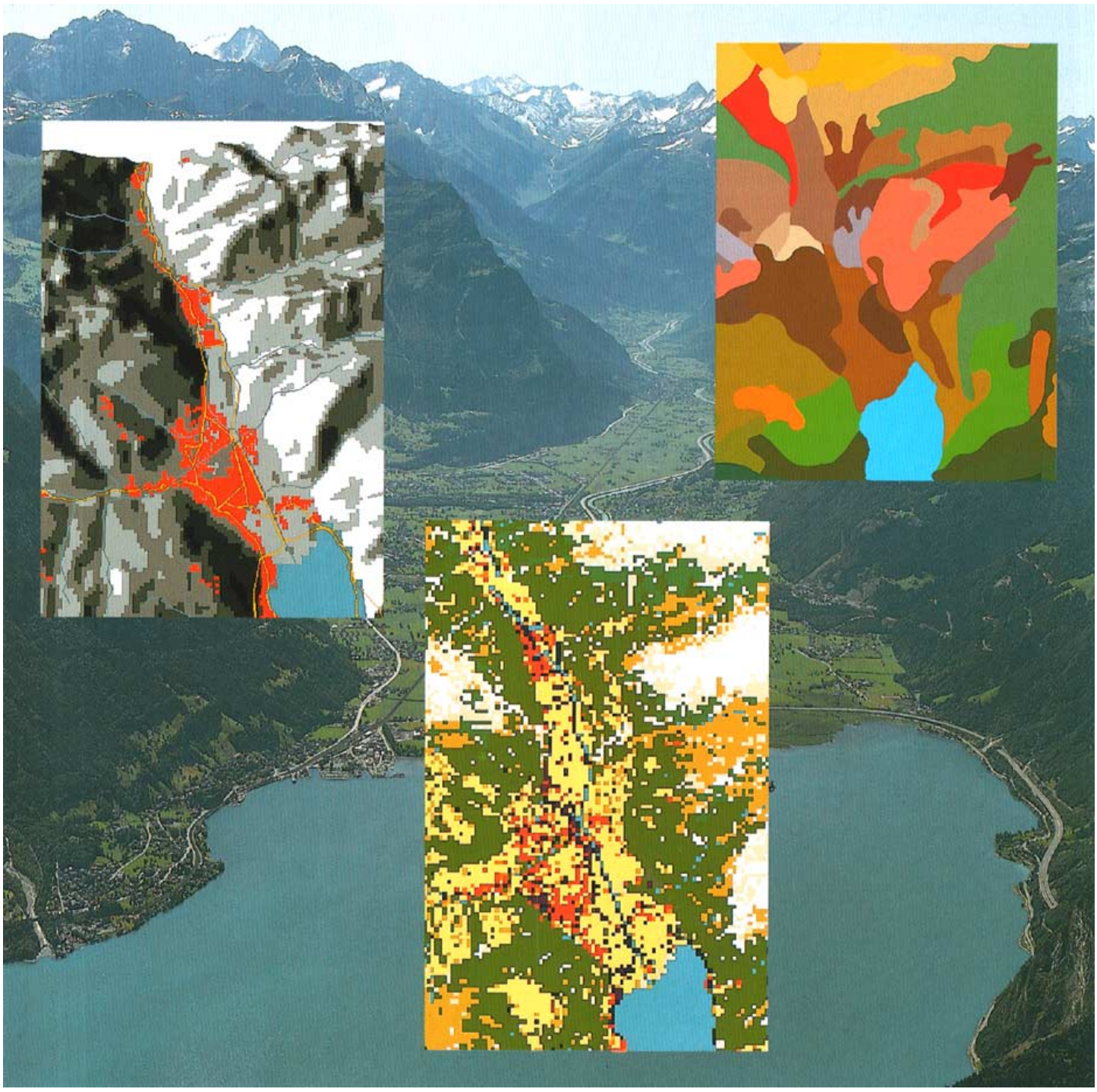
GEOSTAT

The service for Spatial Data in the Swiss Federal Administration



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Bundesamt für Statistik
Ufficio federale di statistica
Swiss Federal Statistical Office

OFS BFS UST

Neuchâtel, 1999

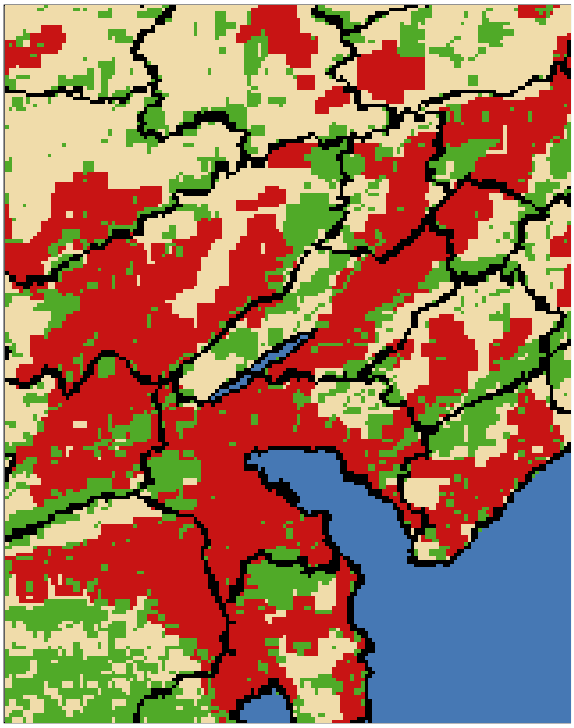
Introduction: Spatially related statistical data

In connection with the many new tasks and problems confronting us today, there is a growing need for evaluating regional data independently of administrative bodies such as local communities. With the advent of geographic information systems, the compilation and distribution of digital data based on small, flexible unit areas is gaining ground.

This brochure gives concise information on the services and possibilities of the spatial database of GEOSTAT operated by the Swiss Federal Statistical Office. Structure and operation of GEOSTAT are summarized and information on the geometry and the contents of its data sets is given. Examples of applications show how GEOSTAT can be used for solving scientific and practice-related problems alike, e.g. in the fields of regional planning and environmental research.

In 1990 the population of Switzerland totalled 6.9 million people. Settlement and urban areas covered an area of 242,000 hectares, with an additional 100,000 hectares of legal construction zones still undeveloped. Well over 25 % of the country is afforested and another quarter remains unproductive in the form of rocky terrain, brush and scrub, glaciers and lakes.

These figures are arbitrarily selected from the wealth of data largely provided by the Swiss Federal Statistical Office. Much of this data, which is available both for professional purposes and to the public, is informative on its own. Other figures provide relative information in combination with selected data. Particularly interesting in a country as widely varied as Switzerland is the possibility of combining statistical and survey data such as topography. Until only a few years ago, the smallest unit available for regional surveys was the local community. The resultant data on population density – for example in thickly wooded and mountainous communities – was of little value since the populated areas in such communities are only a small percentage of the reference area.



Thematic map based on GEOSTAT data

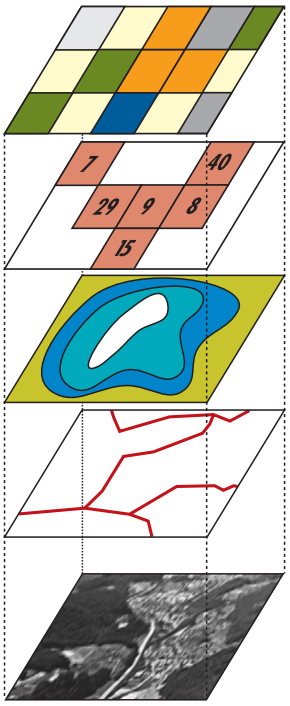
First steps towards an accurate spatial reference of statistical data

A decisive step towards a more precise spatial reference was taken at the end of the sixties by the Institute for Local, Regional and National Planning (ORL) at the Federal Institute of Technology, Zurich. The ORL scientists developed a national planning system known as «Informationsraster». In addition to local community data, this system included a survey database built on a grid network of spatial unit areas of 100 x 100 m (1 hectare). The land use information established in 1972 and based on the 1:25,000 national topographic maps proved to be the most important data set within this hectare database. Each hectare was coded according to the predominant type of land utilization that could be identified on these maps.

The national planning database concept was designed for continuous updating with important regional planning data giving information on residential and working populations, economy, buildings, education and training, culture and recreation, health and social security, traffic, supply systems and the state of local planning. The efforts and resources required for the collection, storage and processing of all this data on a hectare grid basis were underestimated in 1970, however.

This kind of system is known today as a «geographic information system». Thanks to the enormous progress in microelectronics, such systems now have a capacity far beyond the dreams of their originators twenty years ago.

What is a geographic information system ?



Land use

Demography: Population per ha

Geotechnical map

Administrative boundaries

Real world

Geographic information system

their specific characteristics (attributes). Spatial relationships (topology) between the objects and their surroundings are also defined.

Objects are the smallest elements within a GIS which can be associated with a spatial position and with attributes.

- Geometrical data define the absolute and relative positions of objects, based on their coordinates within a standardized coordinate system (GEOSTAT uses the Swiss national coordinates defined by the Federal Office of Topography).
- Attribute data describe the thematic, non-geometrical characteristics of objects. Attribute data are stored separately and linked with the geometrical data by a coding system.

The purpose of a geographic information system (GIS) is to represent the real world in the form of a data model. By transforming and processing simulated data in such a model world, processes affecting the environment can be investigated. The results can be a basis for administrative, economic and scientific decisions.

The spatial data in a geographic information system covers on one hand:
- the atmosphere
- the surface of the earth
- the soil

and on the other:
- population and economy
- technical and administrative installations such as buildings, industrial plants, infrastructure, etc.
- other economical and ecological aspects.

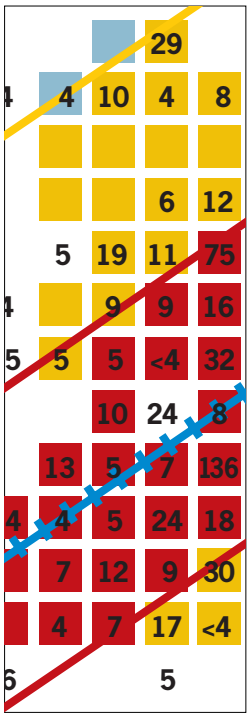
The data contained in geographic information systems can be systematically registered and processed based on a uniform spatial reference system. Real objects are modelled in a GIS by defining their spatial position (geometry) and

Selection and combination of different data

The efficiency and capacity of a geographic information system depend on its capability of systematically linking various data and deriving and displaying results from such combinations as clearly as possible.

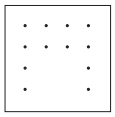
A typical example of a data intersection is the noise emission investigation in the lower Valais, Switzerland, shown on page 14. In order to find out how many local inhabitants would be affected specifically by railway noise, GEOSTAT compared computed noise emission ranges with data taken from the national census of 1990. The geometrical allocation of population data was based on digitized coordinates for all residential buildings registered by the census.

Finer differentiation is easily possible with GEOSTAT if the necessary attribute data is available, such as selected age groups, professions, etc.

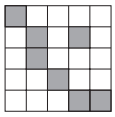


Types of data geometries

***Point data**, defined by XY coordinate pairs, such as the centre of a building or a district.*



***Point data in an equally spaced grid** are also referred to as a **dot matrix or a lattice**, e.g. the official Swiss land use statistics.*



*In case of **grid or raster data**, attributes are allocated to the cells of a uniform grid, e.g. population per hectare.*

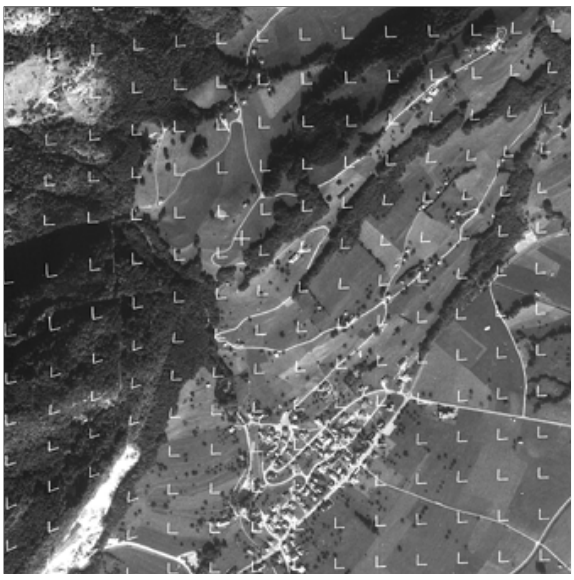
***Line data** are defined by the XY coordinates of their origins and ends (nodes) and of intermediate points (vertices); for example river or road networks.*

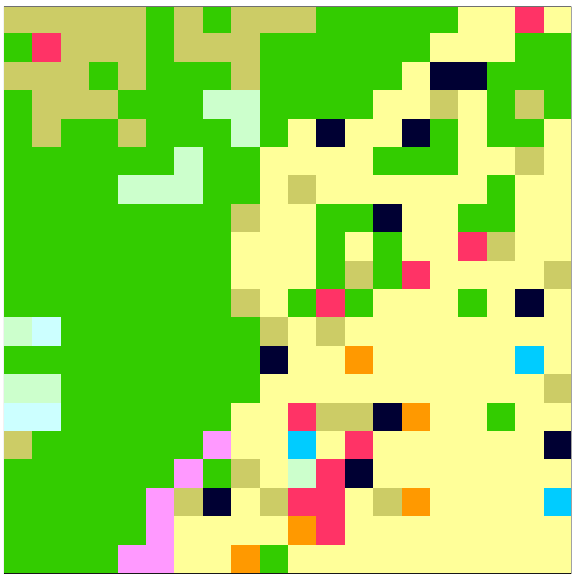
***Polygon data** are defined by the XY coordinates of their boundary lines; e.g. lakes, legally protected areas.*

Accuracy and representation possibilities of point samples

Points regularly arranged in a lattice can also be represented as a grid. A good example is the Swiss land use statistics 1979/85 which is based on point samples located at grid intersections. Information on the actual type of land use is identified and stored for each point. Each sample point thus classified with an attribute statistically represents the area of one grid cell, in this case one hectare.

The error involved in this kind of point sample data depends on the number of points for each attribute within a given evaluation area, as well as on the distribution of these points. Small or linear objects (such as buildings and roads) are represented only in an incomplete and inconsistent way, while large, contiguous areas of land use (such as forests or arable land) are represented with greater precision. This must be taken into account for data analysis and interpretation.





Swiss land use statistics 1979/85: the two illustrations show the same region – on the left as an aerial photograph showing superimposed locations of the point samples, on the right a raster image with color-coded types oft land utilization.

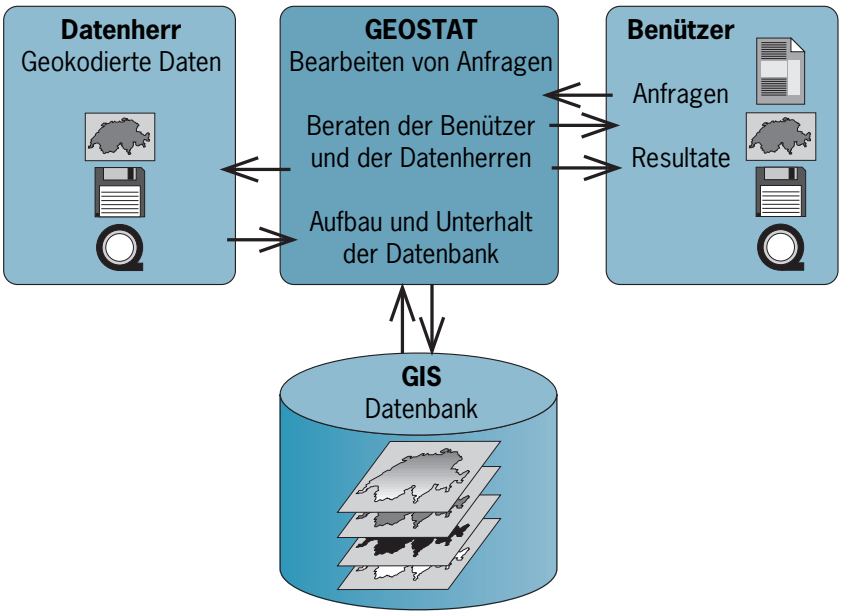
Tasks and operating mode of GEOSTAT

From a planning database to GEOSTAT

In 1976 the national planning database was transferred from the Institute for Local, Regional and National Planning (ORL) to the Swiss Federal Statistical Office. This changed the formerly task-specific concept of the database to an open system, whose spatial data were, stage by stage, expanded.

In connection with the Swiss land use statistics 1979/85, the integration of a modern geographic information system to replace the existing «Informationsraster» and to provide the data processing infrastructure for the new land use statistics was evaluated. In 1987 the decision was taken to procure such a system and to set up a specialized unit at the Federal Statistical Office – the GEOSTAT user service – to manage the new system and above all to councel the data users.

Since then there has been a vast growth in the amount of data and in the requested evaluations, analyses and digital products . GEOSTAT has now matured into an operational system and service facility held in high esteem by numerous specialists.



GEOSTAT services

Organization and operation of GEOSTAT

GEOSTAT consists mainly of two groups: The data processing group is responsible for maintaining and building up the system including programming, data integration, consistency and plausibility checking.

The user service group controls the flow of data to and from GEOSTAT. Therefore, contacts are maintained with data owners and users, aiming at an institutionalized interchange of information on existing spatial data and information systems (user manual, national catalogues of GIS data and systems). The user service group is responsible for data exchange, and answers all kinds of telephone and mail inquiries.
Data owners – persons or institutions possessing copyright on spatially referenced data – are approached by GEOSTAT in order to negotiate the integration, utilization and dissemination of their data. Data is released to GEOSTAT by the specialists concerned, who are responsible for its accuracy, validity, definition and updating and who decide on the specific conditions or eventual restrictions for the utilization of their data.

GEOSTAT mainly collects spatial data of public interest from the federal administration available for the whole of Switzerland. Data procured from owners is homogenized as necessary and added in a compatible manner to existing data layers in the GIS. The standard scale for data compatibility is 1:25,000 or the basic unit area of 1 hectare. Such data from GEOSTAT can be linked, intersected and combined and therefore analyzed for a wide variety of purposes.

The main task of the GEOSTAT user service group is to provide expert inquiry services. Potential users are advised and supported in selecting suitable data, defining transfer modes and data formats for successful data exchange, and identifying meaningful data combination possibilities.

GEOSTAT user manual

Access to GEOSTAT data is facilitated by a comprehensive user manual which is available in two languages (German and French) on paper as well as digitally in Acrobat PDF format. It explains the procedure for retrieving data and summarizes the GEOSTAT services. General conditions of data dissemination are stated and data protection aspects clarified.

The main part of this user manual comprises detailed descriptions of the data available from GEOSTAT. Data origins, collection and processing are explained, results discussed, and special features to be taken into account for analysis are pointed out. Manual owners are provided with periodic updates and additions.

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GEOSTAT attempts to promote a coordinated collection and compilation of spatial data throughout Switzerland. This should avoid as far as possible parallel and inefficient efforts for data collection and administration, both within and outside of the federal administration.

The main tasks of GEOSTAT can be summarized as follows:

- Compilation and administration of different spatial data of public interest collected by the federal administration and other institutions.
- Data processing and analysis according to the specific needs of users.
- User support and advisory services for their own analyses and projects.
- Advisory services for spatial data producers; coordination on a national basis with regard to data formats, collection and evaluation techniques.

Advances in evaluating satellite data will expand its use for geographical information systems (Landsat picture Switzerland; AC Art&Commodity, © ESA, St.Gall)

Data provided by GEOSTAT

The GEOSTAT data catalogue is classified according to thematic layers. Data belonging to various themes (such as land use, planning etc.) are stored in separate data layers. This layer concept does not incorporate any relationships between the different data sets, but they can be linked or intersected for display and analysis purposes by superimposing the corresponding layers. Presently, the following data sets which are described in detail in the GEOSTAT user manual are available to users:

Swiss administrative boundaries
Polygon data, digitized from the Swiss national topographic maps 1:25,000. Administrative bodies (communes, districts, cantons) of 1990, 1994, 1996 and 1998 available.
From this orignal data, four polygon data sets of administrative boundaries generalized to varying degrees were deducted.

Topographical data
Point data, 100 m resolution dot matrix, digital terrain model of Switzerland showing altitudes, inclinations and exposition; absolute and classified values.

Simplified geotechnical map as well as soil suitability map of Switzerland
Polygon data presenting 144 suitability categories of the soil suitability map 1:200,000 dating from 1980 respectively summarizing the content of the 1963-67 geotechnical survey map 1:200,000 in 30 classes instead of 60: loose scree (5 classes), rocky underground (23 classes), landslide and subsidence zones.

Swiss lakes
Polygon data based on the Swiss national topographic maps 1:25,000.

Swiss river network, waterbodies and hydrographic units
Line data compiled in connection with the production of the Hydrological Atlas of Switzerland, based on the Swiss national topographic maps 1:200,000 and corresponding polygon data of watersheds and other hydrographic units.

Swiss land use statistics 1972
Raster data of 12 types of land use, based on Swiss national topographic maps 1:25,000 and 1:50,000: identification of the predominant land use type per hectare.

Swiss land use statistics 1979/85 and 1992/97
Sample point data derived from a 100 x 100 m dot matrix superimposed on aerial photographs; identification of the actual land use at each sampling point.
- Statistical point data sets with 15 or 24 types of land use
- Grids; background data with 17 types of land use in 3 degrees of generalization.

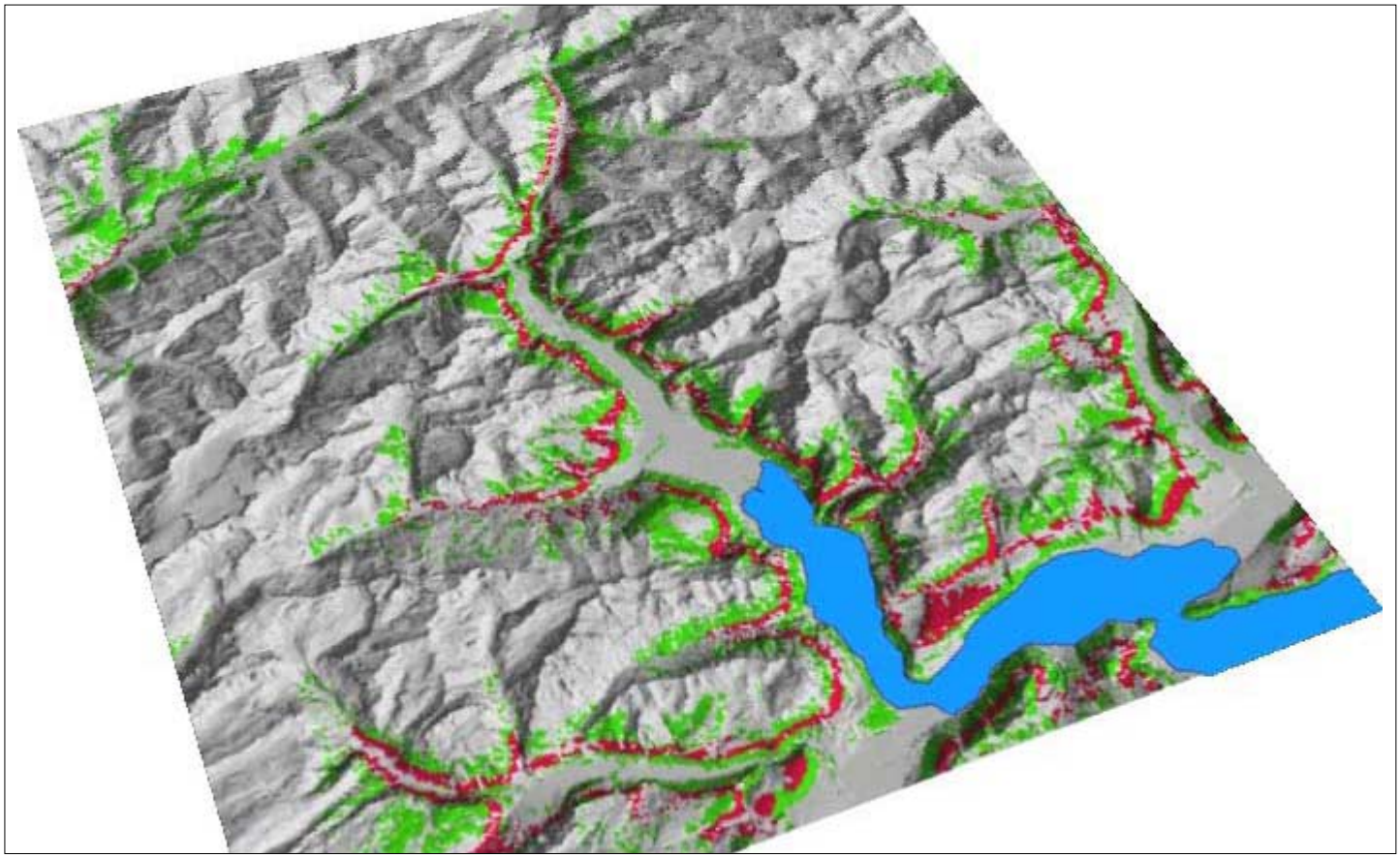
Federal censuses of population, buildings and housing
Point data aggregated on a hectare basis.
1970: 3 attributes; values summarized in classes; available for 750 municipalities.
1980: 54 attributes; absolute values; available for 620 municipalities.
1990: 389 attributes; absolute values; available for the whole of Switzerland.

Federal census of business and enterprises 1995/96
Point data aggregated on a hectare basis, 984 attributes on full and part-time occupation and on the NOGA economic categories.

Legal construction zones and delineation of agricultural zones of Switzerland
Dot matrix data on industrial and purely commercial as well as mixed construction zones based on 1975-1987 mapping surveys.
Polygon data on agricultural production zones based on 1:25,000 national topographic maps.

Federal inventories, protected areas
Polygon data based on 1:25,000 Swiss national topographic maps.
- Federal inventory of landscapes and natural monuments of national importance (BLN)
- Federal inventory of water fowl and migratory bird reservations of international and national importance
- Inventory of ibex colonies
- Federal inventory of Swiss game reserves
- Federal inventories of upland and transitional moorlands, of lowland bogs as well as of wetland habitats of national importance
- Federal inventory of nationally important meadowlands

Endangered forestry areas



Investigations on forestry damage in Switzerland have shown that certain altitudes are prone to particularly strong atmospheric pollution. In these zones, high altitude fog layers caused by atmospheric inversion remain stationary for long periods. The critical areas are situated in the Alps and foothills at altitudes approximately between 800 and 1100 m a.s.l.

Endangered forestry zones clearly displayed

In order to obtain the clearest possible overview of particularly endangered forestry zones, also understandable to laymen, this survey was based on a 3-dimensional topographical model. It was felt that a 3-dimensional aerial view would best show the full extent of these zones between 800 and 1100 m a.s.l. On a conventional 2-dimensional map, the areas in question would only appear as small strips.

Test case Uri

The illustration above covers most of the canton Uri and adjoining areas. It comprises a rectangular section with the coordinates 671,000/164,241 and 711,600/208,041. Afforested areas (not including brush forest) from the 1979/85 land use statistics are classified into three altitudes:

- below 800 m
- from 800 to 1100 m
- above 1100 m

The 800 – 1100 m zone, which is most frequently prone to fog, is coloured red in this illustration. The other areas are shown in green.

The GEOSTAT digital terrain model is used here as follows:

- Linkage with forestry area data for forest classification according to altitude
- Computation of topographical shadowing for arbitrarily selected lighting from the north west (315°). Shading intensity is calculated as a function of the angle between the land surface and lighting incidence.

Uri

- Perspective representation of topography. Land surfaces are shown either by closely hatched transsection lines or by colouring according to lighting. The two methods can be combined if required.

This 3-dimensional representation of canton Uri not only shows how forests form a belt around the valleys, but also the spatial geometry of the critical altitudes. The afforested zones most endangered are mainly situated on the steepest valley flanks, where they protect settlements and agricultural land from landslides and avalanches – as long as they survive in good condition. Further analysis using selected data combinations, such as slope inclinations and agriculture, population and housing census figures or construction zone data could reveal interesting conclusions.

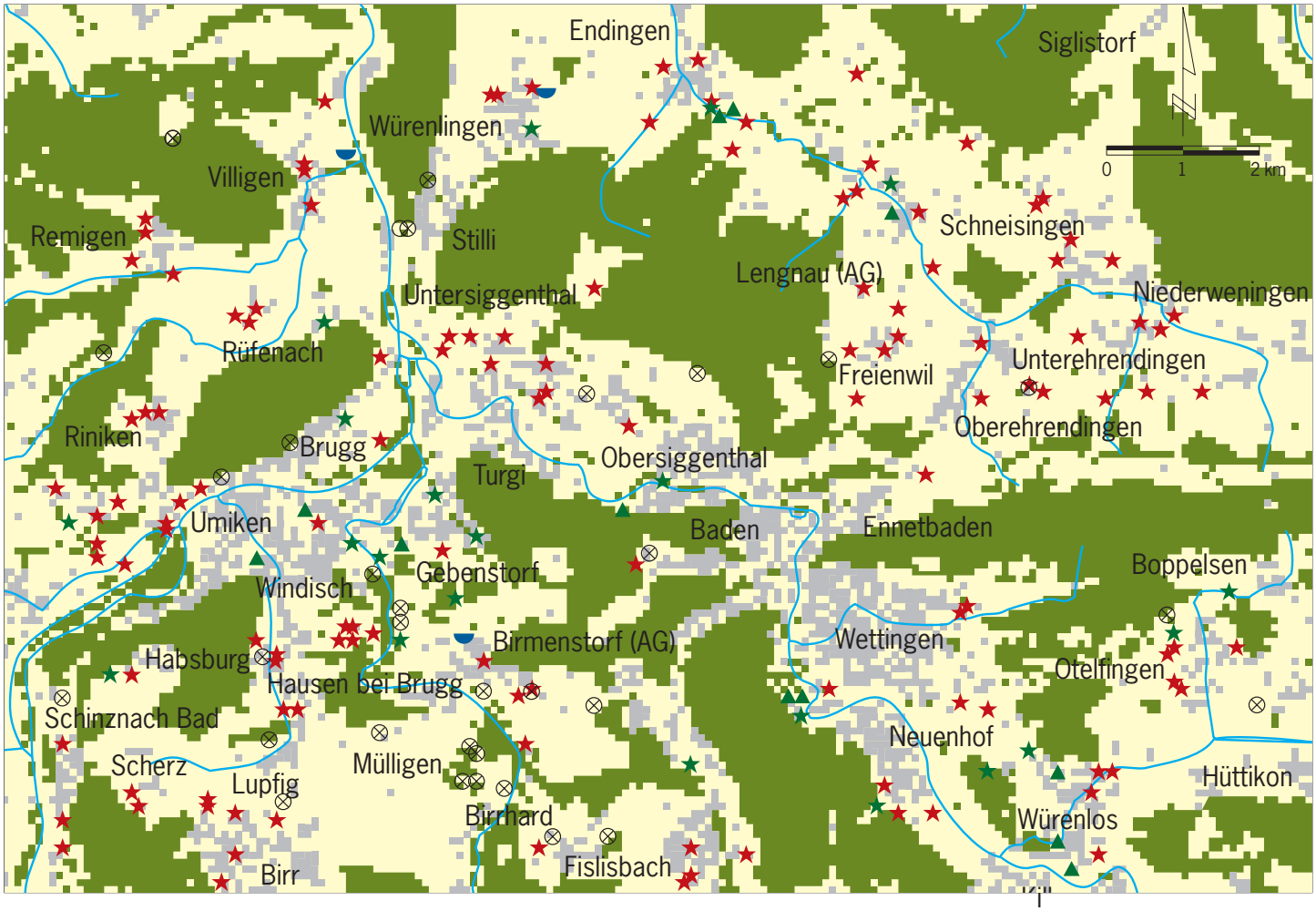
Tabular evaluation of forest areas according to altitude in the canton Uri
Areas in km^2

Altitude	Forest area	in %	Total area	in %
below 800 m a.s.l.	21.46	16.7	77.49	7.2
800 to 1100 m a.s.l.	**33.11**	**25.7**	**57.08**	**5.3**
above 1100 m a.s.l.	74.24	57.6	942.01	87.5
Total	128.81		1076.58	

Data used

- **Land use statistics 1979/1985:**
  Land utilization in 15 categories
  Hectar points
  Source: Federal Statistical Office
- **Topographical data:**
  Hectar points
  Source: Federal Statistical Office

Changes in the landscape: disappearance...



Baden region and surroundings. Each point marked indicates small aggregates which have disappeared or were established between 1982 and 1988.

Small aggregates which have disappeared
- Fruit trees
- Field thickets, hedges
- Tree groups
- Wetland, water

New small aggregates

Background map
- Settlement or urbanized areas
- Forest

Since the second world war the Swiss landscape has undergone enormous changes at an ever increasing rate. From the positive point of view this was coupled with economic booms, individual mobility and much greater agricultural output. The negative aspect is the price paid in terms of landscape deterioration – the spread of built up areas, loss of agricultural land and extinction of species. Despite zone planning and environmental protection efforts, there is no sign yet of a reversed trend. Not only is this confirmed by numerous case studies, but sample update tests of the Swiss land use statistics speak for themselves.

Current GEOSTAT results: small aggregates in the landscape

Land use statistics were updated for the Baden-Brugg region as a test. Presently, an updating programme based on aerial photographs from 1992–1997 is undertaken for the entire country which will allow analysis of land use and landscape changes within the limits of accuracy of the method. The Baden-Brugg example is concerned with the disappearance of small aggregates such as fruit trees, field thickets, hedges and brush, groups of trees, and wetlands. These not only characterize the landscape visually, but also possess high ecological value in terms of flora and fauna. Moreover small landscape elements such as rivers and streams, hedges and groves are highly desirable from the recreational point of view.

...of small aggregates

Baden

Changes from 1982 to 1988
Data analysis by GEOSTAT was based on selected hectare points where changes had been revealed when updating land use statistics.

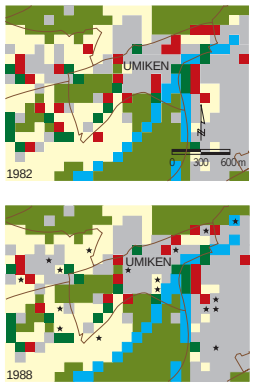
Selection was according to the following criteria:

- **before:** Fruit trees, hedges, groups of trees, wetlands (above all small aggregates)
- **afterwards:** Settlement or urbanized areas as well as agricultural land.

Tabular evaluation: number of changes
Total area of the evaluated region: 21'000 ha
forest: 8200 ha

Small aggregate	Base 1982 ha	In-/Decrease 1982–88 in ha	in percent
Fruit trees	478	- 126	- 26%
Field thickets, hedges	333	- 12	- 4%
Tree groups	202	- 21	- 10%
Wetlands, bushes	21	- 3	- 14%
New small aggregates		+ 32	
Total:	**1034**	**- 130**	

These points were used for building up a map and a table showing changes of small aggregates in the landscape. Each point is marked according to the above selection criteria against a background raster based on the 1979/85 land use statistics. The boundaries and names of local communities are also shown, together with the river network. An enlarged section shows the 69 basic land use categories, summarized in six classes. The special analysis – an example for future applications after updating the land use statistics – is based on two sample years and allows conclusions about the nature of changes of small aggregates. Findings so far are clear: many areas where small aggregates formerly existed have either become built up or are now utilized for agricultural purposes (arable fields, meadows or intensive fruit cultivation). Another aspect revealed in the enlarged section is that settlement areas have grown at the cost of farming areas. The rate at which land use has intensified is notable: within only six years the area covered by small aggregates has decreased by more than 12 percent.



Enlarged section: Land use changes on hectare points formerly covered with small aggregates

This example of small aggregate changes in the landscape shows how GEOSTAT can be applied using chronological data. Such data is partly available from the 1970, 1980 and 1990 national censuses; they are described in detail in the GEOSTAT users manual.

The presented example of land use statistics makes use of test data for a small area of canton Aargau in the Baden region.

Presently, work is going on to establish the ***Swiss land use statistics 1992/1997****. The results of this nation-wide update of the 1979/1985 survey already cover a major portion of Switzerland.*

For special evaluations of this nature, it is advisable to get in touch with the GEOSTAT user service group.

Data used

- **Land use statistics 1979/1985:**
  Land utilization in 24 categories (as background)
  Source: Federal Statistical Office
  Land utilization in 69 categories, based on hectar points (not described in user manual, only available for special evaluations)
  Source:-Federal Statistical Office
- **Land use statistics update:**
  Updates of individual areas with land utilization in 69 categories, based on hectar points. Results from the 1992/97 national updating project are available for completed regions and with up to 74 categories for special evaluations.
  Source:-Federal Statistical Office
- **Generalized municipal boundaries:**
  Polygons
  Source:-Federal Statistical Office / Federal Office of Topography
- **River network:**
  Line data
  Source: Federal Office for Water Resources

Construction zones and ground characteristics

View of Delémont from the south-west

Following the flood disasters in summer 1987, the Federal Office for Water Resources commissioned detailed studies of affected areas. The data used by scientists for this investigation included GEOSTAT data on land use and population distribution. The geological data required for a comprehensive assessment of flood damage was still missing at that time, however.

Geotechnical map of Switzerland

The four sheets of the «Geotechnical map of Switzerland, 1:200,000» provide geological information suitable for technical applications. In order to make this information available to GEOSTAT, the approximately 60 data classes were summarized to 30 units and digitized. Data on landslip and subsidence zones, important for planning large construction projects, were allocated to a separate layer. The areas stored as polygons in this file can be called up individually or collectively for analysis.

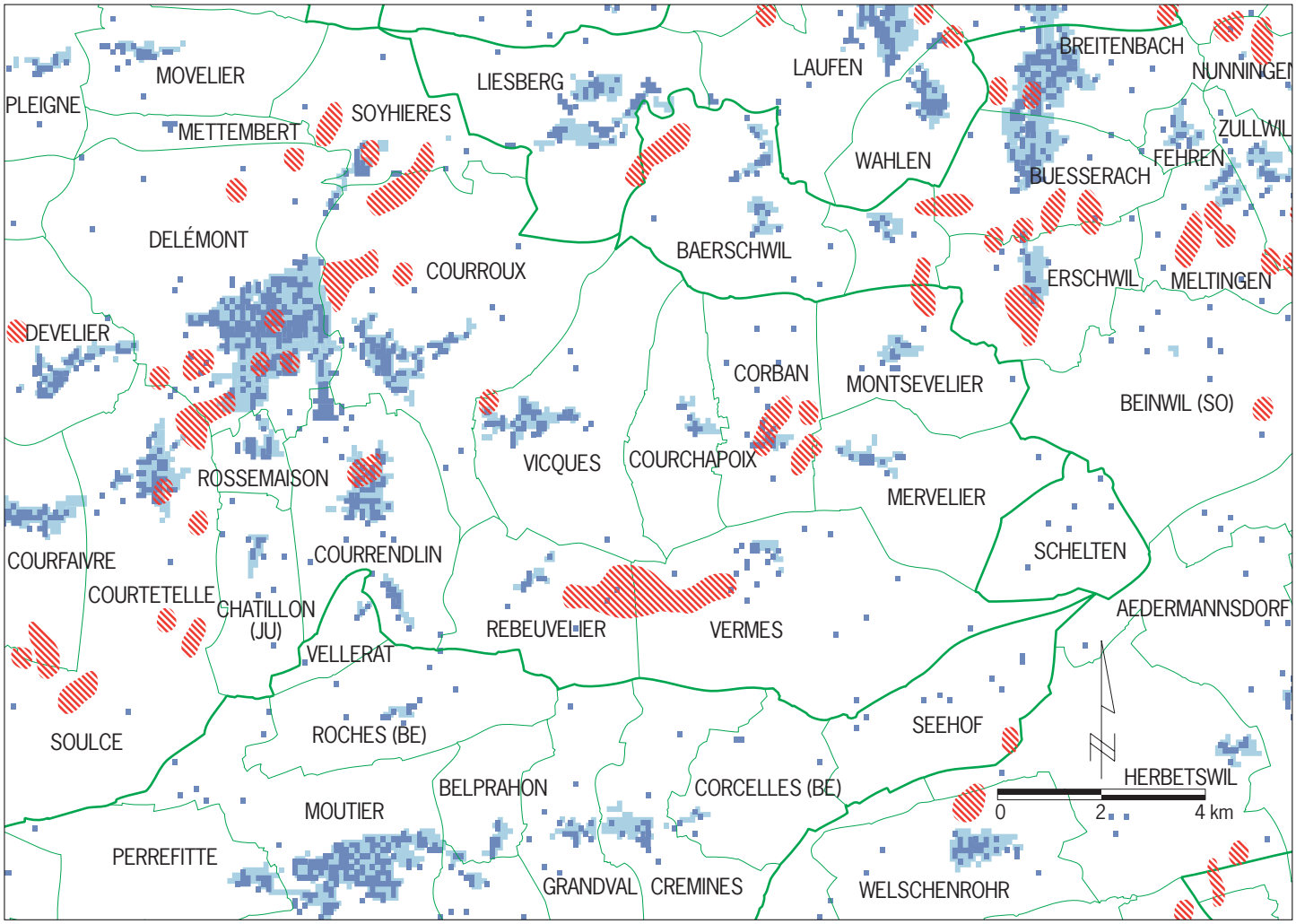
The interpretation of combined data from the geotechnical map and other files requires particular care. On one hand mapping is based on field surveys dating back to 1967 or earlier in some cases. On the other hand, generalization to a scale of 1:200,000 involved simplifications affecting small occurrences and delineation accuracy.

Although both linear and non-linear distortions were corrected during digitalisation, deviations up to 200 m still occur. For this reason excessively detailed application of this data may lead in some cases to wrong interpretations unless results are checked by field measurements. This applies above all when data of different original scales are combined.

Housing zone survey for cantonal planning revision

The model scenario for this GEOSTAT evaluation order is based on the revision of cantonal planning. Construction zones should not only be evaluated with a view to future housing development, but all building zones be comprehensively analyzed for suitability based on geographical and geotechnical criteria. Geometric reference points for further investigations are provided by the thematic map, derived by combining construction zone and settlement area (from the land use statistics) data with the GEOSTAT landslip and subsidence data. This map of the Delé-

Delémont - Scheltenpass region



mont area shows a certain incidence of areas possibly liable to landslips or subsidence. It is also clear from this map that only a few built-up areas or construction zones lie on the edge of such areas or within them.

- Construction zones
- Settlement areas
- Landslip/subsidence zones

Data used

- **Land use statistics 1979/1985:**
  Land utilization in 24 categories
  Hectar points
  Source: Federal Statistical Office
- **Generalized municipal boundaries:**
  Polygons
  Source:-Federal Statistical Office / Federal Office of Topography
- **Construction zones of Switzerland:**
  Hectar points (dot matrix)
  Source: Federal Office of Planning
- **Geotechnical map of Switzerland:**
  Landslip/subsidence zones
  Polygons
  Source:-Federal Office of Water Resources

The map does not provide final, certified information on risks in these areas, however. Only individual and field investigations can reveal whether there is a serious risk, or if the site concerned is merely subject to difficult construction conditions. Furthermore, data precision is insufficient for quantitative evaluation.

Noise abatement of Swiss Federal Railways coaches

The Swiss Federal Railways are currently testing various ways of adapting their standard coaches series I and II to the requirements of the Noise Abatement Act. Improvements can be achieved by modifying the bogies and using different materials. Since more than 1000 of these coaches are still operating and likely to remain in service for some time to come, complete replacement by the quieter and more comfortable series IV coaches is not feasible. The noise problem is therefore being tackled by installing new wheels, braking systems or bogies.

Tabular evaluation for each commune:
Number of inhabitants subject to noise > 60dB

	only affected by «loud» trains		affected by both train types	
Place	inhabitants	ha	inhabitants	ha
Chamoson	340	23	46	5
Charrat	245	28	287	25
Fully	55	8	-	-
Martigny	3839	75	1265	48
Riddes	1036	50	572	29
Saillon	8	2	<4	1
Saxon	1170	92	1531	109
Total	6693	278	3703	217

Model simulation of noise emission

Using a very simple model, noise emissions were computed along the Martigny-Riddes railway line to show the effect of quietened coaches on regional noise generation. Noise emission ranges were computed for the two train compositions set out below, and superimposed on population data of the hectare grid:

- «Loud» train: 8 coaches with conventional shoe-type brakes, generating a noise level of 104 dB(A) at a distance of 7.5 m and a speed of 140 km/h.
- «Quiet» train: 8 coaches with new X-type bogies and wheel silencers, generating a noise level of 89 dB(A) at a distance of 7.5 m and a speed of 140 km/h.

The computed noise levels generated by these trains are marked on the map as «noise belts» delineated by 60 dB isolines. The applied noise emission simulation takes account of the following factors:

- Train speed
- Air damping
- Ground damping
- Distance: at twice the distance between train and receiver the noise level is reduced by 6 dB. The train is regarded as a point source.

No account is taken of noise reduction due to topography, buildings or any noise protection barriers. The computed noise level is therefore a maximum value, and is usually lower in reality.

Determination of noise emission zones

With this noise emission model and digitized railway line data, noise emission range patterns can be computed and displayed spatially. As against conventional cartographical methods, zones affected by noise can also be analyzed in combination with various other GIS data files:

- By combination with population census data, estimates can be made of the number of inhabitants affected by train noise.
- For zone planning purposes, combination is also possible with data on construction zones in Switzerland. Superimposing noise emission data on zoned areas not yet built up indicates

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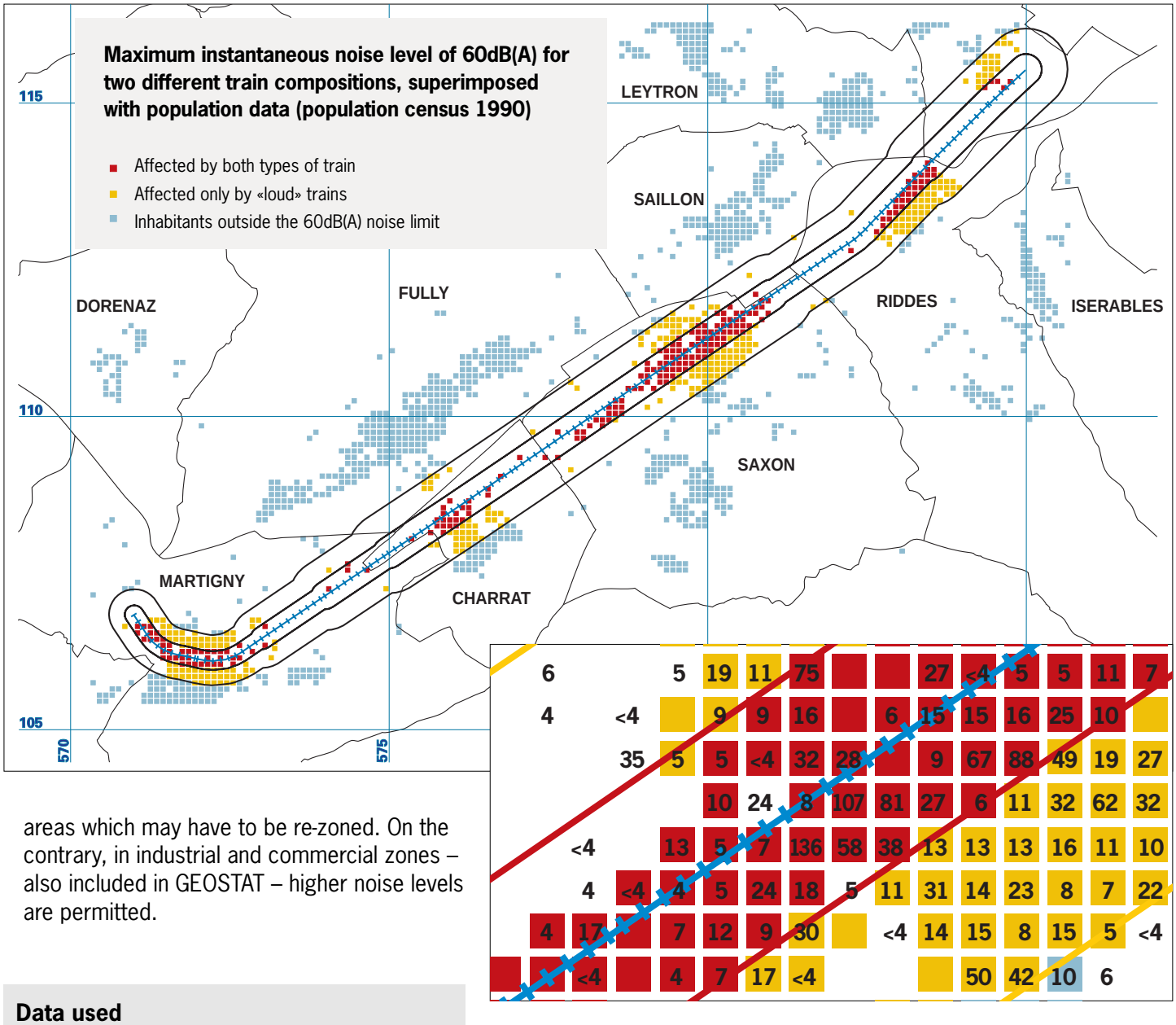

areas which may have to be re-zoned. On the contrary, in industrial and commercial zones – also included in GEOSTAT – higher noise levels are permitted.

This enlargement of the Saxon residential area shows population figures per hectare inside and outside construction zones (values below 4 inhabitants are not shown for reasons of personal data protection).

Data used

- **1990 population census:**
  Hectar points
  Source:-Federal Statistical Office
- **Generalized municipal boundaries:**
  Polygons
  Source:-Federal Statistical Office / Federal Office of Topography
- **Construction zones of Switzerland:**
  Hectar points (dot matrix)
  Source: Federal Office of Planning
- **Railway line data:**
  Digitized according to technical specifications
- **Noise ranges:**
  Computed according to noise emission simulation model along the railway line
- **5 km grid network:**
  Temporarily generated for charting purposes

- In principal, comparable studies can also be carried out for other kinds of traffic (such as highways or airports)
- By selecting a grid unit of 1 hectare, aspects of regional and interregional planning can be studied, such as alternative line routing. For planning and justifying structural measures on a local scale, however, the accuracy of GEOSTAT data is not sufficient.

This brochure gives concise information on the services and possibilities of the GEOSTAT geographic information system, the spatial database operated by the Swiss Federal Statistical Office.

The structure and operation of GEOSTAT are summarized and the main features of its data layers, geometry and content described.

Examples of possible applications from various fields show how GEOSTAT can be used for solving scientific and practice-related problems alike, above all in the fields of regional planning and environmental research.

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