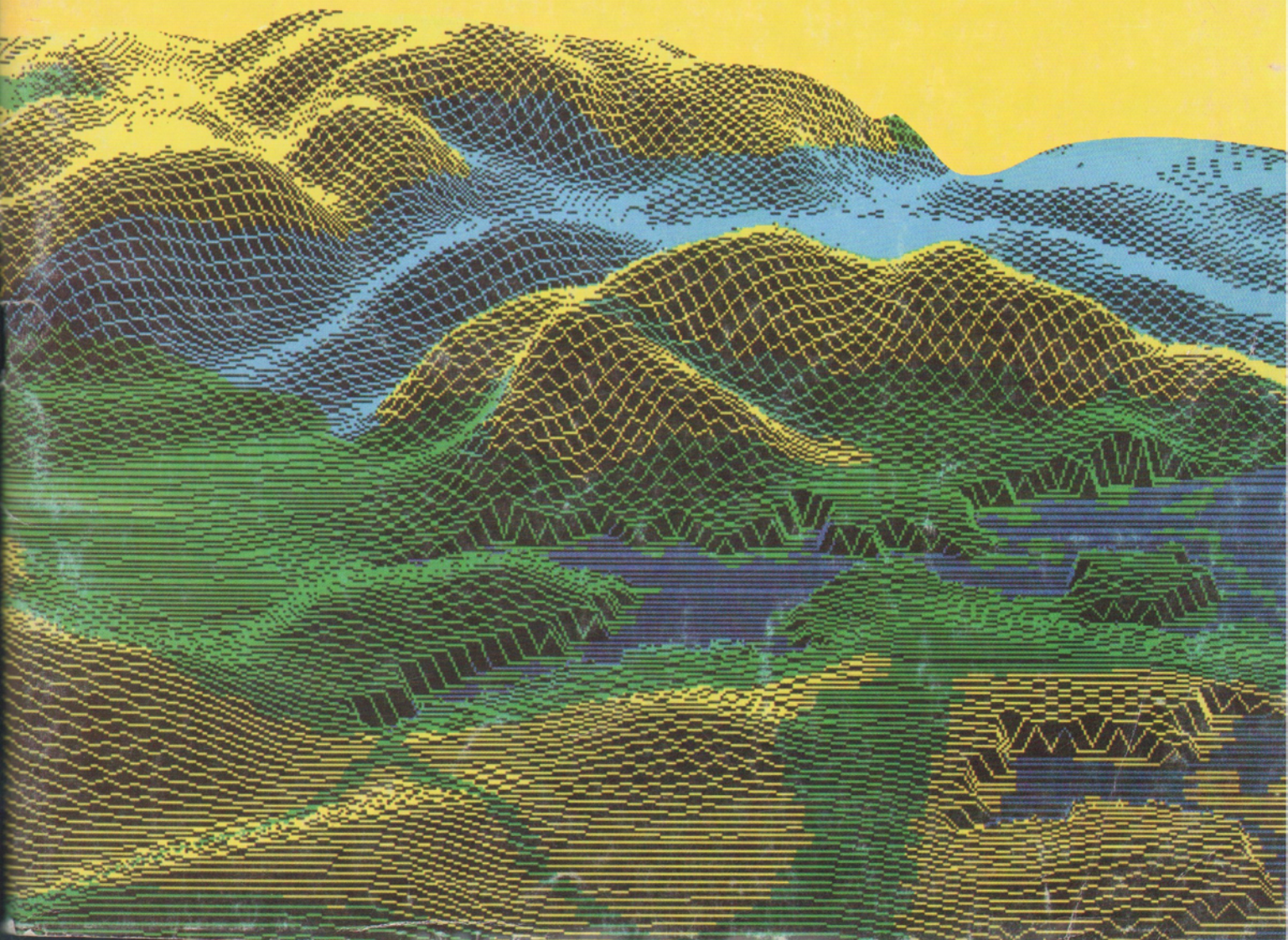

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HUMAN IMPACT ON NATURAL ENVIRONMENT

Antonín Vaishar

Abstract

The map records spatial differentiation of anthropogenic impacts on (natural) environment. The authors attempted at finding, quantification and localization of typical environmental impacts of individual social and economic human activities on environment. Classified are areas according to their methods of use as well as individual sources of air and water pollution. Model example is an area northwest of Brno, which is represented by typical mosaic of land use in the background of capital.

Shrnutí

Vliv socioekonomických aktivit na životní prostředí

Mapa zachycuje prostorovou diferenciaci vlivů člověka na (přírodní) prostředí. Autoři se snažili najít, kvantifikovat a lokalizovat typické environmentální vlivy jednotlivých sociálních a ekonomických aktivit na životní prostředí. Hodnocena jsou území podle způsobu využití a jednotlivé zdroje znečištění ovzduší a vody. Modelovým příkladem je území severozápadně od města Brna, které je reprezentováno typickou mozaikou využití země v zázemí velkoměsta.

Key words: human impact on environment, land use, Brno surroundings

1. *Introduction*

Main idea of the map [1] consisted in an illustration of impacts of human activities on (natural) environment. The chosen scale facilitated detailed expression of individual phenomena. The chosen area in the background of urban agglomeration enabled to grasp a wide range of relationships between the human activities and condition of environment.

In spite of the fact that the mentioned relationships are theoretically very well known, their cartographic intepretation requires precise localization and if possible, also quantification. However, in many a case this is not so simple. It is not possible to measure all impacts at all places and at all times. This is why the individual values must often be estimated or converted. The estimates are usually based on generalization of previous experience. Nevertheless, sometimes a concrete case may be beyond this common experience. Therefore, maximum verification of obtained results is desirable.

First of all, the map presents spatial image. However, the spatial concept does not mean a mere distribution of phenomena, but also their interrelationships. It is therefore not only visual demonstration of these phenomena that is in question, but also an opportunity to learn more about mutual links and contexts of individual anthropogenic effects on environment.

The system of evaluation is entered by resources of different nature and different spatial organization. These may be classified for example by branches of national economy. In a structure like this, we would speak of impacts caused by agriculture, forest management, industry, transport, recreation, residences. Individual interactions are of point, linear or areal character. This is important from the viewpoint of choice for cartographic illustration. No less important is, however, position of the evaluation since changes in comprehension of spatial character may result in changes of quality.

A typical example of such a phenomenon is local heating. Individual house fire-boxes are usually negligible sources of air pollution. However, concentration of several hundreds or even thousands of local fire-boxes may present a greater danger than one big pollutor and apart from this, the one big pollutor can be measured, fined and has a chance to implement technological measures unlike the large amount of local sources. This explains significance of spatial character of

[1] The map was worked out by the team of following authors: Evžen QUITT, Oldřich MIKULÍK, Antonín VAISHAR, Kateřina ČÚZOVÁ, Miroslav KUNDRATA, Jan LACINA, Jaroslav UNGERMAN, Vladimír VLČEK, Jana ZAPLETALOVÁ

individual relationships. An optimum expression of such a spatial character of individual relationships is a map.

2. *Relationships between Man and (Natural) Environment*

Definitions and explanation notes to individual relationships are arranged according to the map legend.

2.1 Urbanized areas

Urbanized areas are considered to be continual areas built up with dwelling houses and accompanied with appurtenant infrastructure. These areas are characterized by types of the dwelling houses as well as by technical equipment and engagement of flats. Basic categories of dwelling buildings in Moravian conditions are family houses and blocks of flats. Country settlements are typically known by their family houses of either traditional character with remainders of rural production function, or by those of urban villa types.

Structure of dwelling houses in urban settlements is more complex. There are usually housing estates of family houses of various ages and types (villas of the highest social status, houses in block configuration of garden neighbourhoods, road town outskirts with row family houses of low social status), housing estates of apartment houses (burgher houses of central and suburban quarters for middle class population, lower social status blocks of flats in workers, outskirts, the so called socialist architecture, ie. originally brick and later prefab structures culminating in "settlements"), as well as mixed housing estates.

Various types of the dwelling houses impact environment to different extent. Significant difference can be seen between family houses and blocks of flats. The relationship between character of the built-up estate and its impact on natural environment can be quantified only with difficulties, and it also depends on configuration of the built-up area, character of topography, original natural environment, etc.

Quality of flats is represented by structure of flats in individual categories of technical equipment. There are following four categories of flats distinguished in the Czech Republic: I – flats with complete technical equipment including bathroom and toilet and with central heating, II – flats with complete technical equipment without central heating, III – flats without bathroom or without toilet, IV – flats without bathroom and without toilet. Occupation of flats was assessed according to criteria of dwelling area per capita, and number of persons per a dwelling room larger than 8 square meters.

Final quality indicator and flat occupation were defined on the basis of the above three indices. The index is to certain extent exceptional in this map as it represents one of characteristics of social environment. However, quality of flats is related to perception of environment by their inhabitants.

Enormously differentiated appears to be the structure of home and housing resources in Brno. In the period between two world wars, Brno was one of the cities in Europe, which followed progressive urban trends. The structure of houses and flats naturally reflects in environmental values of dwelling.

2.2 Production area

Activities of production industries were specified and localized within production areas. This applied mainly to industrial localities, mining areas and built-up areas of agricultural production. Existing maps and topographic surveys were used as a basis in order to verify them. Sense of detaching the production areas consisted in localization of possible sources of environmental problems rather than their specification or quantification which is a subject of other legenda sections.

2.3 Recreational area

Mission of recreational facilities in an area consists in improvement of environment in the region. However, when exceeding certain limits, recreation may also lead to devastation of the area. This applies in particular for overloaded areas which include near surroundings of the cities.

The map illustrates two types of recreational areas. The first of them are chalet settlements, garden colonies, areas used for recreation. This category includes also urban parks. In reality, the mentioned group of objects is considerably heterogeneous both in terms of recreational significance and in terms of environmental consequences. Differences are seen for example in different ratios of active and passive recreation, in different intensity of area utilization, different carrying capacity of the area, different infrastructure. Some chalet settlements with greater number of objects, of not always proper architectonic solution which allows high concentration on a relatively limited area, may produce similar critical

problems (waste, social conflicts) as towns - but with incomparably worse infrastructure. Some recreational areas may become zones of reduced safety for population due to criminality. At other places, the increased motion of holiday-makers may result in direct devastation of both vegetation and topography. Generally viewed, however, occurence of these recreational facilities should indicate areas where at least some phenomena exhibit positive influence on environment.

It is useful to realize that recreation in cottages, gardens and weekend houses represented not only a very frequent type of recreation in the past regime, but also one of a few expressions of individual ownership. In addition, it played an important role at self-supplies with vegetables and fruits. Therefore, garden colonies represent a relatively intensive productional utillization of the area.

Another type of recreational areas are sport facilities which serve active recreation and - from the viewpoint of environment - behave usually as facilities of tertiary sector. Among other, these areas can produce temporary noise disturbances from time to time (motor tracks, football stadiums).

2.4 Forests

Forest areas are characterized by two groups of indices. The first of them tell much about the degree of transformation of forest tree species composition as compared to potencial condition. It is in fact a comparison of present representation of individual forest tree species with original natural structure. With regard to the fact that the natural structure of forest corresponds with natural conditions, it is possible to judge - from the degree of its transformation - on the relationship of present forest to environment. It is assumed that severely transformed forest stands can much worse resist atacks of anthropogenic activities and cannot fulfil non-wood-producing functions to full extent, whose sense consists in maintaining ecological stability in the landscape. We would like to point out that the discussed issue includes only composition of forest tree species, not forest appearance and character of management applied in the forest. According to the mentioned criterion, forests were differentiated by their tree species composition as follows:

- forests very little transformed,
- forests little transformed,
- forests transformed,
- forests heavily transformed.

In addition to the fact that forest management takes a certain part in influencing environment as one of the human activities, the forest as a natural landscape element is affected by condition of environment. One of the most pronounced impacts can be seen in consequences caused by air pollution. According to the degree of damage and danger to forest stands represented by air pollution, classification of forests was illustrated as follows:

- forests with low signs of damage,
- forests with lower and medium damage,
- forests with severe and very severe damage,
- dying and died forests.

Very essential is also a non-wood-producing ecological function of the forest. Urban forests provide a possibility of compensating unfavourable characteristics of urban environment. In the northern half-circle of Brno surroundings extensive forest stands form a so called "green horse shoe" which is a very beneficial element for environment of town inhabitants.

Damage to forests belongs among important indicators of disturbed natural environment, namely air pollution. Significant is also a fact that this indicator is relatively very sensitive to transfer of air pollutants often at great distances.

2.5 Rural areas

In conditions of Central Europe, rural areas represent the most visible element of natural environment degradation. Total transformation of the original biota is further intensified by consequences caused by used agrotechnical methods whose range is relatively wide from pollution of environment with chemical preparations, mechanical damage due to employed machinery up to opening extensive areas to water and wind erosion.

With regard to the fact that data needed for an analysis into impacts of chemization in agricultural production onto deterioration of natural environment are hardly obtainable in the chosen scale, the map includes mainly phenomena related to erosion processes. Danger of erosion to soils is expressed qualitatively, by two more or less contradictory categories: arable land protected from erosion by turf, and arable land with prevailing accumulation and transport processes.

The methodology of analyzing the degree of water and wind erosion hazard to soils is based

on confrontation of natural potential (resistance against changes) with anthropic pressure (KUNDRATA 1988). Arable land with prevailing erosion and denudation processes was divided into three categories by intensity of the phenomenon:

- low intensity,
- high intensity,
- very high intensity.

In addition to this classification, plots of arable land which are exposed to very heavy wind erosion formed a special group.

2.6 *Animal production facilities*

In contrast to the non-point character of environment devastation by plant production, pollution of environment by animal production is of purely point nature. Heart of the matter consists in the fact that the majority of large-scale facilities in which a considerable part of livestock was kept during the period under study were built with technology for processing wastes in the form of liquid slurry. This technology has been proved to have an extremely negative impact on pollution of natural environment. The large-scale facilities of animal production were divided in the map according to employed technological process into litter, slurry, and combined facilities. In the latter case, share of both mentioned technologies was illustrated.

Values of a so called population equivalent of pollution were allocated to individual point sources of pollution from animal production, the value being defined as wastes produced by human residence of a given number of inhabitants. This quantitative classification has five categories, and extremes range between thousands and ten thousands of inhabitants.

2.7 *Solid waste dumps*

Solid waste landfills are identified in the map with the waste being mostly either communal or mixed. Localization of the dumps was made on the basis of existing records which were then combined with terrain survey. According to regime of their operation, the dumps were classified into controlled dumps, ie. landfills with approved regime complying with environmental principles and knowledge, approved dumps, ie.landfills approved to certain provisions but with no controlled regime, and wild dumps, ie. illegal landfills.

2.8 *Impacts of traffic*

Negative effects of traffic are the first of line sources to environmental problems entered in the map. Factors taken into consideration were air pollutants and noise. Data were obtained from information on counting road traffic, whose results not only register numbers of passing vehicles along various road sections, but also composition of the vehicle flow of which the most interesting part for us was the rate of passing trucks, especially heavy lorries. The mentioned data were converted according to existing formulas into negative effects of traffic, valid for individual sections of selected roads.

Air pollution was expressed in $kg \cdot km^{-1}$ in three categories while noise was recorded in dB/A in four categories. Obviously, this expression can apply only to road sections which were measured at counting the traffic. It is assumable that it was first of all road sections with higher traffic load that were counted. Therefore, with a certain exaggeration, we can assume that uncounted road sections fall into the next category - least damaging the natural environment.

2.9 *Air pollutants*

This item of legenda to our map illustrates point sources of air pollution with noxes whose occurrence is currently measured in Czech conditions. It is dust, sulphur dioxide and carbon monoxide. Data were obtained from registers of air pollutors recorded in registers of REZZO information system, operated by TERPLAN Prague. Sources of dust air pollution are mentioned in two categories as to their significance: less important sources of dust air pollution (1000-3000 MT noxious substances per year), and sources of dust air pollution important from the super-regional point of view (beyond 3000 MT noxious substances per year). In addition to this, there is a special marking for important sources of sulphur dioxide immissions (beyond 2000 MT per year) and carbon monoxide (beyond 3000 MT per year). Production rates of air pollutants from non-point sources such as local heating of residences are mentioned in another item of legenda.

2.10 *Water pollution and waste water treatment*

The first of parameters expressing consequences of environment pollution is the index of water stream polution. In the Czech Republic we have four categories to indicate cleanliness of water streams. The categorization has been a result to complex characteristic of water streams, which

included oxygen regime (BOD_5), basic chemical composition and special indices. Values of the index are principally related to pollution sources and their localization as well as to 355-day water passage $Q355_d$. Category I represents clean water, category II polluted water, category III heavily polluted water, and category IV water which has been very heavily polluted. Water of the categories III and IV is usually not usable for most of purposes. In addition to the categories of water cleanliness this item includes also localization of waste water treatment plants.

2.11 *Air polluted regions*

Another index to show consequences of natural environment pollution can be seen in air polluted regions. Air pollution with sulphur dioxide and with flying dust was taken into account at their demarcation. Data were obtained partly through measurements, partly through estimates made on the basis of localization and character of the sources, relief articulation and dominating wind direction. Average annual values in $\mu g \cdot m^{-3}$ were calculated for 1981 – 1988.

Cartographically the air polluted regions were demarcated by means of isolines which reflected identical level of pollution and were graduated by 10 $\mu g \cdot m^{-3}$. The highest tolerable concentrations in sulphur dioxide and flying dust were 60 $\mu g \cdot m^{-3}$ and 40 $\mu g \cdot m^{-3}$, respectively.

2.12 *Production of residential wastes*

Wastes from residences were calculated on the basis of numbers of inhabitants and individual characteristics related to technologies of waste formation. This applies to air pollution and its connection with methods of heating flats where the decisive role is played by availability of gas. This kind of air pollution is naturally considerably increased during the heating season. Method of heating plays an important role also in terms of amount and sorts of solid communal wastes which differ - on the top of it all - by the degree of urbanization of the residence. Resulting values of waste production were expressed by a triad of numbers, recorded under the name of residence. In the City of Brno, the calculation was made for individual neighbourhoods.

2.13 *Method of using water areas*

A complementary characteristic in the map is the method of using water areas, marked with a letter. Legenda of the map distinguishes utilization for protection, water management, agricultural purposes, livestock keeping purposes, recreational purposes and swimming pools. Admitted is a multi-purpose use of water reservoirs.

3. *Disturbance to natural environment in NW surroundings of Brno*

Northwestern surroundings of Brno are situated at a counter direction to prevailing winds and at a counter direction to water streams from the city. Theoretically, this ought to be a relatively advantageous position. However, it is necessary to consider that the locality is known by numerous anthropogenic activities which are more or less bound to Brno. First of all, there are many engineering and other plants of the Brno industrial agglomeration, which are localized in Blansko, Adamov, Kuřim, and partly also at Tišnov. The landscape is massively disturbed by lime stone mining near Čebín. The most important recreational area for town inhabitants is situated around the dam reservoir Kníničky and in adjacent wood complexes which can also be found northwest of Brno. West of Brno, there is the Boskovice furrow which spreads along north-southern direction and is intensively used for agricultural purposes, while highway D1 spreads along eastwestern direction. Road traffic massively disturbs also a corridor along the road no. 43 (E461) in Svitavy direction.

A sheet of the map illustrates the northwestern section of the city of Brno itself. It is mainly dwelling parts and infrastructure while industrial zones are situated to the East and South of the town. Nevertheless, several large factories of engineering, electrotechnical, chemical, food, and building material industries as well as an important traffic corridor can be found even in the northwestern section.

The area situated to northwest of Brno is considerably differentiated in terms of physical geography. There are both forested ridges to be found here, which are relatively stable in ecological terms and inversion basins and breaks which are loaded with concentration of inhabitants, their activities and traffic corridors. Utilization of the area is then defined by topography and other natural conditions.

The area is relatively densely inhabited, particularly along major communications. However, there are also relatively extensive forest complexes here which can be found in the western and northern outskirts of Brno. Large amount of small residences can be found on the western margin of the map within the articulated topography of Křižanov Uplands.

The above rough characteristic of mosaic utilization of the area indicates that in the area under study there is a whole range of much diversed sources of disturbance to natural environment. However, diversed are also natural conditions and their greater or lesser capacity of absorbing the disturbance. All this then results in alternation of environmentally good quality areas which to certain extent can improve environment for inhabitants in Brno, with territories which are massively devastated by different forms of human activities.

4. *Conclusion*

Compared with the majority of other maps in the submitted collection 1 : 50 000, the map describing effects of socio-economic activities on the landscape is much more exacting with diversity of its problems. Its construction requires joint work of many experts in various partial geographical disciplines. Its results may sometimes look trivial because they illustrate generally obvious things. However, it is necessary to take into account that localization of problems concerning individual sources of disturbance to natural environment, similarly as attempts at their evaluation at such a large scalecannot be called simple in any case.

The above discussed complexity of the issue and organizational demands for processing of results present pronounced limits to application of illustrated problems in other regions. On the other hand, however, it is exactly this diversity that can provide a great field of action for fantasy of a cartographer who is thus free to create rich combinations of map elements which will ever better express contents of cartographical information.

In fact, sense of the map consists in interpretation of land use with emphasis being put on active human factor. Ambitions of the map should be seen in its capacity to form a basis for strategy towards sustainable development of the concrete region.

There is no doubt that similar maps must be made. Their minimum benefit consists in the fact that a relatively considerable number of environmental problems in concrete region can be recorded. These records are then an important helping hand at decision-making of local and regional councils and authorities, or possibly also an orientation starting point for ordering detail studies.

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Reviewer

Doc. dr. Alois Hynek, CSc.

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Explanations to the map - Appendix No.4

Urban areas
Quality and occupation of flats: 1 – very good, 2 – good, 3 – medium, 4 – poor, 5 – very poor.
Type of houses: 6 – Family houses, 7 – Blocks of flats, 8 – Combined.

Production facilities
9 – Industrial, 10 – Mining, 11 – Agricultural.

Recreational areas
12 – Recreational areas with weekend houses, allotment gardens, 13 – Sports areas.

Forests
Forest tree species structure changes as related to the natural status: 14 – Very slightly changed, 15 – Slightly changed, 16 – Medium changed, 17 – Severy changed. Air pollution impacts on forests: 18 – Slight, 19 – Medium, 20 – Strong, 21 – Decaying forests.

Agricultural areas
Soils exposed to erosion: 22 – Soils partly protected by plant cover, 23 – Arable lands characterized by accummulation and transport processes. Soil damage by erosion: 24 – Low, 25 – Heavy, 26 – Very heavy, 27 – Damage caused by severe wind erosion.

Rural animal production facilities
(assessed by population equivalent) 28 – Below 2000, 29 – 2000 to 5000, 30 – 5000 to 10000, 31 – 10000 to 25000, 32 – Beyond 25000, 33 – With litter technology, 34 – With semi-liquid and liquid manure technologies, 35 – With combined technologies.

Solid Waste deposits
36 – Controlled, 37 – Tolerated, 38 – Illegal.

Negative impacts of traffic
Polluting gases ($kg \cdot km^{-1}$ per day): 39 – Less than 100, 40 – 101 to 200, 41 – Beyond 201. Mean equivalent noise level in dB(A): 42 – Less than 65, 43 – 65.1 to 70.0, 44 – Beyond 70.1.

Air pollution
46 – Little source of dust pollution (1000–3000 MT per year), 47 – Source of dust pollution important from the regional point of view (beyond 3000 MT per year), 48 – Important source of sulphur dioxide (beyond 2000 MT per year), 49 – Important source of carbon monoxide (beyond 3000 MT per year).

Water pollution and cleaning facilities
Water quality classes: 50 – First class, 51 – Second class, 52 – Third class, 53 – Fourth class, 54 – Waste water cleaning plant.

Regional air pollution
Air pollution by SO_2 ($\mu g \cdot m^{-3}$): 55 – Measured annual mean concentration values in 1981-1988 (MAC = $60\,\mu g \cdot m^{-3}$), 56 – Expected air pollution. Air pollution caused by dust in $\mu g \cdot m^{-3}$): 57 – Measured annual mean concentration values in 1981 – 1988 (MAC = $40\,\mu g \cdot m^{-3}$): 58 – Expected annual mean concentration.

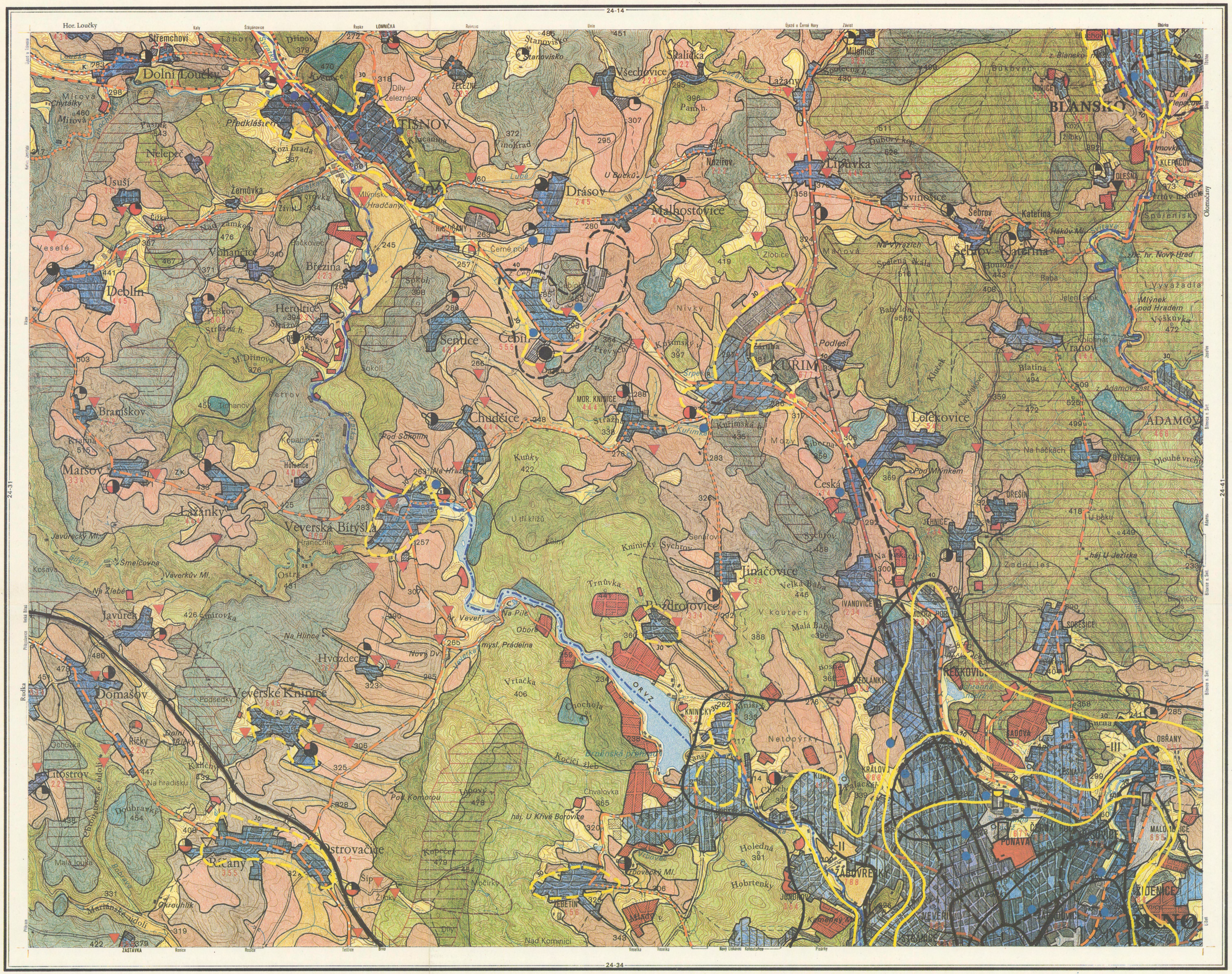
Urban waste production (red marked numerical code)

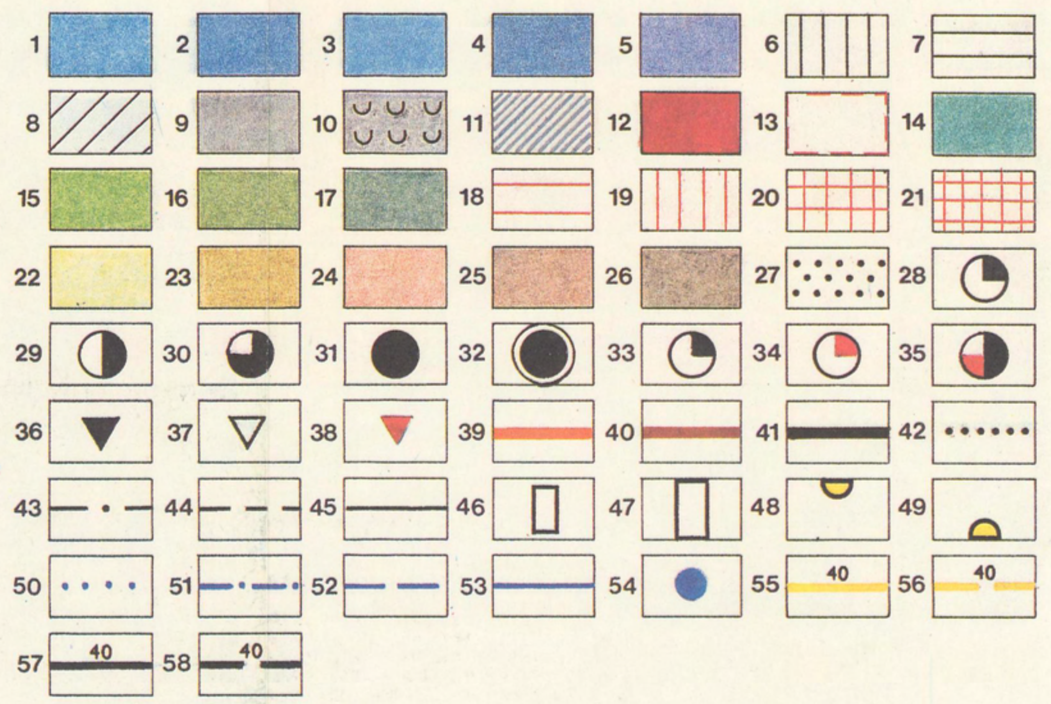
	SO_2 MT per yr	Waste water MT BOD_5 per yr	Solid urban waste MT per yr
0	less than 1	less than 1	less than 17
1	1.1 – 2	1.1 – 2.3	18 – 34
2	2.1 – 4	2.4 – 5.3	35 – 68
3	4.1 – 8	5.4 – 12.2	69 – 136
4	8.1 – 16	12.3 – 28.0	137 – 272
5	16.1 – 32	28.1 – 61.6	273 – 544
6	32.1 – 64	61.7 – 134.5	545 – 1088
7	64.1 – 128	135.5 – 298.0	1089 – 2176
8	128.1 – 256	298.1 – 655.5	2177 – 4352
9	beyond 256.1	beyond 655.6	beyond 4353

Function of water areas
O – nature protection, V – water management, Z – irrigation, C – fish production, R – recreationa

SOCIOEKONOMICKÉ ZDROJE NARUŠENÍ PŘÍRODNÍHO PROSTŘEDÍ ČR

24 - 32 BRNO





URBANIZOVANÁ ÚZEMÍ

Kvalita a obsazenost bytového fondu: 1 - velmi dobrá; **2** - dobrá; **3** - průměrná; **4** - špatná; **5** - velmi špatná;

Typ zástavby: 6 - rodinné domy; **7** - bytové domy; **8** - smíšená zástavba;

VÝROBNÍ ÚZEMÍ

9 - průmyslové areály; **10** - těžební činnost; **11** - zastavěné plochy zemědělských podniků;

REKREAČNÍ ÚZEMÍ

12 - rekreačně využívané plochy, chatové osady, zahrádkářské kolonie; **13** - sportovně rekreační areály;

LESY

Diferenciace změny dřevinné skladby: 14 - velmi málo změněná; **15** - málo změněná; **16** - změněná; **17** - silně změněná;

Poškození a ohrožení lesních porostů imisemi: 18 - s malými známkami poškození; **19** - méně a středně poškozené; **20** - silně a velmi silně poškozené; **21** - odumírající a odumřelé;

ZEMĚDĚLSKÁ ÚZEMÍ

Erozní ohrožení půd: 22 - půda, chráněná před erozí drnem; **23** - orná půda s převažujícími akumulačními a transportními procesy;

Orná půda s převažujícími erozně denudačními procesy: 24 - slabé intenzity; **25** - silné intenzity; **26** - velmi silné intenzity; **27** - orná půda, postihovaná silnou větrnou erozí;

PROVOZY ŽIVOČIŠNÉ VÝROBY

Přepočet na populační ekvivalent znečištění: 28 - do 2 000 obyvatel; **29** - 2 000 až 5 000 obyvatel; **30** - 5 000 až 10 000 obyvatel; **31** - 10 000 až 25 000 obyvatel; **32** - nad 25 000 obyvatel; **33** - stelivové provozy; **34** - kejdové provozy; **35** - stelivové i kejdové provozy s podílem jednotlivých procesů;

SKLÁDKY TUHÉHO ODPADU

36 - řízené; **37** - povolené; **38** - divoké;

NEGATIVNÍ VLIVY DOPRAVY

Exhalace ($kg.km^{-1}$ za 24 hodin): 39 - 100 a méně, **40** - 101 až 200, **41** - 201 a více;

Průměrná ekvivalentní hodinová hladina hlučnosti v dB/A: 42 - do 65; **43** - 65,1 až 70; **44** - 70,1 až 75; **45** - 75,1 a více;

EXHALACE DO OVZDUŠÍ

46 - méně významný zdroj prašného znečistění (1 000 až 3 000 t za rok); **47** - zdroj prašného znečistění významný z nadregionálního hlediska (nad 3 000 t za rok); **48** - významný zdroj emisí oxidu siřičitého (nad 2 000 t za rok); **49** - významný zdroj emisí oxidu uhelnatého (nad 3 000 t za rok);

ZNEČISTĚNÍ VODY A ČIŠTĚNÍ ODPADNÍCH VOD

Třídy čistoty vodních toků: 50 - I. třída; **51** - II. třída; **52** - III. třída; **53** - IV. třída; **54** - čistírna odpadních vod;

IMISNÍ OBLASTI

Znečistění ovzduší oxidem siřičitým v $\mu g.m^{-3}$: 55 - naměřené roční průměrné koncentrace v období 1981 až 1988, (při NPK = 60 $\mu g.m^{-3}$); **56** - předpokládané;

Znečistění ovzduší polétavým prachem v $\mu g.m^{-3}$: 57 - naměřené průměrné roční koncentrace za období 1981 až 1988 (při NPK = 40 $\mu g.m^{-3}$; **58** - předpokládané průměrné roční koncentrace.

Produkce odpadů ze sídel (červený třímístný číselný kód)

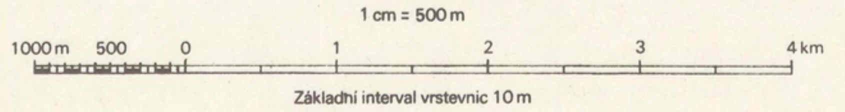
	oxid siřičitý t za rok	odpadní vody t BSK_5 za rok	tuhý komunální odpad t za rok
0	do 1	do 1	do 17
1	1,1 - 2	1,1 - 2,3	18 - 34
2	2,1 - 4	2,4 - 5,3	35 - 68
3	4,1 - 8	5,4 - 12,2	69 - 136
4	8,1 - 16	12,3 - 28,0	137 - 272
5	16,1 - 32	28,1 - 61,6	273 - 544
6	32,1 - 64	61,7 - 135,4	545 - 1088
7	64,1 - 128	135,5 - 298,0	1089 - 2176
8	128,1 - 256	298,1 - 655,5	2177 - 4352
9	256,1 a více	655,6 a více	4353 a více

Způsob využití vodních ploch (červená písmena)

0 - ochranná; **V** - vodárenská; **Z** - zemědělská; **C** - chovná; **R** - rekreační; **K** - vodní plocha ke koupání.

1:50 000

1 cm = 500 m



Základní interval vrstevnic 10 m

SOUBOR GEOGRAFICKÝCH MAP ŽIVOTNÍHO PROSTŘEDÍ

SOCIOEKONOMICKÉ ZDROJE NARUŠENÍ PŘÍRODNÍHO PROSTŘEDÍ ČR. List 24-32 Brno.
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