Geo-Data Infrastructure for Land Management in Austria

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Key words: Spatial Information Management (SIM), Geodata, Geodata Policy, Geoinformation, Land Management.

SUMMARY

The competence of public land management in Austria is distributed to three different levels of public authorities: federal state, federal provinces and municipalities. Whereas the issues of land register, of land cadastre and land taxation lie in the field of responsibility of the federal state, the tasks of spatial (development) planning and ecological planning (nature conservation) are administered by the federal provinces and municipalities. Regardless of the specific tasks assigned to them, all levels of land management authorities have one thing in common which is the urgent need for more and quality geoinformation.

The paper starts with the description of all geoinformation used for land management activities in Austria. The description includes illustrations that depict samples drawn from nationally and provincially acquired datasets and is accompanied by the discussion of possibilities for the public to access and use the data. Finally, the concluding remarks are presented not only to wrap up the material, but also point out issues that could be further considered in a bid to strengthen the geodata infrastructure of Austria.

ZUSAMMENFASSUNG

In Österreich werden die Kompetenzen für die öffentliche Verwaltung zwischen den drei Gebietskörperschaften Bund, Land und Gemeinde aufgeteilt. Während Angelegenheiten des Grundbuchs, die Führung des Grundstückskatasters sowie die Besteuerung von Land in Bundeskompetenz liegen, fallen Raumplanung und ökologische Planungen in der Regel in den Verantwortungsbereich der Bundesländer bzw. der Gemeinden. Unabhängig von der jeweiligen Aufgabe haben alle Gebietskörperschaften einen dringenden Bedarf an Geoinformation.

Zu Beginn wird vorgestellt, welche Datensätzen für Bodenordnungsfragen in Österreich verwendet werden und welche auch öffentlichen Zugriff haben. Beispiele von bundesweit und regional erfassten Daten werden vorgestellt und die Möglichkeiten des öffentlichen Zugriffs diskutiert.

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1. THE COUNTRY

Austria is a federal republic in Central Europe with a size of 83.000 km² and has as per the estimate for mid-year 2003 8.2 million (http://www.prb.org/datafind/datafinder.htm) inhabitants. The country is divided into 9 federal provinces and 2500 municipalities – both kinds of units with own authorities. 43 percent of the whole country is covered by forests, 32 percent of the land is used for agriculture, 10 percent of the country consists of high-mountain areas, 7 percent is unused wasteland, 5 percent is covered by settlements and infrastructure facilities (e.g. houses, roads, railways), and finally 2 percent of the Austrian territory is covered by water.
The GNI (gross national income) per capita is about 24.000 $ (year 2001). The structure of the economy is such that 33 percent of the GDP (gross domestic product) is contributed by industry, 65 percent by services (e.g. 17 percent by the tourism and trading), and only 2 percent by agriculture and forestry.

2. PUBLIC (LAND) ADMINISTRATION IN AUSTRIA

The responsibility of Land Administration in Austria is clearly defined in the Constitution and is apportioned among the three levels of public authorities: the federal state, the federal provinces and the municipalities.

- The federal state is the authority for land cadastre and land register and for the specification of land taxes (determination of rates).
- Spatial planning and nature protection are domains of the federal provinces and finally
- The municipalities are the authorities for compiling the zoning maps and for the levy of land taxes.

The parcel is the smallest land administration unit in Austria. Within the land administration system parcels with the same ownership rights (owners, servitudes, mortgages, etc.) are summarized to entities or the so-called *real estates*. Each parcel has an individual number that is unique in the "Katastralgemeinde" (cadastral commune). One or more cadastral communes (commune being the next higher level of the land administration system) are aggregated to form a political commune (municipality) and this is the smallest public administration unit that also has an own council.
The Austrian Federal Office of Metrology and Surveying (BEV) with its 41 regional offices (subordinated to the Ministry of Economic Affairs and Labour) is responsible for the management and the maintenance of all cadastral (physical) information of parcels (see section 4.1). Local Courts (Regional Land Register offices) that are answerable to the Ministry of Justice administer and maintain the ownership rights of all parcels (see section 4.2).
In former days the information about ownership rights and parcel characteristics were separately held and managed by the respective authorities. As a result, the cadastre authorities had to be informed by the land register authorities on changes in the land register and the

latter in turn needed to get info from the cadastre to maintain the largely analogue data sets under their disposal. Since the implementation of the *Real Estate Data Base* (*GDB*, see section 4.3) in 1985 the cadastral and the land register data are integrated and now reside in a common data base. As the responsibilities of both authorities are now regulated by access rights to the GDB, the time-wasting effort exerted in updating the auxiliary registers has been eliminated.
Changes of cadastral information in the GDB can only be made by the Federal Office of Metrology and Surveying and their regional offices while the task of cadastral surveying is assigned to a range of entities as stipulated in a specific Austrian law of (Liegenschaftsteilungsgesetz, §1). Accordingly,

- Private surveyors with a license (doing an essential part of cadastral field survey)
- Surveyors with an academic education in a subordinated public department of the federal state, the federal provinces or the municipalities and
- Persons with a surveying education in a regional land reform authority are mandated to undertake cadastral surveying.

3. GEODATA

Geodata is a collective term for all kinds of data with a spatial reference. The spatial reference has to provide an unambiguous location for the specific data and has to allow the merging of data of different sources. The reference is realized as a point, a line, or an area in a defined (national or global) coordinate system. Also units of administration, addresses, or specific geographic names are used for referencing thematic data. In general the thematic data are describing physical characteristics, economic or ecological properties, legal aspects, as well as social and cultural features of land (Mansberger, 2003).
As it is well known, each and every decision in land management requires spatial information. This information is needed ex ante in order to see before hand the likely impacts of decisions (e.g., scenario development) or ex post in order to monitor and evaluate if land management decision are aligned with the planned and desired objectives. Though there are no limits as to the duration of projects that benefit from the use of geoinformation in this manner, projects with mid-term or long-term objectives are generally considered more appropriate for this kind of analysis.

4. COUTRYWIDE AVAILABLE SPATIAL DATA INFORMATION FOR LAND MANAGEMENT IN AUSTRIA

4.1 Cadastre

The origin cadastre in Austria can be traced back to the *Grundsteuerpatent* which was installed in 1817 by Emperor Franz I. The Emperor instituted this throughout the Austrian (and since 1867 Austrian-Hungarian) Empire. For the present day it could be said this laid the foundation for the relatively impartial system of taxation (*land taxation cadastre)*. Through time the cadastre - developed and matured - became one of the most powerful tools in the Austrian land administration.
In addition to this, the special surveying law enacted in 1968 enabled the mutation of "datasets of the *land taxation cadastre"* to "datasets of the *boundary cadastre"*. The

objective of the *boundary cadastre* has been to secure parcel boundaries in a new dimension. Additional to the title of parcels in *the land taxation cadastre* boundaries of parcels in this "higher quality level" of the Austrian cadastre (*boundary cadastre)* are also guaranteed by the state. The basic principle employed for a parcel to become part of the boundary cadastre is that its boundaries, before surveying, are negotiated and agreed upon with owners of contiguous parcels and each owner whose parcel is likely to be affected by this process has to express his consent in writing that the boundaries under consideration are correct and inviolable. Therefore, in case of a boundary dispute later, the boundary points of the concerned parcel will be re-established by the surveying authorities without the intervention by a court of justice. In contrast to this, boundaries disputes for parcels in the *land taxation cadastre* must go before a court of justice and be resolved. As the *boundary cadastre* is implemented on demand, the progress of the transition towards it is creeping: up to the year 2004 only 1.1 million parcels out of the 10.5 million parcels have been converted.
Additional to sites and boundaries of parcels the Austrian Cadastre (*land taxation cadastre* and *boundary cadastre*) includes additional information, such as

- Land use
- Area of parcels and areas of specific land use within a parcel,
- An index describing the soil quality for parcels in rural areas (*Ertragsmesszahl*).

The Austrian Cadastre contains:

- The Cadastral Map
- The coordinates of appr. 300.000 control points established by the BEV
- The coordinates of appr. 28.5 million parcel boundary points (7.6 million points as part of the *boundary cadastre)*
- Parcel register.

Cadastral Map

The process of digitizing and improving analogue Cadastral maps which is the graphic part of the cadastre (Gauss-Krüger-System; Bessel-Ellipsoid) was completed in 2003. The Austrian Federal Office of Metrology and Surveying (BEV) just finished this project, called the *Digital Cadastral Map* (*DKM*, see Figure 1). As the whole cadastre (including cadastral maps) is public in Austria, everybody also has access to the Cadastral Map. The whole information is also available on the Internet for a small fee.

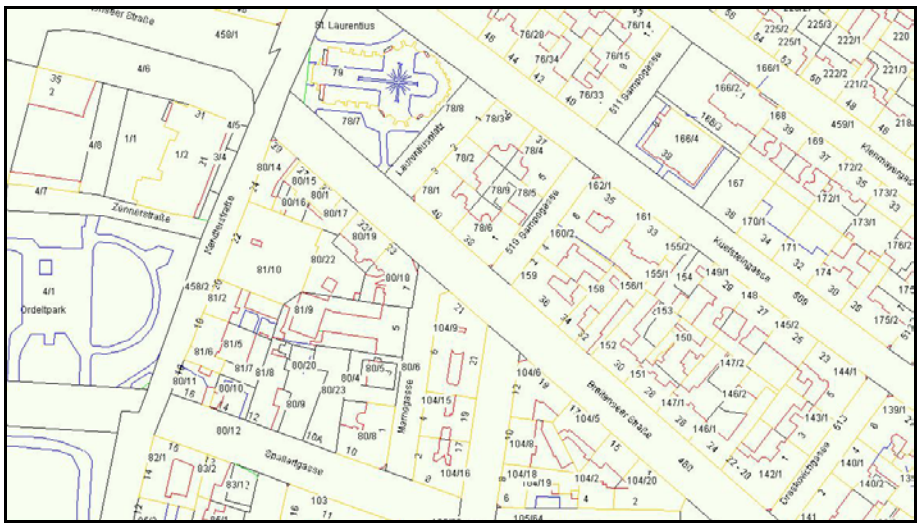


Figure 1: Cut-out of the Austrian Digital Cadastral Map (DKM), © BEV

Control Points

The Federal Office of Surveying (BEV) signalizes surveys and maintains appr. 300.000 control points all over the country. The sites of the points are indicated on topographic maps (detail scale: 1:50.000). This information and also detailed graphic topographies of all the control points are available free of charge on the Internet (www.bev.gv.at). The actual coordinates of the control points can be ordered for fee also via the WorldWideWeb. Of course people can obtain all this information in an analogue or digital form from the regional surveying offices.

4.2 Land Register

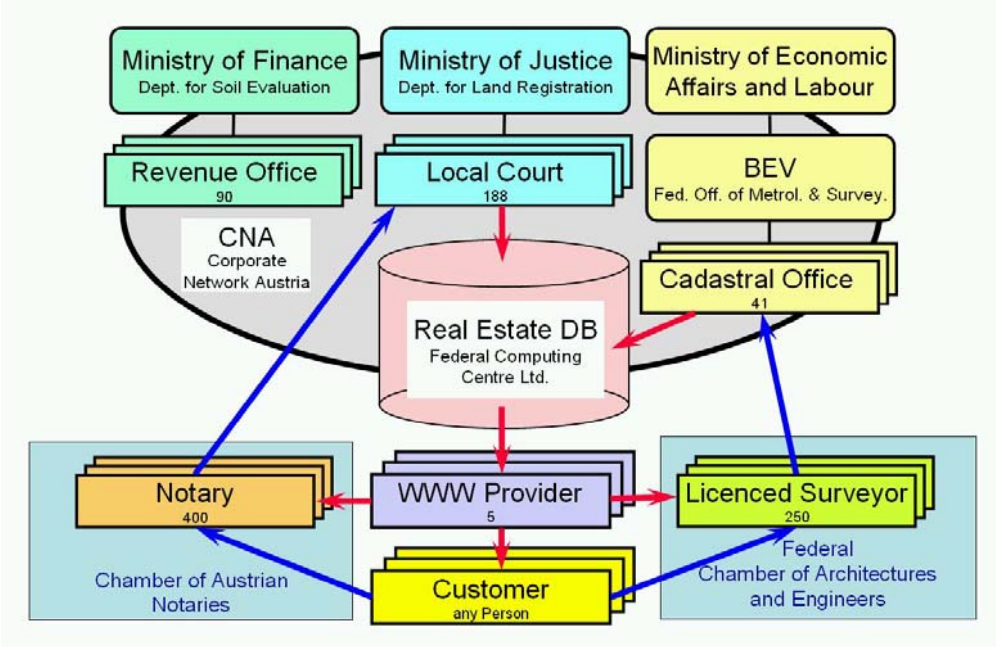
The Austrian Land Register is a public and legally binding catalogue in which all parcel based real property rights and other parcel related matters that has to do with legal issues are recorded (e.g. ownership rights, mortgage, servitudes). The registration is clearly defined in a number of specific laws pertaining to the matter (Allgemeines Grundbuchgesetz, Grundbuchanlegungsgesetz, Grundbuchsumstellungsgesetz, Allgemeines Bürgerliches Gesetzbuch). The land register has always been administrated by the Local Courts and its operation is governed by two fundamental principles:

- The mentioned rights can only be acquired by a registration in the land register and
- All users can rest assured as to the correctness and the integrity of the record.

The land register consists of the so-called Main Book (the “real” land register), of the register of deleted records, and of the collection of all the deeds (e.g. deed of sale in the case of a purchase of a parcel) (BMJ, 2004).
Since the year 1984 all the records of the Austrian land register are available in a digital format and stored in the Real Estate Data Base.

4.3 Real Estate Data Base (GDB)

As mentioned before the Real Estate Data Base (GDB) contains all relevant information of the Austrian parcels – merging the physical information and the legal information in a unique data base. The legally binding parcel information lie with in the Ministry of Justice (land register offices), the cadastral issues are managed and maintained by the Ministry of Labor and Economy in which BEV and regional surveying offices are the most important actors concerning land administration. Finally the financial issues (land valuation) are covered by the Ministry of Finance (delegated to their regional offices). Cadastral surveying can be done by licensed persons as mentioned in section 2). Surveying Authorities (BEV and regional offices) and subsequently they update the changes in the GDB. In the same manner private notaries are allowed to make contracts concerning ownership rights of a parcel. But the final control and the input of the changes to the GDB only can be realized by the land register authorities (land register offices).
All coordinates of the public control points and about 28.5 million boundary points (status: January 2004) are stored in the GDB in the nation-wide Austrian projection system (Gauss-Krüger-Projection-System; Bessel Ellipsoid).
Everybody has access to all updated data sets of the Real Estate Data Base. Only when privacy can be at stake that restrictions to the amount and type of data to be accessed are applied. Provision of data via the Internet is handed over to private enterprises that have special contracts with the public authorities.
Figure 2 shows in a schematic diagram the various players using and managing the Real Estate Data Base as well as the specific data flows to and from the data base.



[gm1]

Figure 2: Players and Data Flows within the Austrian Real Estate Data Base[gm2], © BEV

4.4 Aerial Photographs

Since the end of the Second World War aerial photographs of the whole country have been taken periodically in a scale of at least 1:30.000 and in a maximal time interval of ten years. Most of the photographs are archived at the Federal Office of Surveying (BEV). The BEV also documented each photo flight operated or ordered by it. Information about the average scale, the photo material, focal length and date of the photo flight is available and the public can access this information via Internet. Search functions in the "photo flight data base" allow a rapid selection of desired photographs (http://www.bev.gv.at/). Copies of all photographs as well as the coordinates and topographies of all available photogrammetric control points can be bought at the BEV in analogue or digital form. In certain cases (especially for photo interpretation tasks) the photographs also can be borrowed for a fee.

4.5 Topographic Maps (Data)

Topographic maps in various scales are often used as basics for thematic mappings and also as fundamentals for specific planning tasks. According to the federal surveying law the Austrian Surveying Authority (BEV) has to provide topographic maps for the whole federal state. Presently the following topographic maps which generally have a revision time frame of 7 years are available:

- Austrian Map 1:50.000 (ÖK50, Gauß-Krüger-Projection-System / UTM)
- Austrian Map 1:25.000 (ÖK 25V, photomechanical magnification of the ÖK50)
- Austrian Map 1:200.000 (ÖK200, Gauß-Krüger-Projection-System / UTM)
- Austrian Map 1:500.000 (ÖK500, Lambert's Cone-Projection-System)
- Austrian Orthophoto-Map 1:10.000 (ÖLK10, Gauß-Krüger-Projection-System)

The Austrian Orthophoto Map (ÖLK10) is not available for the whole country, but the Federal Office of Surveying avails this kind of product on demand (and incentive wage) in customer-defined scales and with diverse film materials.

Up to now the Austrian Map ÖK 50 and Austrian Military Map ÖMK50 were produced on the same machines with 2 additional colours for ÖMK50. Since Austria joined the NATO-program "Partnership for Peace" Austria agreed to co-operate on a common mapping infrastructure based on UTM and WGS84. In the period between the middle of 1997 and the beginning of 2000 all 191 sheets of the new ÖMK50 were finished, in addition to the continuation of the civil Austrian Map 1:50 000 (ÖK50). These maps, respectively the UTM information system, have been introduced at the Austrian Army in 2001. Consequentially the civil ÖK50 is produced in the UTM sheet line system beginning in 2000 and thus the production of the two maps will be unified again.

Furthermore, various layers of the Austrian Maps (e.g. body of water, roads) can be provided digitally in a vector format (without generalization) or the images of the maps in a raster format.

Some years ago the BEV launched a new product: The AUSTRIAN MAP 3D (A-Map) contains all the afore-mentioned maps (except the ÖLK) on two Compact Discs (CDs). Besides the topographic information the CD includes additional data sets describing the altitudes of topographic elements or all geographic names in the maps. The above-mentioned data allow a simple search routine within the maps. The A-Map offers many interactive features: e.g. for the displaying of three-dimensional coordinates of map objects in various

projection systems; some functions for the measuring of distances, height profiles, and areas; simple drawing utilities; a separate data base for the individual registering of geo-coded information; interface for GPS-instruments. Whereas the CD-version is provided by the Federal Office of Metrology and Surveying by specialized trade for money, an online version of the A-Map with a shortened functionality can be accessed free of charge via Internet (http://www.bev.gv.at/fr_2.html).

4.6 Digital Elevation Model (DEM)

Austria was one of the first countries in the world with a country-wide digital elevation model (digital terrain model). This model was compiled by photogrammetric methods using raster measuring functions and profile measuring functions with a sample width of 30m (in mountainous areas) up to 150m (in flat areas). The DEM was improved by the use of additional ridge lines, drainage lines, and break lines and is distributed for money by the Federal Office of Surveying (BEV). The data sets are delivered in a fixed raster width (maximal resolution: 25 per 25m²) as well as in a more proper way in a format including the point information and additional the above mentioned feature lines.

5. OTHER BUT NOT IN ALL CASES COUNTRYWIDE AVAILABLE SDI

5.1 (Digital) Soil Estimation Map

For parcels in rural areas the Austrian Cadastre contains an index that depicts the soil quality (*Ertragsmesszahl*). Soil quality is valued by soil experts of regional Tax Offices which are provincial departments under the Ministry of Finance. The valuation is based on the nature of soil, on the topography (relief) and site of the area, and finally on the water and climatic conditions of the site. The results of valuation are visualized in analogue and digital maps, the so-called *Soil Estimation Maps*. The final soil quality index of a specific parcel that serves as the basis for the taxation of farmers and agricultural enterprises is derived by the intersection of this soil valuation data set with the digital cadastral map. Usually these data sets only can be accessed by financial authorities and surveying authorities.

5.2 Cadastre of Regional Development

In Austria the governments of the regional provinces are responsible for regional land use planning. For this task all federal provinces have been implementing a Cadastre of Regional Development that contains all geodata required to practice various planning related functions. The data is provided in both analogue and digital format and also has both geometric as well as attribute information. The data set is public for all citizens and – as far as existing in a proper set-up – accessible via Internet (e.g. http://www.kagis.ktn.gv.at/kagis/; http://www.land-sbg.gv.at/sagis/).
The contents of the Cadastre of Regional Development are not uniform throughout the provinces and thus exhibit variations depending on the practice the federal province under consideration. Amongst copies of other public data sets (e.g. Digital Cadastral Map; Zoning Maps of the municipalities, see section 4.1 and section 5.3) people can visualize by using WebGIS-technologies specific planning maps, information about site and capacity of

infrastructure facilities (e.g. roads, railways), sites of areas of protection, water quality of rivers and lakes, and much more information to planning relevant topics.

5.3 Zoning Plan

The assignment or allocation of a specific parcel for is pointed out in the Zoning Map. The Zoning Map is based on cadastral maps and has two different functions:

- Regulation function: Each assignment/allocation is related with different ownership-rights (e.g. the dedication "Greenland" implicates a building ban for the parcel).
- Development function: Each assignment/allocation shows the potential use of parcels that must not necessarily be identical with the actual use (e.g. a parcel dedicated as "Building Area" is used as agricultural land at the moment).

The preparation of Zoning Plans started some decades ago and has always been the responsibility of municipalities. The Zoning Plans are public and can be inspected in the respective municipal office. Some municipalities place the Zoning Plan free of charge on the WorldWideWeb (see Figure 3).

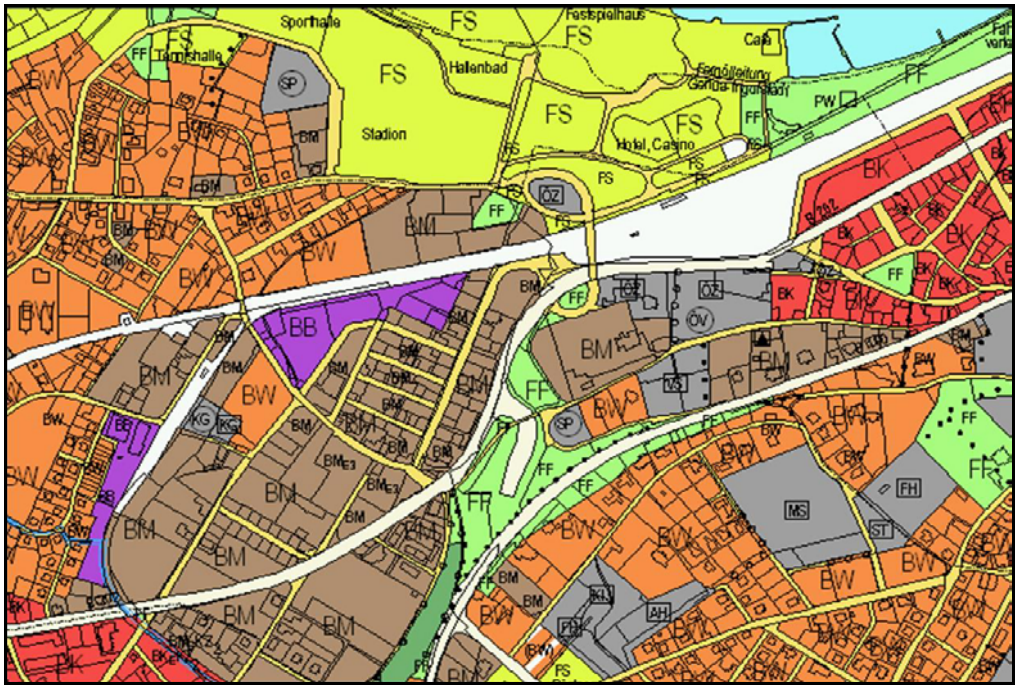


Figure 3: Zoning Plan, © *City of Bregenz*

5.4 Danger Area Plan

The Danger Area Plan outlines areas with a specific risk of natural disasters (e.g. avalanches, land slides, floods). The degree of risk is indicated in different colours, whereas the red zones (see Figure 4) point out areas with the utmost probability of a natural disaster impact. Usually the different zones are linked with different land use restrictions. The composition of Danger Area Plans lies in the responsibility of the Regional Offices of Risk Protection which are subordinated to the Austrian Ministry of Agriculture, Forestry Environment and Water

Management.

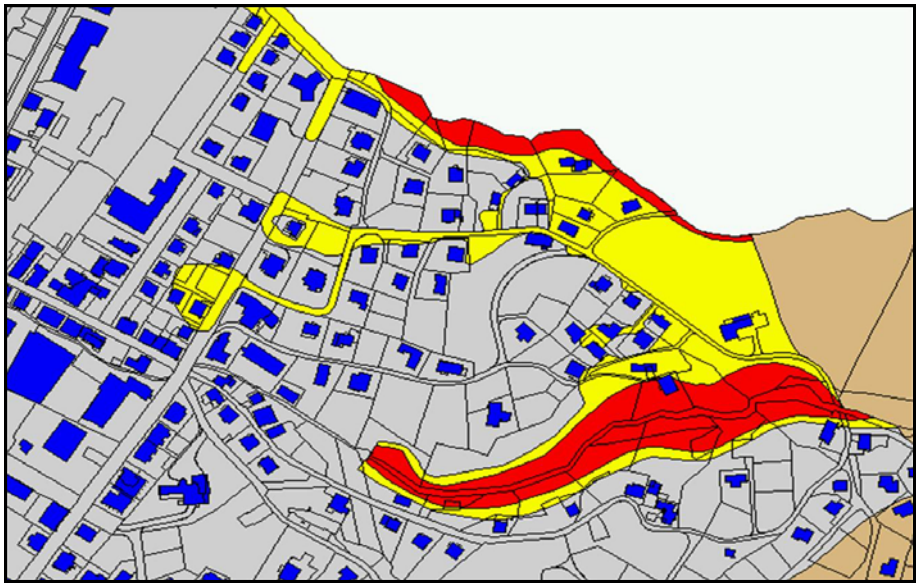


Figure 4: Danger Area Plan, © BEV

Danger Area Maps exist are produced for municipalities with a given risk probability. But Austria is a mountainous country with a plenty of flowing waters and therefore this kind of spatial information is existent for almost all Austrian communes. Citizens are enabled to have a free look to these maps in the specific municipality or in the Regional Office of Risk Protection. Danger Area Maps are not yet published on the Internet.

5.5 List of Additional in Austria collected Spatial Data Sets (without descriptions)

Road Networks in different levels; service pipes; mobile radio telephone service; geological maps; soil maps; climate maps; forest development plans; maps indicating proposed soil contamination; environmental protection area maps; water quality maps; etc.

6. AUSTRIAN CONTRIBUTIONS FOR EUROPEAN SDI

Austria has been a member of the European Union since 1995. Therefore the country is also involved in some European-wide initiatives that are aimed at developing homogeneous Spatial Data Infrastructure. Some of the European projects with contributions of Austrian institutions are listed in this section.

6.1 EuroGEOGRAPHICS

Austria contributes to the **EuroGlobalMap** which is a topographic dataset that covers the whole of Europe at a scale of 1 : 1.000.000. As part of the eContent Program of the European Commission, this dataset is produced in cooperation of the National Mapping and Cadastral Agencies of Europe (NMCAs) by using public national databases. At the moment 36 countries have agreed to contribute to the dataset. The project started in the mid of the year 2002 with the vision to achieve interoperability of European mapping (and other GI) data

within 10 years and so help the public and private sectors develop good governance, sustainable growth and benefit future generations (EuroGEOGRAPHICS, 2004).

6.2 EULIS

Within the eContent Programme of the European Union, national land registries with computerised systems – including Austria - have started a co-operation within a project called *European Land Information Service* (EULIS). *EULIS* will provide the possibility of reaching on-line and up-dated information about land and property rights across European borders via Internet. A first demonstration draft of the service is on the way to be published.
EULIS covers questions as content of the service, standards, protection of privacy, pricing, billing, security, technical solution, and marketing. The project will illustrate the positive effects of having land information available across borderlines and can be seen as a measure to improve the single market for financial services (more information: http://www.eulis.org/).

6.3 List of Additional Austrian Contributions for a European-wide Spatial Data Infrastructure (without descriptions)

NATURA 2000; CORINE Land Cover Project; EuroRoadS; etc.

7. SUMMARY AND CONCLUSIONS

The paper has given an overview of the elements of the spatial data infrastructure that is in the making in Austria. It has also highlighted the aims of the Austrian geodata policy. The institutions involved, the data under their custody, and the way the public authorities use this data and how citizens access and use the same are also discussed. The discussion is, however, by no means exhaustive.
However, it is considered to be adequate to share experience for those who are interested in Austria's endeavour and also to make some conclusions concerning the current and upcoming state of geoinformation in Austria vis-à-vis other countries. For instance, one could note that Austria has a huge amount of geodata in the public domain. In addition to the data holding, the state-of-the-art in technology and systems used to manage the data do by any standard place Austria high on the list of nations. This means that the country's geodata infrastructure is well advanced and can enhance its competitiveness in the global market and also promote its environmental concerns. Obviously this has not been achieved over night. Whatever success the country has made in the development of SDI, one should note that this is embedded in the history of the country in which continued government commitment and world class education system have played a major role in shaping the current databases and systems.
As regards the future, the cooperation between public authorities on different levels and private institutions must be intensified continuously to expend the Austrian virtual infrastructure (SDI) for a sustainable management of land and to avoid redundancies in data acquisition and data maintenance.

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BIOGRAPHICAL NOTES

Gerhard MUGGENHUBER has some 20 years of professional experience in management of cadastre and Geo-Information in Austria as well as abroad. Therefore he has an excellent knowledge in the management of geoinformation. In his present function as Vice-head of international affairs of BEV – Federal Office of Metrology and Surveying - he contributed to international initiatives in Eastern- and Central Europe like the Word Bank "Initiative on Real Property Rights". Gerhard Muggenhuber is elected Chairman of FIG-*Com.3 (Spatial Information Management)* and representative of the commissions in the FIG Council. From 1996-2001 he was member of bureau of the Working Party on Land Administration, an advisory body on land registration matters to the UN-ECE in Geneva.

Reinfried MANSBERGER currently works as an Assistant Professor at the Institute of Surveying, Remote Sensing and Land Information at the University of Natural Resources and Applied Life Sciences in Vienna (BOKU Wien). In 1982 he obtained his Master's degree in surveying at the Technical University in Vienna. From 1983 until 1987 he was appointed as a research and teaching assistant at the Institute of Applied Geodesy and Photogrammetry at the Technical University in Graz. He obtained his PhD degree at the University of Agricultural Sciences in Vienna (BOKU Wien). He is council member of the Austrian Society for Surveying and Geoinformation and he is actively involved in FIG as Commission 3 Vice Chair on Administration and Information. He is an elected member of the European Faculty of Land Use and Development. His research work is focusing on Land Use Planning, Land Information, Environmental GIS Applications, and Cadastral Systems.

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