**Atlas Information Systems and Geographical Names Information Systems as contribuants to Spatial Data Infrastructure**

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## Development of geospatial digital databases

Realization of a number of national and international programs dealing with spatial data infrastructures – SDI (for details see Kapralov et al., 2005), including those on the global scale, i.e. GSDI, as well as such programs as the Digital Earth, Global Mapping Initiative (Japan's response to the recommendations of the 1992 UN Conference on Environment and Development in Rio de Janeiro) and a number of European (EuroGeographics, SABE etc.) and national (American National Map of the US Geological Survey, OS Mastermap of the UK Ordnance Survey etc.) initiatives have already made it possible to compile a uniform digital base and a universal toolkit for the integrated description of territories. SDI may form a reliable basis for integrated digital territory models (IDTM) that are necessary for realization of any models of sustainable development for these territories (Tikunov, 2004). First of all, these are the digital model of territory considered as virtually-realistic model, supplemented with sets of ordered remote sensing materials and with a number of thematic layers, socio-demographic, economic, ecologic etc.

## AIS as portal for SDI

It is convenient to form integrated digital models on the basis of atlas information or directly within the atlas information systems (AIS). Such systems are usually provided with well-developed modelling functions, they are capable of integrating expert systems and could be designed as full-scale multimedia products. AIS allow the integration of diverse information resources, modelling, visualisation and analysis, as well as the elaboration of various scenarios and possible development alternatives for such complex systems as those of nature-society-economy.

The structure of an integrated AIS includes closely interrelated social-political, economic (or production), natural resource and environmental blocks. They provide general descriptions of socio-ecosystems of different territorial range, showing the importance of both natural and human resources. One should speak of both nature and social management within this line of research. All themes are described in terms of the hierarchy of their changes (from the global level to the local one) and specific features of phenomena at different scales of their representation are taken into account. This is the realisation of the hypermedia system principle: the topics are integrated by associative links, for example the topics of lower hierarchical levels represent a particular theme at the appropriate scale and at the same time expand it and show it more in detail.

Regularities of phenomena evolution are shown for all thematic topics rather than their actual state. This requires the analysis of their dynamics, which is realised according to the evolution-dynamic principle of AIS development. Parameters characterising various phenomena at particular time periods or years, as well as thematic animations, are mainly used for this purpose. The block principle of the system should be also pointed out, because it is possible to change, supplement and expand individual logical blocks without modifying the structure of the system itself.

### Applications for SDI

Elaboration of scenarios for the development of countries and their regions is among the principal application of such systems. In this case the multi-variant principle is realised: final users could obtain a series of scenarios (optimistic, pessimistic and other ones), which could be of interest to them. In reality this means, for example, the description of changes resulting from the construction of transport corridors through the territory of Russia. Such scenarios stimulate considerations and discussions which, in their turn, lead to new scenarios. The increasing complexity of these scenarios gives rise to a growing necessity of the system’s intellectualisation with expert systems and neurone networks assisting in reaching plausible solutions for very complicated and often rather fuzzy problems.

Of particular importance is the possibility of mining modelling of complex phenomena within the information system. Such modelling is based on the integrated system approach to socio-ecosystem modelling.

Modern AIS are equipped with a range of instruments that makes it possible for users to compile their own cartographic topics using the base maps and acquiring necessary data through the Internet, for example. Specialised means of mathematical modelling are of particular importance, particularly those aimed at the elaboration of scenarios of regions’ transition to the models of sustainable development. The most sophisticated AIS could be used as full-scale decision-support systems. Finally, it should be mentioned that AIS need the multimedia principle as well, as this facilitates the decision-making process.

## Geographical names as a means of linking geospatial data

All aspects related to geographical names are of particular importance in this application of AIS to SDI. Infrastructures of geospatial data should provide for both the whole spectrum of names of a particular geographical object and the history of their formation, as well as the differences in the existing names.

There are too many examples when the same geographical object has many place-names. It is often because objects are named in different languages. Man distinguishes a few approaches in transmission of foreign place-names: when native official form is used (Estado Español, Kongeriket Norge, Republik Österreich, Suomen Tasavalta, or brief form: España [Spain], Norge [Norway], Österreich [Austria], Suomi [Finland]); phonetical – when the original pronunciation is simulated; transliteration, when each letter receives its English equivalent; translation (Severnaya Dvina – Northern Dvina, Grønland - Greenland ) and, at last, when we name countries as Deutschland, Ayastan, Sakartvelo, Choson as Germany, Armenia, Georgia, Korea according to tradition. Even on the maps of the same multilingual country, such as Russia, Belgium, Switzerland we can easily find examples when many place-names are used for one geographical object, it maybe even the name of country - Schweiz, Suisse, Svizzera. It is also typical for lingering objects, situated in places where people speaking different languages live, for example for rivers – Danube, Donau, Dunav, Dunarea and others. Often objects have a few names after discovery by a foreign traveller when they receive new names together with the original one. Reverse replacement has occurred as well. Many may remember the mass renaming after decolonization of African countries. The International community (in particular official UN bodies) tries to regulate this process, but nevertheless many disputable (for different countries) names still exist, for example Persian or Arabic Gulf, Japan Sea or East Sea, Falkland Islands or Islas Malvinas. In these cases the variant place-names reflects aspirations to denote sovereignty over or protection of territory (area of water), that may sometimes lead to military conflicts – such as the war between Argentina and Great Britain. Are civilized decisions possible in such cases? Let's consider the last example. Both names Falkland - Malvinas Islands exist simultaneously on maps printed in many countries, sometimes together with special mark (disputable territories).

As there is an increased use of digital maps, such toponymical issues need special attention. Catalogues of place-names (digital gazetteers) have been created in many countries, so it is possible to store all names referring to a geographic object. Then, as a next step characteristics are needed which will describe the time period when a specific place-name was used, as well as a description – why was this place-name changed (although different opinions are possible)- and so on? But nevertheless the users of these digital maps will receive much more information to draw their own conclusions. It will be timely to realise such a toponymic project at the present time, when creation of national and international regional spatial data infrastructures (SDI) is going on at full steam. After the USA SDI projects become incarnate in a number of international and national organizations, such as Global SDI (GSDI), Canadian SDI (CSDI), SDI of Australia and New Zealand (ASDI), Asian-Pacific SDI (APSDI), European national initiatives in the framework of Pan-European initiatives (such as EUROGI). Basic spatial information in SDI is usually understood as a collection of "basic", "fundamental", the most needed layers and groups of GIS, with content corresponding with the basic map. Moreover, the layer of place-names should be one of its main layers, and this layer should be informative enough, permit use of place-name variants, and inform in detail about them.

Moreover, a place-names subsystem sooner or later will contain elements of intellectuality. Let's, for example, analyze the next series of place-names: Cameroon, Chad, Congo, Denmark, Djibouti, Gambia, Georgia, Jordan and Nicaragua. Of course, every geographer can say that this is an enumeration of countries, but the same enumeration may be transformed in the following way when the same place-names refer to:

a) rivers – Congo, Gambia, Jordan, Danube, Mississippi, Nile;

b) lakes – Chad, Nicaragua, Victoria, Baikal;
c) straits – Denmark, Georgia, Gibraltar, Dardanelles, Magellan, Dover, Cook, Davis;
d) volcanoes – Cameroon, Etna, Popocatepetl;
e) cities – Djibouti, Moscow, London.

At this time, another setting would give these place-names another meaning, if we discern other categories. Let's consider rivers. We will add Albany, Arkansas, Churchill, Colorado, Columbia, Connecticut, Delaware, Humboldt, Illinois, Kabul, Mississippi, Ohio, Orange, Sabine, Salmon, Salt, Steward, Swan, White in addition to those earlier mentioned. Among these place-names are: a) cities - Albany, Columbia, Delaware, Kabul, Orange, b) states - Arkansas, Colorado, Connecticut, Delaware, Illinois, Mississippi, Ohio, and if we want to get out of this place-names multitude, then by adding Bismarck, Clinton, Lincoln and Washington to a Churchill river we create a list of politicians. But we can regard this just as well as a list of cities (Bismarck, Clinton, Lincoln, Washington). If we group cities in other ways (Lincoln, Mercedes, Toyota) together with Ford and Volkswagen anybody would say that this list refers to car brands. Cities as Zanzibar, Grenada joined together with Christmas turn into islands, but Christmas itself together with Easter and Annunciation are also holy days, not only islands. Cape May together with January, February and so on are months, and the city of Leon combined with tiger and leopard forms a list of predators. If you turn to the list of rivers mentioned in the beginning of this paragraph you can easily find other continuations. Anybody can easily make sense of a list of names, classify them, the same can be done by a heuristic program. In this case a system of place-names should be associated with the right notions, which should be used and taken into account when a plurality of place-names occurs. A reader can test all existing kinds of place-names translation, search for associations with specific notions, select relevant material connected with the history of place-names. In other words, technological progress lets us describe geographical objects in more ways, using for their description all that humankind has collected through the ages.

**Current geographical names projects**

At present in Russia we are starting work on a specialized database with geographical names for the territory of Russia and adjacent seas providing more detailed information for the southern regions of the country. Experiments were taken on the multi-variant positioning of inscriptions on digital models and models of virtual reality.

Another project is the EuroGeoNames project that started in 2006, and that should provide within 30 months for a virtual Europe-wide geographical names database. Essentially the project is about building a server which will enable access to national official geographical names databases, and enable extraction of names data, as well as point coordinate data and/or bounding box data on the respective named geographical objects. The project was initiated by the Bundesamt für Kartographie und Geodäsie in Germany, Utrecht University in the Netherlands, the Austrian and Slovenian national mapping organisations and partners from private enterprise. The project occurs within the framework of INSPIRE, a legal framework being developed by the European Commission services with officials and experts in Member States. It is to be implemented throughout the European Union (EU) from 2006 onwards with different types of geographical information gradually harmonised and integrated, resulting in a European Spatial Data Infrastructure (ESDI). In the context of the current INSPIRE initiative, geographical names are considered to be one of the three most important data components (see 3).

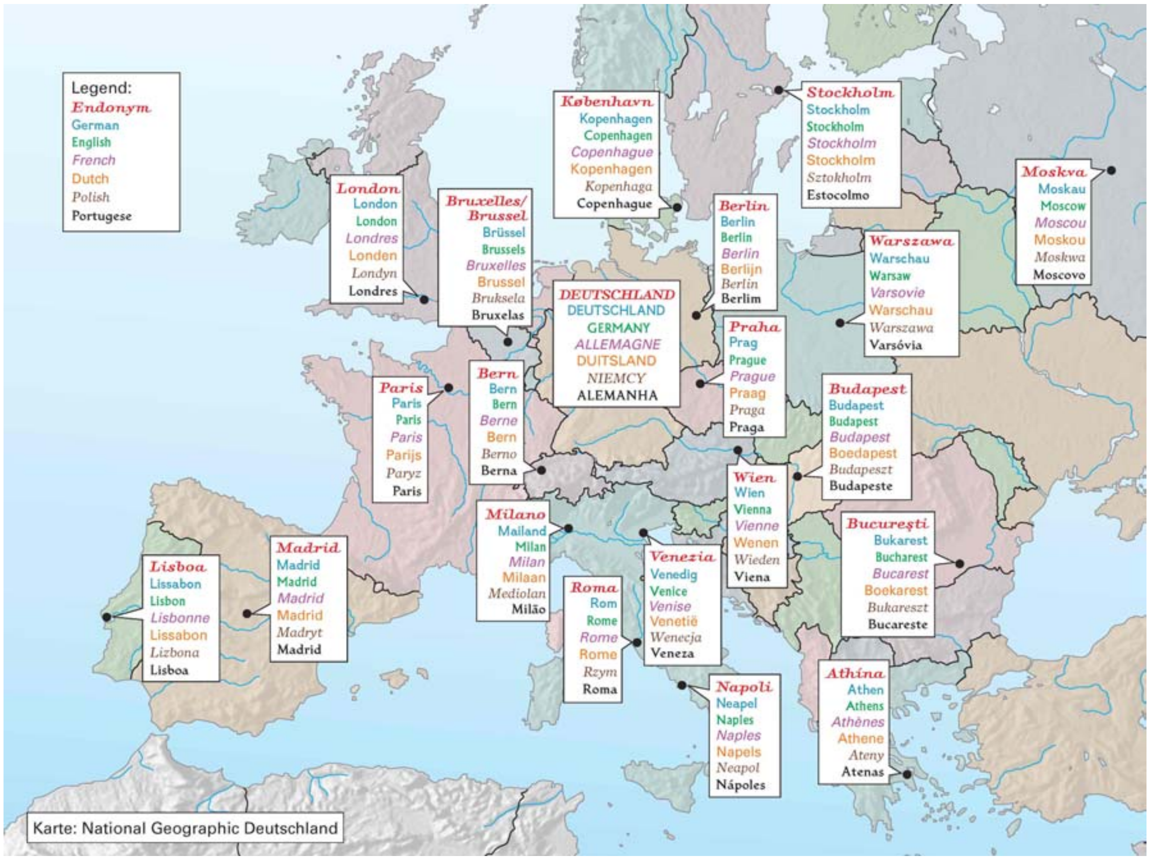

Figure 1 If different in spelling from the official local name versions (endonyms, the red version on top) the name versions in other languages (German blue, English green, French purple, Dutch yellow, Polish brown, Portuguese black) for geographical objects in areas where the language is not official, are called endonyms.

Figure 1 shows the problem of exonyms in Europe, and one of the objectives of the EuroGeoNames project is to make available a concordance of all exonyms in use for geospatial objects inside Europe. The main objective is to provide a virtual Europe-wide data base of geographical names, in which the various national names data bases are linked together, allowing for a Europe-wide search and any analytical actions irrespective of the national borders. Ultimately, a data model to which countries that have not yet developed and implemented their own data models in which geographical names have been integrated might conform, will be propagated.

The data base is kept up-to-date by the various national names authorities. The problems to realise such a virtual database are many: not in all European states the same name categories are collected and processed ; processing systems are different, the updating frequency, the scale of the source maps for the data base (see figure 2), nor the metadata collected and incorporated into these databases (see figure 3).

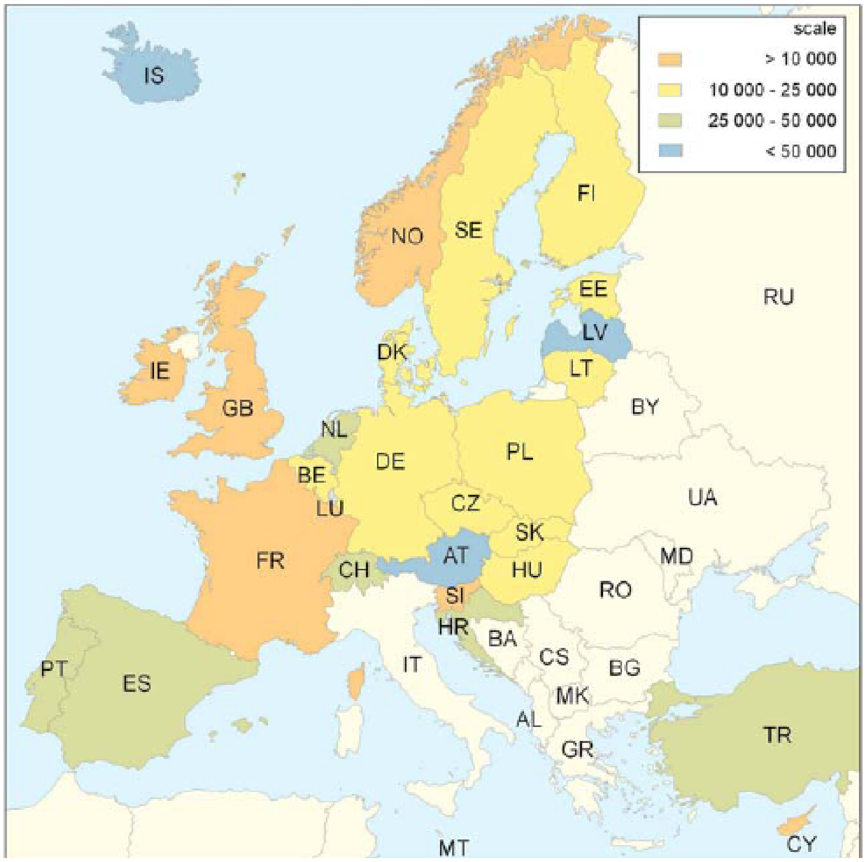


Figure 2 Current sources of national geographical names data bases: topographic maps at different scales

The objectives for such a future EGN service, are envisaged to be the following:

- Improved availability and usability of standardized official national geographical names data amongst others through value-added resale by commercial enterprises;

- Harmonisation of the European geographical names digital data by developing common specifications;

- Integration of geographical names data as a part of geospatial data infrastructures;

- Improvement of efficiency regarding the collection, handling, storage, maintenance and distribution of geographical names data;

- Provision of multi-lingual access to geographical names data users through the Internet, making it equally accessible for all languages officially spoken in European countries.

| Attribute information linked to the names in the various national databases | Feature coordinates | Name placement coordinates | Feature category | Feature object ID | Map scale indicators | Statistical classification | Name status | Language | Pronunciation | History | Other | Height | Number of inhabitants | Map sheet number | Language status | Size + style character | Gender | Name sources | Variant names |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Albania | | | | | | | | | | | | | | | | | | | |
| Austria | X | | X | X | | | | | | | | X | | | | | | | |
| Belgium | | | | | | | | | | | | | | | | | | | |
| Bulgaria | X | X | X | X | X | | X | X | X | | | | | | | | | | |
| Croatia | | X | X | X | | | | | | | | | | | | | | | |
| Cyprus | X | X | | X | | | | | | | | X | X | | | | | | |
| Czech Republic | | X | X | X | | | X | | | | | | | | | | | | |
| Denmark | X | X | X | X | X | X | X | | | | | | X | | | | | | |
| Estonia | X | X | X | X | | X | X | X | | X | | | | | | | | | |
| Finland | X | X | X | X | X | X | | X | | | | | | X | X | X | | | |
| France | | X | X | | X | | | | | | | | | | | | | | |
| Germany AdV | X | | X | X | | | | | | | | X | X | | | | X | | |
| Germany BKG | X | | X | X | | X | | | | | | | | | | | X | | |
| Germany StAGN | X | | X | | | X | | | | | | | | | | | | | |
| Great Britain | X | X | | X | X | X | X | X | X | X | | | | | | | | | |
| Hungary | X | | X | X | | | X | | | | | X | X | | | | | X | X |
| Iceland | | X | X | X | | | | | | X | | | | | | X | | | |
| Ireland | | X | | | | X | | | | | | | | | | | | | |
| Latvia | X | | X | X | X | X | X | | X | | | | X | | | X | | | |
| Lithuania | | X | X | X | | | | | | | | | | | | | | | |
| Netherlands | X | X | X | | | | X | | | | | | | | | | | | |
| Norway | X | | X | X | X | X | X | X | | | | | | | | | | X | |
| Poland | X | | X | X | X | X | X | | | | | | X | | | | | | |
| Portugal | | X | X | | | | | | | | | | | | | | | | |
| Slovakia | X | | X | X | | X | X | | | | | X | | | | | | | |
| Slovenia | | X | X | X | X | | | X | | | | | | | | | | | |
| Spain | X | | X | | X | X | X | X | | | | | | | | | | | |
| Sweden | | X | X | X | | X | X | X | | | | | | | | | | | |
| Switzerland | X | | X | X | X | | | | | | | | | | | | | | |
| Turkey | X | | X | X | X | X | | | | | | X | X | | | | | | |

Figure 3: Attribute information linked to the names in the various national databases/geographical names repositories

As can be seen from figures 1-3, there is still a long way to go, but at least it is realised what an important contribution standardisation and producing concordances for geographical names will have for implementing both national and Europe-wide or global spatial data infrastructure.

**Literature**


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