

# Experiences in Establishing pan-European Geographic Digital Datasets

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## Abstract:

To meet the requirements of a common European market the European National Mapping Agencies joined in the association **EuroGeographics** have established several projects to integrate and harmonize pan-European geographic digital data sets. BKG is involved in the following **EuroGeographics projects**:

- Seamless Administrative Boundaries of Europe (SABE), a pan-European dataset of administrative units compiled from national contributions,
- Pathfinder towards the European Topographic Information Template (PETIT), a feasibility study for a pan-European 1 : 250,000 scale topographic dataset,
- EuroRegioMap, a pan-European 1 : 250,000 scale topographic dataset using the experiences of PETIT,
- MapBSR, a project mapping the drainage basin of the Baltic Sea at a scale of 1 : 1,000,000, which was recently chosen to serve as a basis for
- EuroGlobalMap, the European contribution to the Global Mapping Project.

All these projects aim at producing seamless, homogeneous and consistent digital datasets on the basis of standardized models with uniform spatial reference. Data acquisition is dominated by the principle of not digitizing maps again but to found strictly on the existing digital resources of the National Mapping Agencies. Thus, much importance is attached to the aspects of data integration and harmonization. BKG is gathering a lot of experience in various roles: BKG is Project Co-ordinator for SABE and will be a regional co-ordinator for EuroGlobalMap and plays an active role in the EuroRegioMap project. For the other projects BKG is responsible for the quality and in timely delivery of the German contribution to the project co-ordinator.

Experiences from managing pan-European projects will be presented as well as technical problems of integrating and harmonizing datasets from different sources giving examples of problems and solutions with regard to different data models, scales, accuracy, semantic meaning, projection systems, exchange formats.

## 1 Introduction

As Europe becomes more closely linked, pan-European topographic data will become increasingly important. Multi-national companies and international organisations need to be able to monitor their activities using reliable and comparable cross-border data. On the political level the awareness of the possibilities of geo-information is rising. Especially usage of multi-national coverage of geographical data sets as a vehicle to support international marketing and free-trading will increase. Applications as environmental protection or route planning do not stop at national boundaries.

National Mapping Agencies (NMA) as the providers of basic topographic information have to cope with that trend. They need to extend the geographical coverage of their data sets, which could be done by co-operating with NMAs of neighbouring countries on agreements of common specifications. To provide a **legal and organizational framework** the European NMAs founded **EuroGeographics** on 1 January 2001 as the successors of **CERCO** (Comité Européen des Responsables de la Cartographie Officielle) and **MEGRIN** (Multipurpose European Ground-Related Information Network).

## 2 EuroGeographics

CERCO was just a loose organisation that mainly serves the purpose of information exchange with some working groups dealing with special subjects like legal and economic affairs, Geodesy and GPS, updating databases, and quality. The need to have an unique focal point with permanent staff for operational and commercial activities in the growing geoinformation market led in 1991 to the creation of MEGRIN. Because of different legal background only 19 of the 35 CERCO member NMAs were able to join MEGRIN, too. This was one of the reasons to start the evaluation about a reunion of both organizations in 1999. The outcome was the creation of **EuroGeographics** as an Association based on French law **to strengthen the co-operation between the European NMAs**. EuroGeographics will continue with the MEGRIN projects and include also the Working Groups of CERCO. In addition, EuroGeographics will support its members in convincing their own governments for adequate national GI policies and support the development of a European Geographic Information Infrastructure.

Membership in EuroGeographics is limited to one representative per country (Active Member) but additional organizations could become "associated member". The highest decision making body is the General Assembly (GA), which will meet at least once a year and elect by its active members the President and complementary members of the Management Board (MB). Active Members whose subscription for the coming year exceeds 10% of the total subscription voted for the said year each have the right to appoint a member to the Management Board for a two-year period (this are DE, GB, FR). In addition four members will be elected by the Active Members of the General Assembly from among the representatives of the Active Members. The President is elected on a one-year-term from among the members of the MB by the Active Members.

The Management Board represents the Association in all circumstances and has full power to manage it. For the day-to-day management the MB mandated an Executive Director, who is supported by a Head Office Team located in Marne-la-Vallée near Paris. This team is responsible for general administration and co-ordination, representing the organisation at conferences, etc. external communication and supports and advises to EuroGeographics projects and working groups.

The following **EuroGeographics projects** which are currently running could be summarized as activities in the fields of

- supporting the **building of a European Geoinformation Infrastructure** by contributing to the EC project **ETeMII** (European Territorial Management Information Infrastructure) aimed at bringing together many of the key stakeholders involved in European GI in order to both explore and promote the main issues that lie behind the creation of a European Geographic Information Infrastructure.
- improving **access to geo information** by establishing **metadata services**,
  - like **GDDD** (Geographical Data Description Directory) created in 1994 to establish a descriptive listing of all the principal geographical databases available from the official National Mapping Agencies (NMAs) of Europe, LaClef, ESMI),
  - its successor **LaClef** aiming to include for example, a multilingual service, metadata of a higher resolution than at present, and a prototype electronic commerce service,
  - and **ESMI** (European Spatial Metadata Infrastructure) to create a single access gate to linked internet services.
- providing **topographic information** by
  - **EuroRegioMap**, a pan-European 1 : 250,000 scale topographic dataset using the experiences of the feasibility study PETIT (Pathfinder towards the European Topographic Information Template) and
  - **EuroGlobalMap**, the European contribution to the Global Mapping Project, based on experiences of MapBSR (Map of the Baltic Sea Region), a project mapping the drainage basin of the Baltic Sea at a scale of 1 : 1,000,000 and
- providing information about **administrative boundaries** in the project **SABE** (Seamless Administrative Boundaries of Europe), maintaining a pan-European dataset of administrative units.

Although EuroGeographics's Members vary greatly in terms of their national responsibilities, they share a number of common interests. Whenever Members consider that joint discussions or project work could develop solutions or improvements, a EuroGeographics **Work Group** is established. Their programme of work is agreed at the annual General Assembly.

Currently there are four Work Groups (WG) active:

- WG on Copyright and Economic Affairs studying legal and commercial subjects.
- WG on Geodesy producing the current European control frameworks (EUREF and EUVN).
- WG on the maintenance of Digital Databases addresses all aspects of this key responsibility of all NMAs.
- WG on Quality Issues studies such matters in both administrative and technical fields.

More information about the WGs, projects, and EuroGeographics in general could be obtained from [www.EuroGeographics.org](http://www.EuroGeographics.org)

### 3 Experiences in pan-European projects

To **EuroGeographics**, its projects and Work Groups, BKG is contributing in various ways financial support, manpower and input in form of expertise and data sets. On the other hand BKG benefits from the framework provided by EuroGeographics in gathering experiences in various fields, i.e. improved access to latest developments in cartography and surveying, qualifying of staff by working in an international environment; taking part in revenues from commercial activities, etc. In the following BKG experience in multinational projects will be reported mainly based on the EuroGeographics project SABE (Seamless Administrative Boundaries of Europe).

#### 3.1 SABE

**SABE** is EuroGeographics pan-European dataset of administrative units. The project started in 1992 and in the meantime versions showing the administrative situation of 1991, 1995 and 1997 are available and successfully commercialized by EuroGeographics.

##### Contents

The dataset has been compiled from source data provided by Europe's official national mapping organisations with the best available semantic quality. In its latest version (SABE97 Version 2.0) it contains the geometry and semantics of the administrative hierarchies of 29 countries: a total of over 100,000 polygons. Each country has its own specific administrative hierarchy, composed of a different number of levels. SABE contains all levels of national administrative hierarchies from the highest (country) to the lowest. SABE is the first pan-European boundary dataset available at this level of detail and assembled from high quality data and features.

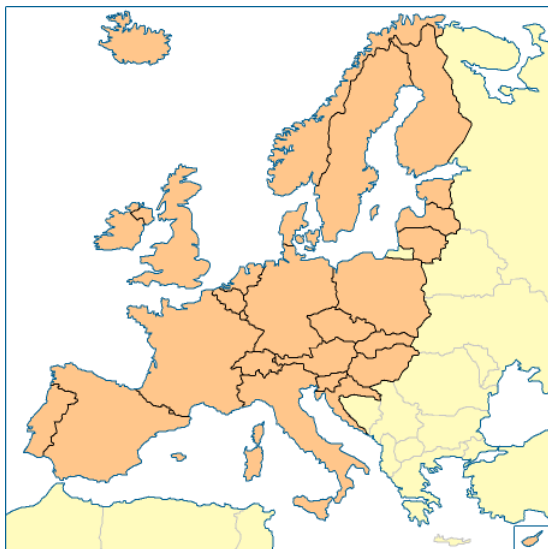


Fig. 1: SABE97 Version 2.0 coverage

The SABE dataset covers the following countries: Austria, Belgium, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Great Britain, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, The Netherlands, Northern Ireland, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland.

Coastline is delivered for:

Croatia, Finland, Germany, Great Britain, Ireland, Northern Ireland, Norway, The Netherlands, Poland, Sweden.



SABE is delivered as individual country files which create a seamless and consistent dataset. The term **consistent** refers to the contents, to the structure, to geo-referencing, and time referencing of the data, although with so many independent data sources there are variations in the currency of the data. The term **seamless** means that there are no gaps or overlaps between polygons initially derived from different sources. Coordinates are two-dimensional, geographical in degrees (longitude, latitude) with decimal

fraction. The spatial reference system is WGS 84 (ETRS89) with ellipsoid GRS 80. No map projection is applied.

Additional information could be obtained from the **SABE User Guide** that is available at the EuroGeographics Internet home page.

### **Organizational background**

While MEGRIN projects were managed directly by the Central Team the management tasks of EuroGeographics projects are delegated to member NMAs. i.e. in the MEGRIN project SABE BKG was involved as a "Service Centre", responsible for the data harmonization only. With the change in project structures BKG role was transformed into the "Project Co-ordinator", which means the day-to-day management of the project was transferred from the Head Office to BKG. The experiences of both phases are summarized below.

### **Data harmonisation**

The contributions provided by national mapping agencies have been transformed into a uniform structure and uniform positional reference system, line-filtered to a uniform resolution and are edge matched at international boundaries.

The harmonization process from national contribution to SABE data format is controlled by a conversion procedure consisting in several steps that are documented. The main steps are :

- Pre-processing: (check national contribution for completeness with regard to the requirements of the SABE data model)
- Transformation of coordinates from national map projection to geographic coordinates (WGS84).
- Processing of geometry to the SABE format (mosaic of lowest level administrative boundaries, harmonization with neighbouring countries, codes, names, administrative hierarchy, residence of authority, exclaves, condominiums)
- Generalization to map scale 1 : 250,000
- Final quality check

A brief view to the quality files of the 91, 95 and 97 version shows that the number of NMAs delivering the required format has increased from version to version. In parallel the number of inconsistencies detected decreased significantly.

For the 97 version for two countries a transformation from the national map projection and datum to SABE specifications was necessary. Seven contributions were generalized to SABE30 geometric resolution. Six countries were edited interactive to change geometric features and for six countries additional work was performed to correct the semantic information.

In two cases the conversion of diacritical characters to ISO 10646 Latin 1 needs additional editing. The integration of the Central and East European countries (CEEC) into future versions of SABE will increase the problems with diacritical characters. For the next version SABE offers to the NMAs to include the geographical names in their original language and the best suited ISO national character set in parallel to the ISO 10646 Latin 1 version.

Only for six countries inconsistencies were detected by the final check routines, mainly missing codes and names, which were clarified by the NMAs except in one case.

There are still differences in scales, reference systems and map projections used to derive national contributions to SABE. Due to its federal constitution even within Germany the scale of source data varies between the Federal States from 1 : 5,000 to 1 : 200,000.

The source data scales used for SABE deliveries varied between 1 : 5,000 and 1 : 750,000 (Table 1). More than 25 different reference systems (Tab. 2) and nearly 20 different map projections (Tab. 3) were used as sources for SABE contributions.

Most data delivery was in time. But the delay of one country could affect the complete harmonization process. It is obvious that additional delays were caused by incomplete or missing metadata information and necessary transformation parameters. The latest data delivery for SABE97 arrived at BKG in April 1998 and the first version was ready one month later, except one country. Due to problems with transfer format and data contents it needed additional 12 month to include this data set and SABE97 therefore was available on the market in May 1999. One of the project aims is to recover the costs of producing SABE. Each extra effort within the harmonization process leads to additional costs making it more difficult to reach this aim and hampers the up-to-date availability on the market improving the chances of SABE competitors from the private sector.

Scale	Countries
5,000	Slovenia, Germany (5 000 – 200 000)
10,000	Belgium, Switzerland Denmark, Great Britain, Netherlands, Slovakia
25,000	Croatia, Latvia, Liechtenstein, Spain
50,000	Austria, Czech Republic, Estonia, France, Northern Ireland, Norway, Poland
100,000	Cyprus, Finland, Luxembourg
200,000	Lithuania
250,000	Italy, Sweden
500,000	Hungary
600,000	Portugal
750,000	Iceland
Unknown	Ireland

Ref. Sys.	Country
DG72	BE
LISBOA	PT
Luxemburg	LU
ED50	DK, ES, CY, NO
MGI	AT, SI
Poland	PL
ETRF89	LV
MGI modi.	HR
NDS	NL
Roma m Mario	IT
HD-72	HU
NTF	FR
RT90	SE
HJÖRSEY	IS
OS-GB	GB
S-JTSK	CZ, SK
IDATUM	IE, NI
PULKOVO	EE, LT, RO, BG
SD	CH, LI
KKJ	FI
Rauenberg	DE

Projection	Country
EOV	HU
Krovak	CZ, SK
SPS	CH,LI
GB	IT
Lam-B	BE
TM	LV
Geogr	DE
Lambert	IS
UTM	ES, GR, CY
GK	FI, SE, EE, PT, AT, HR
LamII	FR
UTM31	NO
GK05	SI
NDS	NL
UTM32	DK
GL	LU
NG	GB
Igrid	IE, NI
Ptolemy	LT

### Project management tasks

With the re-organisation of projects parallel to the transition from MEGRIN to EuroGeographics one of the first tasks for BKG in its new role as Project Co-ordinator for SABE is to prepare the data delivery for the next SABE version (SABE2001) and to provide the legal background for working on behalf of the contributing NMAs and to suggest solutions for pre-financing the project costs. At the General Assembly at Malmö 2000 all heads of NMAs agreed to the continuation of SABE and promised to support the necessary activities. In December 2000 BKG distributed a first request to the NMAs to nominate a responsible contact person for NMA contributions to SABE2001. It was disappointing to notice how slowly NMAs respond on this request even after two reminders. About 20% of the NMAs did not answer until end of April 2001.

### 3.2 Other pan-European projects

Traditionally NMAs were responsible more or less for the territory of their respective country only. This led to specific national cartographic representations of the Earth surface, i.e. usage of different reference systems, map projections, symbol sets, scales and content of maps. A look on the list of map projections

used in Europe (Tab. 3) shows a high correlation between the type of projections surface and its relative position to the Earth's axis and the extent of a country. An area with large extent parallel to a meridian is well represented by a transverse cylindrical projection (i.e. Universal Transversal Mercator = UTM) while an area with a large West-East extent is better represented in a normal conical projection (i.e. Lambert Conformal Conical = LCC). For areas with a more or less equal extent in all directions an oblique azimuthal projection (center of the projection axis in the center of the area) is well suited.

Even when analog maps were transformed to digital data sets national characteristics were preserved. It is not an unsolvable problem to match the basic geometry of data sets from different countries if the parameters of scale, reference system and map projection are well documented. But to join objects with different semantic meaning needs a lot of additional work and may cause trouble in multinational projects. After the detection of such semantic differences mutual agreement about a common representation in the technical specification is needed. For the affected NMA a change in the description of geographical objects means inconsistencies between national and multi-national data sets causing additional efforts for future updating of the international data set. Therefore negotiations about harmonization of semantic problems could be difficult. One example is given in Figure 3, showing that the different modelling of water bodies in Germany and The Netherlands (river versus ditch) could not be solved for the PETIT (Pathfinder towards the European Topographic Information Template) project.

### PETIT

PETIT was an EuroGeographics project funded in the framework of to the European Commission's INFO2000 Programme to determine the feasibility of creating a pan-European topographic dataset using VMap Level 1 data collected by European VMap co-producers according to specifications defined under the leadership of the US National Imagery and Mapping Agency.

Results of the project were a prototype dataset, reports covering legal issues as well as a specification and production and marketing plan for a proposed pan-European dataset at scale 1 : 250,000. BKG contributed in the user testing, data harmonisation and data provision for the Prototype. The project was seen as a first stage in the development of consistent dataset easily accessible to users.

PETIT showed clearly the geometric and semantic problems of integrating topographic data sets of different countries, i.e. cross-border projects have to deal with different resolution (Fig. 2: Forrest areas are generalized differently), different attributes of geographical objects on both sides of the borders (Fig. 3: Ditch north of the border = river south of the border), gaps in contour lines (Fig. 3: Contour lines do not fit at the border).

PETIT delivered valuable experiences for the new EuroGeographics topographic mapping projects EuroRegioMap and EuroGlobalMap.

Fig. 2: Different resolution in forest areas Northeast and southwest of the border and different classification of a road (centre)

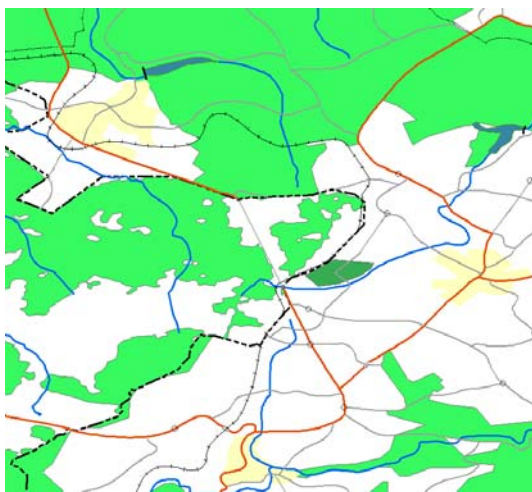
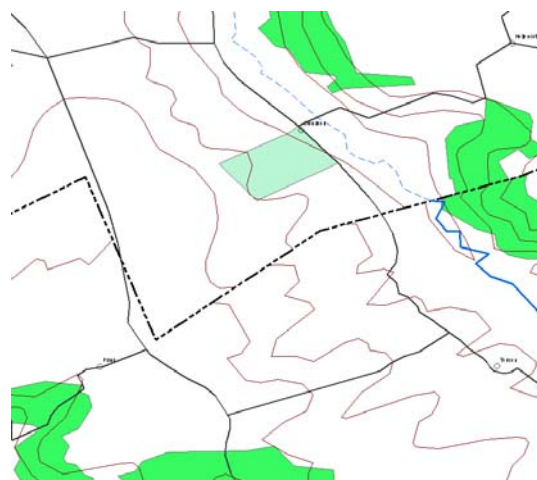


Fig. 3: Different naming of geographical objects (Ditch north of the border = river south of the border), contour lines do not fit at the border



The EuroRegioMap project is still in a preparatory phase. Only 6 NMAs (BE, DE, DK, FR, GB, IR, NI) are currently able and willing to participate in the production of a digital 1 : 250,000 data set. It is obvious that the number of participants will increase if external funding becomes available. Therefore one of the main tasks for the **project co-ordinator (Institut Géographique National – Belgium)** is lobbying for funding from the European Union. BKG is contributing to the development of the technical specifications and is willing to participate in the production of a prototype.

### **EuroGlobalMap**

EuroGlobalMap will be EuroGeographics contribution to the Global Mapping Project and is taking great benefit from the experiences with the MapBSR project, in which a digital topographic data set at the million scale was produced by a joint effort of NMAs from 13 countries (BY, CZ, DE, DK, EE, FI, LT, LV, PL, RU, SE, SK, UA) for the drainage area of the Baltic sea. The **National Land Survey of Finland (NLS-FI)** managed the MapBSR project and will do this for EuroGlobalMap, too. Because of the greater number of countries involved NLS-FI will be supported by up to 8 regional coordinators. BKG will be one of them, responsible for integrating contributions from DE, NL, BE, AT, CZ, HR, SI.

## **4 Résumé and outlook**

The additional effort for harmonizing data sets from national contributions is often underestimated. These efforts include the definitions of technical specifications, requesting national contributions, harmonizing these data sets and commercialize the final product.

In the preparatory phase of projects NMAs endeavour technical specifications close to their national database content to decrease their amount of work for data conversion. The project coordinator is more interested to define specifications that could be fulfilled by most of the project participants and that are close to international standards to enable successful market activities.

For the preparations of their contributions the NMAs need various amounts of time according to the special situation of each NMA with respect to staff (and its skills and willingness), equipment and availability of national base data sets. From the practical work we got the feeling that there seem to be a gap between the ambitious agreements of the Heads of the NMAs and the possibilities within some NMAs to work for pan-European projects. In many NMAs contributions to pan-European projects are not fully implemented in their organizational, financial and legal framework even if there are commitments from governments to support common European activities. Therefore it is necessary to ask for external funding for each project. The participation in calls for proposals and tenders of the European Union needs additional efforts causing delays of the projects. Financial support from the European Union is given for a limited period only, but topographic base data sets have to be updated regularly. Therefore mechanisms are required to guarantee the transition of projects to permanent services.

One of the challenging tasks for EuroGeographics is to convince the governments of the European Countries that pan-European harmonized topographic base data sets are essential parts of an information infrastructure and the creation and maintenance of these products have to be financed on a regular basis like it is done for the conventional infrastructure (transportation routes, education, etc.).

### References:

- Illert, Andreas (1997): Harmonization of National Contributions to a Dataset of European Administrative Boundaries. – 14. United Nations Regional Cartographic Conference for Asia and the Pacific, Bangkok, Conference paper E/CONF.89/INF/11
- Luzet, Claude (2000): CERCO-MEGRIN and Global Map. – Paper presented at the ISCGM meeting Cape Town, 16 March 2000.
- Ursin, Heli & Luzet, Claude: A European regional contribution to Global Map. Paper presented at the Global Map Forum in Japan at 28-30 November 2000

EuroGeographics <http://www.eurogeographics.org>

EuroGeographics project SABE: [http://www.eurogeographics.org/Projects/SABE/SABE\\_index\\_level1.htm](http://www.eurogeographics.org/Projects/SABE/SABE_index_level1.htm)

MapBSR: <http://www.mapbsr.nls.fi/index.html>