15 Geographic Information, Access and Availability

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15.1 Introduction

Cartographers have always been collecting geographic information for producing maps. Already, Ptolemy collected the position of around 8,000 places (see Chapter 1). Abraham Ortelius collected a lot of geographic information as well in order to be able to produce his atlas, the *Theatrum Orbis Terrarum* (Theatre of the World).

Nowadays, geographic information is available in digital form and the first attempt to produce a national database of geographic information was made in Canada in the 1960s by Roger Tomlinson. The idea was to create a database for spatial planning. The database was called Canada Land Inventory (CLI),

http://sis.agr.gc.ca/cansis/nsdb/cli/index.html. This database is still used and data can be downloaded from it. To handle the database an information system was needed. That was called Geographic Information System (GIS).

The ICA was active as well in promoting the collection of geographic information for the development of computer cartography. Under the presidency of Professor Ormeling Sr. ICA organized a set of task forces. The first one was held in 1981 in Wuhan, China and another one in New Delhi in 1983. The discussions on the importance of geographic information were very intensive and decisions were made to co-operate in building geographic databases.

As more and more geographic data came to be included in these databases, the need for the creation of a digital

information infrastructure became pressing; it was first set up in the USA. The intention of this information infrastructure there was to achieve a better administration that worked better with a lesser cost. Nancy Tosta at the US Geographic Survey (USGS) worked with Al Gore, the Vice President of the US, with the formulation of the National Spatial Data Infrastructure (NSDI) of the US. NSDI was published in April 1994 as an executive order by President Clinton (http://www.archives.gov/f)ederal-register/executiveorders/pdf/12906.pdf). The NSDI became very popular in the field of geomatics and was followed in many countries. At the same time Internet was launched and its access module Explorer became very popular simultaneously, and it was already at that time that people realised that Internet could be a tool for distribution of geographic information. Electronic highways were built for distribution of data. The thought was that Geographic Data should be stored and updated at one place and then distributed to the user when

Studies have shown that the benefits of NSDI to society are larger than the costs for implementing it. A commonly used ratio is 4:1. A study in Sweden showed a ratio of 30:1, however.

needed.

The distribution of geographic data made it necessary to have standards for geographic information.

Standardization was started in many countries, but since we are living in a global world international standards are needed. The problem was brought to United Nations, which instigated the necessary international cooperation in a technical committee (http://www.isotc211.org/). Many standards have now been developed and a summary of them can be found at the homepage of Open Geospatial Consortium (OGC), http://www.opengeospatial.org/.

As we can see there are many different kinds of geographic data so persons with knowledge in each field must be included in these technical committees in order to find out which functions and attributes should be included in the definitions of each type of objects. An example of an object class is a *building*, which can be defined as a construction with walls and a roof with an identity and many different functions. Sometimes these definitions look silly, but they must be formulated as simple as possible in order to be understood world-wide. Each item included in the database is an *object* belonging to an *object class*. A building may form a *super-class* and buildings like villas, barns, and saunas etc. form *sub-classes*.

As geographic data always refer to objects it is very natural to use the Information Technology (IT) known as *object orientation*. The references in the end of this chapter give more information on handling object orientation (e.g. Booch et al, 2006); there you will find out how United Modelling Language (UML) works and how to handle object classes, super class and subclasses. With UML an information system and its databases can be clearly described.

15.2 International NSDI Initiatives

15.2.1 United Nations

UNRCC

UN Regional Cartographic Conferences (UNRCC) have been operational since the 1950s, as a follow-up to relevant UN resolutions, including statutes how to operate. These UNRCC were first held for Asia (including Australia and the Pacific), followed by conferences for the Americas and conferences for Africa. It is the UN that convenes these meetings. The attendance is open, but in order to be registered as delegate, one has to be

nominated officially by one's country. Decisions are taken by resolutions. At the UNRCC in Bangkok 2012 a resolution was taken in which ICA was asked to organise the International Map Year in 2015.

UN-GGIM



Figure 15.1.The first GGIM conference in Seoul, South Korea 2011.

In 2011 UN decided to set up Global Geospatial Information Management (GGIM, http://ggim.un.org/) with the focus to make geographic information more accessible to society at large. There is also an intention that UN-GGIM shall take over UNRCC, while simultaneously setting up such conferences for Europe. So far, all National Mapping Organisations in Europe have become members of EuroGeographics; its statutes now are being redrawn to fit the UN-GGIM conditions.

The homepage of GGIM provides rather detailed reports from almost all countries of the World on the situation of geographic information in their own country.

Global Map

In the 1950s the UN accepted a resolution to revive the project of the production of a world map at the scale of 1:1Million. The task was given to the International Geographic Union (IGU). This project petered out, however, in the 1980s, also for Cold War security reasons. To the UN Conference on Environment and Development in Rio de Janeiro in 1992 Japan proposed

to build up a database with a similar purpose. This has now been accepted as a UN activity and the task to build the database is handled by the International Steering Committee for Global Mapping (ISCGM), http://www.iscgm.org. The national dataset in all countries have been built up in the same way and can be downloaded for free. Building the database provides an educational experience for all countries, as they learn how to build geographic datasets. The management costs of the project are paid for by Japan. Of course, it would have been cheaper for Japan to build the whole dataset itself, but then the education benefits would

have been lost.

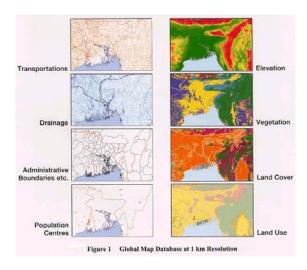


Figure 15.2 shows the different layers of Global Map.

More information on UN activities in cartography and geographic information can be found in Chapter 10.

15.2.2 International Organisations Dealing with Geographic Information

Apart from the International Cartographic Association, the following international organisations are active in this field:

GSDI

Global Spatial Data Infrastructure (GSDI) is an organisation that is promoting the construction of NSDIs globally. Its homepage is handled by OGC (http://www.gsdi.org/) and this shows that GSDI has its main focus on the juridical aspects of building geographic datasets like copyright issues and the costs for downloading and use of geographic data. The homepage also includes links to literature like a *Spatial Data Infrastructure Cookbook* (GSDI, 2009), that that can be downloaded in different languages for free from the GSDI homepage. It gives detailed instructions on how to build geographic datasets.



Figure 15.3. The front page of the SDI Cookbook.

JBGIS

The Joint Board of Geographic Information Societies (JBGIS) is an organisation for co-operation between the international organisations that have an interest in geospatial matters. JBGIS may have ad-hoc committees, such as the committee for Disaster and Risk Management has together with the UN Office for Outer Space Affairs published a booklet that can be downloaded for free (JBGIS and UN, 2010). The different organisations cooperating in JBGIS are described in Chapter 18.

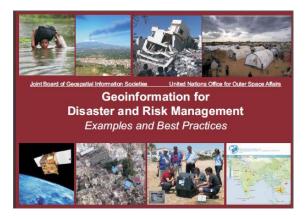


Figure 15.4. The JBGIS publication on Disaster and Risk Management.

Google

As is widely known, Google provides a lot of geographic information for free through its *Google Maps* and *Google Earth*. More information on the Google tools will not be given here. Our advice is just to use these tools for discovery.

East View Geospatial

East View Geospatial, EVG

(http://www.geospatial.com/). EVG is previously known as East View Cartographic. It now provides not only maps but also geographical information, such as satellite imagery and aerial photos, as well as open source data, further described in Chapter 16. EVG provides a lot of maps and data on Russia and China (this explains the "East" in the name of the company). EVG is an affiliate member of ICA.

Open Street Map (OSM)

Open Street Map (http://www.openstreetmap.org) provides Volunteered Geographic Information (VGI) and is further described in Chapter 16. VGI started as a reaction to the high fees charged by National Mapping Organisations for downloading and using geographic data, especially maps. Often this opposition movement is called either Neo-cartography or Neo-geography; however, one should never call something 'new', since new will soon be old if the term is sustainable. VGI is also well described in a position paper for the UN-GGIM produced at the Ordnance Service of Great Britain (GGIM, 2012).

Data for OSM is collected by many persons and can be used for free, but you should follow the rules and refer to OSM whenever you use their data. OSM has now a broad coverage of the World and a mobile availability e.g. in telephones. Some cities are no longer producing city plans in printed versions, as they rely on OSM.

15.2.3 NSDI Initiatives

The main aim of NSDI is to build national geographic datasets and set up *Geo-Portals* for searching, viewing and downloading geographic data. Searching and viewing should be done without costs for the user, but

downloading and use may have to be paid for by the user. In the following sections, some examples of NSDI initiatives will be given.

USA

Since NSDI was first set up in the United States, it is natural to start here. The US NSDI is handled by the Federal Geographic Data Committee (https://www.fgdc.gov/) with its headquarters at USGS. By using the link Data & Services different kinds of geographic data can be searched for and sometimes also downloaded. Via the Geo-Platform portal it is also possible to download climate data and topographic maps from the US Geological Survey, and census data with street addresses from the US Census Bureau. The street addresses are linked to Census districts and these digital linkages have increased the use of census data tremendously. Through the street addresses it is possible to find both suppliers and users of company products. A lot more information can be found via the homepage.



Figure 15.5 shows the Webpage of the Federal Geographic Data Committee (FGDC).

Canada

The Canadian Geospatial Data Infrastructure (CGDI) is handled by the Canadian National Mapping Organisation and can be reached with http://www.nrcan.gc.ca/earth-sciences/geomatics/canadas-spatial-data-infrastructure/8906. If you enter Satellite Imagery and Air Photos you will find an educational kit for children, where you will get an introduction to remote sensing.

Europa

For a rather long time many research initiatives for building a common database of geographic information were submitted to get support from the European Union (EU) to no avail for. But finally in 2001, when data on the environment were included in the initiatives, the EU called a meeting of experts in Brussels, and in 2007 a directive for INSPIRE (Infrastructure for Spatial Information for the European Community) was launched as a result. The homepage of INSPIRE is http://inspire.ec.europa.eu/index.cfm from which the following text is copied.

The INSPIRE directive will be implemented in various stages, with full implementation required by 2019.

The INSPIRE directive aims to create a European Union (EU) spatial data infrastructure. This will enable the sharing of environmental geographic information among public sector organizations and better facilitate public access to geographic information across Europe.

A European Spatial Data Infrastructure will assist in policy-making across boundaries. Therefore the spatial information considered under the directive is extensive and includes a great variety of topical and technical themes.



Figure 15.6 shows the webpage INSPIRE.

INSPIRE is built on a number of common principles:

- Data should be collected only once and kept where it can be maintained most effectively;
- It should be possible to combine seamless spatial information from different sources across Europe and share it with many users and applications;
- It should be possible for information collected at one level/scale to be shared with all levels/scales; detailed for thorough investigations, general for strategic purposes;
- Geographic information needed for good governance at all levels should be readily and transparently available;
- Easy to find what geographic information is available, how it can be used to meet a particular need, and under which conditions it can be acquired and used.

The implementation of INSPIRE will be done in several steps starting with the most necessary layers and then

followed by the more complicated ones. It is also said that only existing layers shall be included.

INSPIRE also includes rules for building Geo-Portals, where all the information should be viewed for free both by the public and by organizations, through the use of Internet tools. Downloading and use may involve a charge that must be recognized by the national committee maintaining the implementation.

The further development of INSPIRE is mainly handled by the Joint Research Centre (JRC) in Ispra, Italy (https://ec.europa.eu/jrc/). JRC includes a lot of topics on its website and it is difficult to find what you are looking for.

Asia and the Pacific

The Geographic Information Infrastructure for Asia and the Pacific is now coordinated via the UNRCC, and in the future, will be coordinated by The Regional Committee for United Nations Global Geospatial Information Management for Asia and the Pacific (UN-GGIM-AP), homepage http://www.un-ggim-ap.org/. The two organizations work together until UN-GGIM will have been fully established. The organizations have about 60 member countries that can benefit from each other's achievements, China, India, Australia and Japan are leading and when looking at their web sites we can see a lot of progress. Although both China and India tried to get ahead with the creation of national data sets for computer cartography in the early 1980s, the technical solutions were not ready until 1994, when Internet could be used. That is very common in cartography that it does not have the strength to drive technological development itself, but cartographers are very quick in finding, recognizing the usefulness in new technical developments and harnessing them to reach their objectives.

Japan houses the secretariat of the Global Map development and is helping developing countries in establishing their geographic infrastructure.



Figure 15.7 shows the ANZLIC website.

Australia works together with New Zealand in the development of their geographic information infrastructure in a committee called the Australian New Zealand Land Information Council (ANZLIC). 'Foundation spatial data' describes the basic layers that are needed by users of location-based information. They are the original pieces of spatial information that are created by authoritative sources, like government agencies. Often, this information is collected for core business purposes by these agencies, and not made available in a consistent way, if at all. Governments in New Zealand and Australia have realised that this information needs to be more available. By establishing a common framework for how this information is collected, described and released across Australia and New Zealand, ANZLIC is setting a direction for both countries to aspire.

Africa

Africa has over 50 countries with very different geographic information resources. Since gaining

independence in the 1960s, the production of topographic maps was discontinued and it is now difficult to find updated topographic maps. Now you have to use Google Earth to find large scale maps.

Environmental information and geographic information are important in Africa. The coordination of that is handled by EIS-Africa - a pan-African membership organization working to improve use of geospatial and environmental information to enrich policy debate and support decision-making for the well-being of Africa's people.

Under the item *publications* at the homepage of EIS you will find its newsletter and references to reports. The *Study of Fundamental Geospatial Datasets in Africa* provides a good overview of the situation. The report is a request for tender and will give answers on how to continue with building up a geographic information infrastructure in Africa.

NEPAD, a development organization of the UN Economic Commission for Africa (UNECA) has briefly reviewed the African situation at the beginning of the 21st century and found that:

- · Africa was the poorest region in the world with not less than half of *its* total population living on less than \$1 per day:
- · Africa also accounted for only 1 per cent of the global gross domestic product (GDP), while the income distribution was highly skewed against the poor;
- · Africa was the most marginalized region accounting for only 1.7% of world trade, 2% of world export, and 0.9% of global foreign direct investment (FDI);
- \cdot 1 out of 5 Africans lived under armed conflict, creating doubt about the region's future;
- · African economies were fragmented, structurally shallow and heavily dependent on primary sector – petroleum, mining and agriculture – with little value added;
- \cdot Africa was the most indebted and most aid dependent region, and

· Africa had the largest population infested with HIV –

In spite of the above deplorable situation, it is not in doubt that Africa is a well-endowed region.

In order to support its sustainable development, Africa needs a geographic information infrastructure, but that is not mentioned in the report from NEPAD.



Figure 15.8 shows a Road Map example.

15.3 Road Data

Road data has always been important. When road databases were first created by national road organizations, they were built for supporting the management of the roads. The network was not often closed so the databases could not be used for calculation of shortest or fasted routes between two places. Later on, companies were set up to build the road databases such as Tomtom and Navtech. For collecting road information, specific cars with measuring instruments and videos are driving over all the roads. The road data are then edited and inserted in the database. After that, street addresses are added as well as petrol stations, restaurants and tourist attractions. With such a system in the car it is easy to find the way. If you have a license to

the system you can use the data in the system, but not view and download it. Street addresses are frequently updated and the systems have contacts with many organizations and can report on road work, accidents and other impediments on the road you are driving,

Nokia, a Finnish telecom company, has bought Navtech and implemented its database for free in its mobile phones.

15.4 Statistical Geographic Information

Statistical data are very important for atlas production and for planning purposes. When statistical data are georeferenced it also constitutes geographic information. Geo-referencing means that data are connected to a geographic location e.g. an administrative area, of which the borders have been digitized. With statistical data georeferenced to administrative areas we can produce thematic maps that can be included in atlases or be available for decision support in spatial planning.

It is also rather common that street addresses have coordinates of the entrance of each building that is linked to a property that in its turn is linked to an administrative area. Geo-referenced statistical data, both from the census and from administration systems are available in enormous quantities.

Useful statistical data can be accessed from statistical offices and from organizations such as:

- The UN;
- The World Bank and
- The EU.

All these organizations have large amounts of statistical data related to administrative areas.

Search at http://data.un.org/ for UN data.

Search at http://data.worldbank.org/data-catalog/world-development-indicators for World Bank data.

Search at https://open-data.europa.eu/en/data for European data.

The Global Map also include administrative areas with digital borders. It should be possible to use the Global Map for creation of a world digital population map.15.5 Geo-portals

Geo-portals are built for the exchange of geographic information such as for searching, downloading and use. A geo-portal is built on Internet in a Service Oriented Architecture (SOA). In SOA a service is a specialised process in a computer that is prepared for taking orders from other processes and deliver back the required results. Services can also be linked to other services. In that way more complex services can be built for more demanding tasks.

A geo-portal also has a set of metadata that describes the different object classes. Metadata give *data about data* and are described in Chapter 3 of the *Spatial Data Infrastructure Cookbook* (GSDI, 2009).

A geo-portal user must have access to Internet and the geo-portal services that via Internet have access to the organization where the required data are located can be found by using metadata.

Figure 15.9 shows a topographic map achieved with using the Swedish Geo-portal www.geodata.se.



Figure 15.9 shows the topographic map showed in Figure 5.1 achieved by using the Swedish Geo-portal www.geodata.se. The green lines indicate borders for nature reserves.

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A geo-portal can also include more advanced services, where the user can order up-dates of data or other services such as transformation between different coordinate systems or handling of licenses or payment systems.

References

Booch, G., Rumbaugh, J. and Jacobson, I., 2006 *The Unified Modelling Language User Guide*, 2nd edition. Reading, MA: Addison Wesley. ISBN 9780321267979.

GGIM, 2012 Future Trends in Geospatial Information Management., Report from the Expert Committee on Global Geospatial Information Management, GGIM Second Session, New York,

2012.http://ggim.un.org/2nd%20Session/Future%20Trends%20Background%20Document.pdf.

GSDI (2009) *Spatial Data Infrastructure Cookbook.* http://www.gsdi.org/gsdicookbookindex.

JBGIS and UN (2010) *Geoinformation for Disaster and Risk Management*. http://www.un-spider.org/sites/default/files/VALIDPublication.pdf