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SMALL AREA STATISTICAL UNITS AS SOLUTION FOR ENVIRONMENT
RELATED ASSIGNMENTS

Paper submitted by The Austrian Central Statistical Office¹

Summary: For the field of environmental planning, statistical information with a deep spatial structure is often necessary. It is the objective of this essay to demonstrate how the data of the Combined Census (= Population Census, Housing Census and Census of Non Agricultural Units of Employment) of the Austrian Central Statistical Office (ÖSTAT) can be processed for small areas in order to gain more information in the field of environment.

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I. Categories of Data

1. In the field of environment different categories of data are needed, as for instance:

- topographical basic data (digital topographical maps, digital and scanned aerial photos etc.)
- data concerning spatial structure (statistical data concerning population, economy, structure of settlement etc.)
- data on the conservation of nature and landscape, and the protection of species (digital mapping of biotopes, the protection of species and of the damage in woods and forests)
- data on the pollution of the environment and on the dangers to it (immission, emission and noise registers, radiation protection etc.).

2. These data have one thing in common: that is the spatial relation, their relation to the area. Especially for work with themes relevant to the environment, the selection of the area for which data will be processed is of decisive importance. On the one hand, the spatial aggregation of data is necessary to form mean values and, on the other hand, maximum values important to the state of the environment are obscured. Therefore, the level of aggregation will depend upon the respective task. Consequently, we must try to store the data in data banks in a form as disaggregated as possible (for instance, as co-ordinate values at permanent or mobile measuring stations).

II. Data from the Combined Census as a Source for Issues Relating to the Environment

3. As far as spatial structure is described by data those from official statistics are predominating. Especially important to the problems of the environment are the data of the Combined Census from which the following characteristics are available.

- **Population, households, dwellings, building activity, urbanisation:** age structure and density of population, average size of households, maximum population, number of dwellings, dwellings for recreational sojourns, size of dwellings, furnishing of dwellings, use and age of the dwellings, built-up area and type of building, area and number of floors of the building, and subsequent building activities during the last 10 years.
- **Traffic:** Persons commuting to their place of work or to school recorded at their place of residence or at their place of work respectively their place of school, type of vehicle and time necessary for the daily travel to the place of work or school.
- **Energy, air:** Type of heating, energy carriers for dwellings, buildings and places of work (the last one according to the type of enterprise and the number of persons employed).

III. Territorial Breakdowns of Issues Relating to the Environment

4. Spatial orientation is of priority in environmental statistics. It is necessary to show the diversity of the environment in its regional multiplicity. The statistical enumeration districts are the smallest territorial units on which statistical data of the Combined Census are published. Because of the circumstance that on the one hand, administrative boundaries had to be considered for the formation of the statistical enumeration districts and on the other hand, the number of inhabitants had to be between 300 and 2000 this breakdown into statistical enumeration districts is insufficient for inquiries concerning the environment. The only possibility to get a better description of the regional distribution is to pass on to a more accurate territorial breakdown.

5. For the Combined Censuses of 1981 and 1991 the Austrian Central Statistical Office made it possible to create territorial aggregates of optional size by special evaluation methods based on the smallest statistical survey unit, the building. These optionally formed aggregates are called "Project Areas" (German: Projektgebiete). Currently the formation of these areas involves the sacrifice of a lot of time of external users as there is still no digital reference geometry on the level of buildings. Only if every building address is furnished with a co-ordinate value as location point the formation of individual relation units can be realised quickly and easily. For the future, ÖSTAT plans in collaboration with the Federal Office of Metrology and Surveying to get co-ordinates for every building. As the data of the Combined Census as well as other data are attached to the buildings this is the most economic way to form optional small area units for statistical analysis.

III.1. Data on the Basis of Buildings

6. For every Austrian building, ÖSTAT provides the absolute figures only of persons living in it (resident population) as well as of the dwellings and units of employment to be found there. But already the population figure based on the buildings can answer many questions related to the environment, as for instance.

- How many persons of the area to be investigated into are living alongside a main street or railway track and, therefore, are molested by noise?
- How many persons are living outside the catchment area of local supply shops that can be reached by foot, and are therefore in an unfavourable supply situation?
- Which areas have no connection with the public network of water supply nor with the sewerage system? How large is the number of persons concerned?

7. The publication of characteristics concerning these persons, dwellings or units of employment is subject to severe regulations. The confidentiality of the personal data of the citizens has to be guaranteed. Depending on whether data from the Population Census, the Housing Census or the Census of Non Agricultural Units of Employment are concerned the level of aggregation is different (see following chapter).

III.2. Data on the Basis of Grid Squares

8. The simplest way to unfold an area without much work is the formation of grid squares. The territory is broken down into units of the same size. The grid squares are uninterrupted, homogeneous, covering the whole area, regularly divisible and therefore independent of scale. ÖSTAT will also have to offer certain standard maps on the basis of grid squares for selected statistical data relevant to the environment. The cartographic presentation of characteristics of the resident population, of dwellings, buildings and of units of employment on the basis of grid squares can help answering the following questions:

- How many persons have their main residence in a certain the territory and how many have their second residence there?
- Which vehicle is used for the way to the place of work or to school and how long does it take?
- What is the predominantly used heating fuel?
- What is the predominant use of the building?
- Which sort of water supply and which kind of disposal of waste water is there in the building?

9. As can be seen from these map examples grid squares are very apt to present facts relevant to the environment. It is an advantage of grid squares that it is possible to enlarge or reduce their size according to the problem to be solved. If small grid squares are selected (confidentiality must be attended to) statistical data can be connected with other environment data from topographical or thematic maps, with air or satellite photos. Only by the integration of Combined Census data into these breakdowns, which are mostly characterised by geographical facts (e.g. breakdown according to the facts of natural space), it is possible to demonstrate spatial connections.

III.3. Data on the Basis of Individual Territories

10. Statistical interpretations are often blurred if they were made on the basis of grid squares connected with other area information relevant to the environment (e.g. the outlet area of ground water). But this may be neglected, in most cases. If greater accuracy is wanted it will be necessary to harmonise the statistical breakdown with the boundaries of the area unit which has to be superimposed (as, for instance, the outlet area of ground water). The amount of work involved is small only if the statistical data are also stored within a geographical information system (GIS) on the basis of buildings.

IV. Examples for the Solution of Environment Related Assignments

11. The following examples show how effective the results of spatial analysis can be if data exist in a GIS data which have been processed for small areas. Depending on the planning objective, environment-related statistical data can be processed and can serve the production of statistics and maps.

12. **Buildings within the flood-danger (map 1):** In this part of the village the settlement lies on both sides of the stream. Several buildings are

situated within the area shown in the danger zone map as endangered by torrents and are therefore not suitable as dwellings. The question is: How many and which types of buildings lie within the zone endangered by high water? The result of the analysis based on building characteristics shows that 16 buildings are situated within the endangered zone of which 80% were built after 1971. 70% are residential buildings, 80% have one or two floors and the density of the built-up area (percentage of building related to the total area of the real estate) for all buildings concerned is below 50%.

13. **Residential buildings affected by through-traffic (map 2):** Within this part of the village the heavy-through traffic with its negative impacts has become one of the main problems. Corresponding traffic analyses are recommended. One question could be: How many and which types of residential buildings are situated within a strip alongside a thoroughfare? A spatial analysis shows that, within a distance of 25 metres from the thoroughfare there are total 72 of residential buildings. 60% of them were built before 1971, 90% have one or two floors and only 10% have dwellings which are used as a second residence.

14. **Buildings within the "non-building area" (map 3):** Within this municipal quarter the buildings are situated not only in the valley but also on the hills and extend in some cases non-building area. In order to obtain some control over the unhampered urban spread it is necessary to conduct an inventory of the buildings within the non-building area. The question which has to be answered is: How many and which types of buildings are situated within the non-building area, i.e. outside the area shown as building area in the area development plan? The spatial analysis shows that within the non-building area 115 buildings exist of which 30% are holiday and weekend houses of these, 70% are one-stored.

15. **Dwellings with single-stove heating (map 4):** By using narrow grid squares it is easily possible to obtain exact evidence on spatial distributions, for instance, concerning the type of heating. From an environmental point of view the single stove is the most unfavourable form of heating. The map shows in which areas single-stove heating is concentrated.

Note: Missing maps will be distributed at the meeting.