

The Swedish National Atlas in WebbGIS

GIS Activities - Geographic Data Sweden

In Sweden there is a large, and increasing, demand for basic geographic data shown on the national maps in database format from a wide range of users. The Land Survey supplies these data, as well as other geographic data, under the generic designation, Geographic Data Sweden (Sw. *GSD*). Most of the databases are complete whereas production of others is in progress.

GSD-Property Map (GSD-Fastighetskartan)

The database contains the main part of the contents of the Property Map and can be used both in GIS and for map production. The database covers all of the country except for the mountain areas.

GSD-Elevation Contours (GSD-Höjdkurvor)

The elevation contours are produced primarily for the mapping series, but are also handled as a separate data base.

GSD-Digital Elevation (GSD-Höjddata)

The database contains height values for a regular 50x50 m grid covering all of Sweden. Some 200 million values are stored. One major use of the data is the generation of control data for the production of digital orthophotos. In the cartographic field some new relief maps have been produced. Hill shading has been calculated from the elevation data and plotted on a laser raster plotter.

GSD-Orthophoto (*GSD-Ortofoto*)

Contains orthophotos in raster format for the entire country.

GSD-Topographic Map (*GSD-Terrängkartan*) The databases have a vector format and have the same content as the printed Topographic map series.

GSD-Geographical Names (*GSD-Ortnamn*)

This database contains all of the toponyms shown in the national map series.

GSD-Road map (GSD-Vägkartan)

The databases are in vector format for use in GIS and they are produced in connection with production and revision of the Road Map. The databases have the same contents as the maps and are covering the entire country.

GSD-General Map (GSD-Översiktskartan)

The database contains the same information as the printed General Map series. It can also be delivered in raster format.

GSD-Administrative boundaries(GSD-Administrativ indelning)

Information in vector format about the administrative boundaries (county, municipality, parish, etc).

GSD-Land Cover Data (GSD-Marktäckedata)

The database contains a detailed description of land use in 60 classes. The database is available in both vector and raster format.

The Swedish CORINE Land Cover

is build from GSD-Marktäckedata. It meets the European CLC specifications and includes 44 classes,

GSD- Map of Sweden 1:1 million (GSD-Sverigekartan 1:1 milj)

Data in vector format on administrative boundaries, roads and railroads, lakes and rivers, land use, etc.

The Land Survey is also participating in other international co-operation concerning databases, e.g. Euro Regional Map, Euroroads and EULIS

Internet-based services

An e-commerce Internet marketplace giving easy access to all official maps, high-resolution ortophotos, historical maps, property information, etc., has been introduced. The user can have a look at free of charge and – if he wants to use the data – he can directly adjust the product to his needs, order it, download it (or have it sent on CD or in printed form), and pay for the services by credit card. Up to now, the marketplace contains the following services:

PropertySearch contains information about Sweden's 3.2 million real properties from Lantmäteriet's cadastral registers. Searches are made using either the property designation or the address and it is possible to browse and retrieve information about, for example, owner, locality, as well as area and assessed value. Property Search is available in two versions: one for all citizens and one for professional users. The latter version contains more information, but the users have to sign a license agreement and are required to pay an annual fee. YourMap is based on the official maps of Sweden (in digital format). The users can look at areas of interest, free of charge and they can order – in digital form or as a print-on-demand – the areas of interest.

MapSearch and Geographical names includes the official maps of Sweden as well as approx. 1,000,000 place names

MapStore provides an easy way to find and order maps, nautical charts and tourist guides.

SwedeImages contains orthophotos covering the entire country. These images have a resolution of one metre. Images for which orders have been placed can be downloaded from the Internet, delivered on CD-ROM or as printed copies.

ImageNet contains satellite imagery, which can be ordered by use of the Internet.

Historical Maps contains a great amount of historical maps from all over Sweden. Through the development of scanning and storage technology in recent years, it has become possible to create digital map copies that meet the standards of researchers and other demanding users.

GeoLex is an interactive service on the Internet with current metadata information about Lantmäteriet's maps, databases, and aerial photos.

For more information about these services see www.lantmateriet.se.

Literature

The Land Survey publishes information on research and technical development in a series called Professional Papers (Sw. LMV-rapport), ISSN 0280-5731.

The national mapping programme is presented annually in the booklet Kartplan that includes a complete map catalogue as well as index maps for all series except for the 1:10,000 scale. The present edition of the Kartplan also includes the programmes for the Nautical Charting Division of the Swedish National Shipping Administration, the Swedish Geological Survey, and the Swedish Meteorological and Hydrological Institute. This information is also available on the Internet.

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Swedish Maritime Administration (Sjöfartsverket)

Organisation

In Sweden the Hydrographic Service is represented by the Swedish Hydrographic Office, a part of the governmental Swedish Maritime organisation (SMA, Swe: Sjöfartsverket). The Swedish Hydrographic Office (SHO, in Swedish Sjökarteenheten) is responsible for the official Hydrographic Service in Swedish waters including Hydrographic surveying. The SHO prepares and issue official nautical charts and nautical publications including notices to marines to support maritime navigation safety and marine environment preservation. The SMA Head office is located in Norrköping including the SHO. SHO staff consists of 70 employees. The Swedish Maritime Administration shall, according to its regulations, primarily serve merchant shipping and carry out these activities along commercial lines. The interests of the national Swedish navy, the fishing industry and the leisure craft sector should also be taken into account. The major part of the SMA's activities is financed through dues on ships and cargoes.

The SMA primary goal is safety and environmental protection. Thus the security in shipping, including the use of charts and publications, is regulated by the International Maritime Organisation (IMO), where the regulatory work is the SOLAS (Safety of Life At Sea) Convention.

In Regulation 9 chapter V of SOLAS the following is stated in referring to Hydrographic Service: 1. Contracting Governments undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation.

2. In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation:

2.1 to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation;

2.2 to prepare and issue nautical charts, sailing directions, lists of lights, tide tables and other nautical publications, where applicable, satisfying the needs of safe navigation;

2.3 to promulgate notices to mariners in order to keep official nautical charts and publications, as far as possible, up to date;

2.4 to provide data management arrangements to support these services.

3. Contracting Governments undertake to ensure

the greatest possible uniformity in charts and nautical publications and to take into account, whenever possible, relevant international resolutions and recommendations.*

4. Contracting Governments undertake to co-ordinate their activities to the greatest possible degree in order to ensure that hydrographic and nautical information is made available on a worldwide scale as timely, reliably, and unambiguously as possible.

* Refer to the resolutions and recommendations of the International Hydrographic Organization.

The intergovernmental cooperation in hydrography is done through the International Hydrographic Organization (IHO), by the member states Hydrographic Offices and the Bureau (IHB) in Monaco. The Hydrographic Offices cooperate on standardisation, development of exchange format and distribution system in all matters related to Hydrographic surveying, printed nautical charts, electronic nautical charts and other things related to Hydrographic Service in both globally and regionally aspects.

The regional organisations around the Baltic (Baltic Sea Hydrographic Commission, BSHC) and Nordic countries (Nordic Hydrographic Commission, NHC) are very active in international work and analyses and often both prepare and solve issues together. In certain cases activities are co-ordinated between BSHC and HELCOM. HELCOM is the governing body of the "Convention on the Protection of the Marine Environment of the Baltic Sea Area" - more usually known as the Helsinki Convention. A common plan, the HELCOM Hydrographic resurvey plan, has been developed for the purpose of re-surveying major shipping routes and ports of the Baltic Sea. Efforts are being made by the Baltic countries to co-ordinate reference levels for charts and water level information. Although the Baltic Sea is not affected by tides the Scandinavian land mass is subject to post-glacial uplift. Soundings on charts are related to the mean sea level for a given year with instructions for reducing depths according to the relevant land rise coefficient. A co-ordinated reference level would ease the interpretation of depth information. Easy access to water level information coupled to the same reference would be even more useful.

The SHO performs a full range of services from hydrographic surveying to the sale of updated nautical charts and publications. On a national level the SHO supplies merchant shipping, the Swedish Navy and other users with necessary done manually in the paper charts according to the weekly publication Notices to Mariners. The digital chart information for use on commercial ships in ECDIS is available to the users through a cooperative work between several nations together with PRIMAR Stavanger. The SHO and other HO:s continuously update ENC's parallel to the production of Notices to Mariners by delivery of ER (ENC Revision) to PRIMAR. Consequently, the up-dating work of the digital charts onboard a single ship can very easily be assisted by an Internet based tool or done by radio communication, diskette or CD directly into the navigators own ENC database, e.g. on weekly basis.

Other publications

In spite of the fact that a modern nautical chart contains a large amount of information there is a need of supplementary information in the form of publications, which describes what usually cannot be reproduced in a chart. The following are the essential ones for merchant shipping produced by the Swedish Hydrographic Office:

Swedish Notices to Mariners (NtM, Swe: Underrättelser för sjöfarande, Ufs) gives information as small notices of warnings or for maintenance of printed charts and other information essential for safe navigation in Swedish waters. It is a weekly publication on the internet (www.sjofartsverket. se).

Notices to Mariners volume A (Swe: Ufs A) is a compilation of general information of nautical interest.

Swedish Sailing Directions (Swe: Svensk Lots) are sailing directions covering Swedish territorial waters and harbours. It is mainly intended for merchant traffic, performed in three volumes, A, I and II.

- Volume A, gives general information of fairways, regulations, limits and borders, meteorological information, ice regulation, etc.

- Volumes I and II Gives descriptions of the coast and harbours (Swe: Kust- och hamnbeskrivning) contain sailing information of fairways, approaches, passages, entrances and harbours, etc.

- *Kort 1 / INT 1* contains symbols, abbreviations and terms used on Swedish and international charts.

- *Swedish List of Lights* (Swe: Svensk Fyrlista), which is a register of lighthouses, light buoys, radio beacons etc.

- NAVTEX Warnings in the Baltic Sea area: As a supplement to in particular the Ufs, special navigational warnings are broadcasted.

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Sveriges Geologiska Undersökning (Geological Survey of Sweden)

Organisation

The Geological Survey of Sweden (SGU), founded in 1858, is a governmental authority under the Ministry of Industry, Employment and Communications. A Director General and an executive board manage it.

SGU is today a modern, custom oriented organisation with about 280 employees. The majority of these are based at the head office in Uppsala. There are also regional offices in Stockholm, Göteborg (western Sweden), Lund (southern Sweden), and Malå (northern Sweden). The activities can be divided into five main fields – Geology and Minerals, Environment, Research & Development, Consulting services and the Mining Inspectorate. Financing comes dominantly from government grants with the main goal to provide geological information particularly within the fields of environment and health, physical planning, natural resources, agriculture, forestry, and total defence. SGU may also do commissioned work. Activities are carried out in programmes and projects that give the organisation a high flexibility corresponding to changes in demands.

Main Activities

The aim for the geological investigations is to meet society's demand for new knowledge of bedrock, soil, and groundwater in order to create conditions for a good environment, a long-term balanced supply of natural resources, and utilisation of ground and water with consideration taken to natural conditions. Collected geological information will be made available rapidly and in a form suitable for the user.

The Swedish Government has, in 1999, given new targets for geological mapping. This implies that during a 10-year period general geo information will be obtained for the entire country, including the continental shelf. Within the same time period, more detailed geological information will be prepared in urban districts and ore-potential areas. The databases will contain information on bedrock, soil, and on the most important groundwater occurrences.

The present planning period is reaching its end

and SGU has by commission from the Government proposed a direction and goals for the operations subsequent to 2008. Among other things, this will involve an increased focus on end-user requirements in the collection of geological data, a more active and continuously improved administration of data and increasingly customized deliveries of data to end-users. Geological information will be made more accessible and easier to use for the end-users, with the aim to increase the benefits to society. A report presented to the government in February 2007, contains detailed suggestions for a new direction, organization, goals and financing for the period 2008-2012.

Map Production

The main maps produced during the regular activities are described below. All published maps are now also available as digital databases and geological information from ongoing mapping is continuously stored in databases.

Bedrock maps are used in the exploration for natural resources like metallic and non-metallic minerals, dimension stone, and crushable rock as a replacement for natural gravel resources. Bedrock maps are also the basis for planning of building and plant construction, and are used increasingly in environmental conservation contexts. Bedrock maps are produced at scales between 1:50 000 and 1:400 000 and many maps are provided with separate descriptions.

Bedrock quality maps are compiled from regular bedrock maps with the addition of point information. The maps show main structural features, depth to bedrock surface, areas of high radium index in addition to a classification of the bedrock. Technical analyses on point samples include e.g. the Nordic test for studded tyres, Los Angeles test, and point load index.

Quaternary deposit maps are important in physical planning for building and plant construction, environmental conservation contexts, searching for gravel and groundwater, localisation of environmentally hazardous activities, cable- and pipelaying, and passability. Quaternary deposit maps are available at scales between 1:50 000 and 1:400 000 with separate descriptions provided with many maps.

Groundwater (hydrogeological) maps form a basis, among other things, for water planning and for establishing groundwater protection measures. Maps are available at 1:50 000 and 1:250 000 with separate descriptions to each map. Available digital information includes location and size of larger groundwater reservoirs and usually also classification of vulnerability.

Marine geological maps show the Quaternary deposits of the Swedish part of the continental

shelf and provide information concerning dynamic seabed conditions, availability of certain industrial minerals, and environmental monitoring. They are also an important source of information for biological inventories, aquaculture, fisheries, and defence.

SGU supplies two types of *geochemical maps*: biogeochemical and soil geochemical at the scales of 1:250 000 and 1:1 000 000. Biogeochemical maps show variations in heavy metal concentration in the environment, resulting either from natural geological conditions or from human activities. Soil geochemical maps show pH and natural occurrence of elements in till and are used to show surplus and deficiency areas for nutrients and trace elements, as well as state of acidity.

Geophysical maps are used primarily as a basis for geological bedrock mapping, prospecting for mineral resources, and planning purposes. SGU can provide information on the magnetic field, gamma radiation, electromagnetic field, and gravity that can be used to produce interpretations on geological structures, rock type distribution, depth distribution of lithological units, and crush zones and faults. Geophysical maps are produced mainly as print-on-demand products.

The application of new methods in field work and the increasing use of databases has made it possible to produce thematic products which meet the demands of customers from local, regional, and governmental authorities, private enterprises, consultants, scientific institutions, and the general public.

Other Activities

SGUs Mineral Resources Information Office in Malå hosts the national archive of mineral exploration data. The archive contains virtually all the information produced during the long period of government-financed exploration in Sweden as well as information from other organisations. The extensive material covers exploration reports, maps, and digitised geological, geophysical, and geochemical data.

Mining Inspectorate is led by the Inspector of Mines with a Head Office in Luleå and a Branch Office in Falun. This has permitted important improvements in efficiency through new routines, uniform handling of business matters, and a widening of systematic contacts with all parties concerned.

During the last decade SGU has received different new tasks within the field of environment. One is the responsibility to phase out the storages of the national oil stockpile.

Another environmental task that SGU has received is the responsibility of the national environmental goal for *Groundwater of high quality*. done manually in the paper charts according to the weekly publication Notices to Mariners. The digital chart information for use on commercial ships in ECDIS is available to the users through a cooperative work between several nations together with PRIMAR Stavanger. The SHO and other HO:s continuously update ENC's parallel to the production of Notices to Mariners by delivery of ER (ENC Revision) to PRIMAR. Consequently, the up-dating work of the digital charts onboard a single ship can very easily be assisted by an Internet based tool or done by radio communication, diskette or CD directly into the navigators own ENC database, e.g. on weekly basis.

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Printing, Publishing, and Distribution

The regular production of printed maps, map descriptions, research papers, and other reports is complemented by the production of print-on-demand maps and digitally distributed publications (CD-ROM). All publications are distributed by the Geological Survey through its customer service.

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Swedish Meteorological and Hydrological Institute (SMHI)

Organisation

The Swedish Meteorological and Hydrological Institute, SMHI, is a government agency within the Ministry of Environment and the national authority for meteorology, hydrology, and oceanography.

The institute's core activities focus on public requirements for forecasting, early warning, monitoring, research and international co-operation.

One of SMHI's main objectives is to secure a basis for planning and decisions in activities dependent on atmospheric, inland water and sea conditions. SMHI is organised into six departments:

Core Services Environment & Safety Services Business & Media Services Research IT

Administration

SMHI has 550 employees. SMHI's headquarter is located in Norrköping with branches in Sundsvall, Stockholm/Arlanda, Gothenburg and Malmö. Half of SMHI's income comes from commission work and business enterprise and the rest from government grants.

Operational Mapping

The state of the atmosphere, current and forecasted, is mapped on a daily basis using numerical models and observations from several sources. HIRLAM (High Resolution Limited Area Model) is the most important model. The resulting maps of different weather factors are presented to the public through media and like many other maps described here also on the Internet.

Another mapping on a daily basis is done us-

ing the MESAN system (Mesoscale Analysis). MESAN provides gridded map information. The system uses statistical interpolation of observations from different sources with results from the HIRLAM model as a first guess. Among the data sources is information from satellites within the European co-operation EUMETSAT. The system is under development and contains at present several variables describing the lower part of the atmosphere, the ground and sea surface. The grid sizes are 11 and 22 km respectively.

Within oceanography the HIROMB model (High Resolution Oceanographic Model for the Baltic) gives daily forecast maps on sea levels, currents, salt content and water temperature. The HYPAS model (Hybride Parametric Wave Model for Shallow Seas) gives forecasts on wave heights and the BOBA model (Bohai Baltic Sea Ice Model) describes ice formation and ice cover during the winter season.

Hydrologic maps are produced daily based on the results of the HBV model. The maps show the variation of variables such as runoff, snow cover and soil water content. The hydrologic model is also a tool in the production of maps showing the risk of forest fires. Daily forecasts are produced during the summer season. The system is now being developed to include the use of the HIRLAM model and the MESAN system.

Precipitation and cloudiness are mapped daily with a Nordic weather radar network, NORDRAD. The maps are used in presentations of the weather development. They are also used to support the production of meteorological and hydrologic forecast maps.

The weather and water conditions during the past month are mapped and reported in a monthly magazine. The magazine contains hydrologic, meteorological and oceanographic maps. There is also a groundwater map from the Swedish Geological Survey. The magazine is mainly aimed at a use within local, regional or national authorities.

General Mapping

SMHI has created and maintains a number of national maps. Basic maps are those on 30-year averages of precipitation, runoff and evaporation. In addition there are a number of map categories available. Several maps concern climate variables describing averages for the period 1961–990. The number of hydrographical maps is extensive. Examples are the map of water divides for about 11,000 drainage basins, the map of digitised rivers and more than 6,000 lake depth maps.

In 1998 SMHI was commissioned by the Swedish Rescue Service to map flood prone areas along the Swedish rivers. Up to today about 6,000 km of the rivers have been calculated. The maps are mainly required by the municipal rescue services for the planning of actions before and during high flow situations. They could also be used within comprehensive physical planning. The mapping include the derivation of flooded areas at two flow levels, flows with a 100-year return period and maximum calculated flow. The ambition is to cover about 10 % of the Swedish rivers or about 10,000 km.

The HOME project (Hydrology, Oceanography and Meteorology for the Environment) was introduced to provide officials connected to environmental decisions with maps of physical and biogeochemical conditions. The system is applied to the Baltic, the Kattegat and the Skagerrak and their drainage areas. It includes and combines the results from hydrologic, oceanographic and atmospheric models. MATCH (Multiscale Atmospheric Transport and Chemistry model) being the atmospheric dispersion model, HBV the hydrologic model and SCOBI (Swedish Coastal Ocean Biogeochemical Model) the oceanographic model.

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The LFV Group (Swedish Airports and Air Navigation Services)

Organisation

The Swedish Aeronautical Information Service (AIS), which is organised within The LFV Group (Swedish Airports and Air Navigation Services), has a cartographic group, consisting of six employees, producing aeronautical charts. The National Land Survey of Sweden issues small-scale aeronautical charts in co-operation with LFV. International cooperation takes place within the scope of the ICAO (International Civil Aviation Organisation) activity.

Cartographic Duties

The following international aeronautical charts are published in accordance with specifications, accepted by ICAO, in the Aeronautical Information Publication (AIP-SWEDEN).

Instrument Approach Chart at 1:250,000. Altogether 228 pages, concerning 54 aerodromes. Visual Approach and Landing Chart at 1:250,000 (51 pages) and 1:25,000 (26 pages) of 51 aerodromes

Aerodrome Chart at 1:5,000 and 1:10,000, 40 pages, covering 40 aerodromes

Aerodrome Obstacle Chart at 1:20,000, 36 pages of 26 aerodromes

Terminal Area Charts at various scales, 12 pages of 28 aerodromes

General Maps of different kinds, showing location of aerodromes, navigation facilities, controlled airspace, restricted and danger areas, search and rescue units, etc, altogether 31 pages.

In addition to the charts mentioned above the following aeronautical charts are published at the request of the Swedish Air Force. Instrument Approach Chart at 1:250,000, (150 pages) concerning 34 aerodromes Instrument Approach Chart at 1:400,000 (42 pages), and Landing Chart at 1:40,000 (36 pages) concerning 33 aerodromes Visual Approach Charts at various scales, 58 pages of 23 aerodromes Terminal Areas Charts at various scales, 4 pages of 16 aerodromes General Maps of different kinds, altogether 19 sheets

Maps prepared by The LFV Group are usually based on working-plans, rectified aerial photographs or official maps. The basic material is photographically reduced to the drafting scale for each map, usually the same as the final scale. Fieldwork as reconnaissance, levelling and surveying of heights of obstacles is undertaken as a completion of details, etc, most often with the aid of aerial photos, land use and topographic maps etc.

Aeronautical information and fieldwork results are added to the basic material. After checking of the manuscript, the original of text and chart pattern is produced.

A database solution with Oracle 8i and the applications MapInfo and MSWord is in production. The initial population of static data and position data with associated attributes has now ended, and the database is now continuously updated. Next phase will be a system to system connection to the European AIS database and publication of the electronic AIP (eAIP).

As aeronautical information is frequently altered the charts must be constantly revised. Alterations and additions are entered on special revision copies of the different maps. If necessary, field investigations are made. Corrections are made on the reproduction originals and new printing then prepared.

The Administration has its own printing office. In addition to the printed and distributed AIP, the AIP is also published on www.lfv.se as pdffiles.

The charts are printed in one to four colours depending on the range of information provided by the charts.

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Riksantikvarieämbetet (Swedish National Heritage Board)

Organisation

The National Heritage Board (NHB) is the central authority in Sweden for matters regarding the cultural environment and the cultural heritage. Its main objective is to serve as the administrative authority, along with the county administrations and regional museums, to ensure that our entire cultural heritage is both preserved and used.

In the work of fulfilling the parliamentary and governmental decisions concerning the protection, preservation, supervision and use of the cultural heritage, the operations of the Board involves for example heritage management, research & development, education & information and contract archaeology.

Mapping and charting

With more than 300 years of field studies, archaeological documentation and inventories the geographical approach has a long tradition in Swedish heritage management. From 1937 a central survey of ancient monuments was co-ordinated with the general mapping of Sweden by the National Land Survey.

Although the NHB is not involved in the actual production of official maps, it is responsible for keeping a national record of ancient monuments, which provides the National Land Survey with basic information for their cartographic products, such as the land use map of Sweden. Today this record contains more than a million geographical objects. As the heritage legislation has a strong position in Sweden the archaeological information recorded at the ancient monuments survey has considerable impact on land use and planning activities.

GIS

Today GIS is an integrated part of the workflow within the organisation and its importance is increasing in analysis, fieldwork, data capture, presentation and visualization. Archaeological documentation has been the main part in the usage of geographical information technology within the NHB, but today GIS has a widened use, for example in the growing field of environmental quality objectives. Also, much effort is being put into the development of analytical methods regarding decision-making in heritage management and environmental protection.

Sweden has several hundred thousand historical maps, containing unique information on environment and landscape development that may



An example of an historical map from 1774 depicting the gunpowder plant of Kloster in middle Sweden. The buildings of the plant are surrounded by arable land, meadows and grazing land. stretch over almost four hundred years. In co-operation with the National Land Survey substantial contributions have been made to the production of digital copies of historic cadastral maps, in order to facilitate information access and to ensure the preservation of the valuable original documents. The NHB has also had a major role in developing GIS-based methods for analysis, presentation and visualization of digital historical maps.

Much of the GIS related activities in the NHB are based on Standard GIS software packages (such as ArcView/ArcInfo, MapInfo, ERDAS etc). However, the NHB has also developed applications for specialized purposes within the heritage management sphere. Intrasis (Intra-site Information System) is an archaeological information system for recording and managing field data. The system is developed by The NHB, Archaeological Excavations Department and LandFocus IS AB. Furthermore, applications for registration and database search on ancient monuments have recently been developed within the project "Ancient Monument Information" (FMIS). This work took place within the process of an overall digitalization of the Swedish national record of ancient monuments.

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Swedish Road Administration (SRA)

Organisation

The Swedish Road Administration is the national authority assigned the overall responsibility for the entire road transport system. Our task is to co-operate with others to develop an efficient road transport system in the direction stipulated by the Swedish Government and Parliament.

SRA have been commissioned to create a safe, environmentally sound and gender-equal road transport system that contributes to regional development and offers individuals and the business community easy accessibility and high transport quality.



Technical Development

The cartographic tools which are used in the SRA for map production and map dissemination have improved the last years. The internet technology development decreases the need for distributed data on each personal computer and makes it possible to use common data through the web.

An internet site as Google Earth has showed us the power of visualization in general and the use of aerial photos in particular. Many maps on the Internet are transferred quickly to the map consumer without long delays. The user can move seamlessly around the map and zoom in and out with smooth transitions thanks to new internet techniques. In all it demands more of the applications that the SRA provides to internal and external users.

Road navigation equipment has become common to many car drivers. This kind of "spoken" cartography increases enormously the demand of accuracy in the road databases. Route cartography focuses on details and doesn't get the overall perspective as ordinary maps do.

The cartographic challenges remain for visualizing information on a various size of displays. Open Source-solutions has received attention as an option to licensed products in the SRA, but the use of standard products is still dominating.

Development last four years

More and more road-related data has been visualized for the last years thanks to geographical databases adapted for GIS. As many of the SRA's databases are rich, objects can be selected with complicated sequences of questions and thereafter visualized.

A general map component has been developed for re-use in many applications. The SRA has improved the public information on the Internet as road and traffic conditions. Some of these services are map-related.

Cartographic Activities

SRA produces printed maps of the public roads for guidance to the transportation sector. One of them focus on bearing capacity classes, obstacles and proposed routes for dangerous goods. Another is intended mainly for handicapped people and shows facilities along the public road network.

Regional maps are also being produced. One example is the road map of Skåne showing roads with contribution from the SRA. Maps are also highly integrated in the road planning process, see example below. Maps can be disseminated as printed paper, but more often as a digital document.



GIS/GIT Activities

The SRA is responsible for building up and maintaining the National Road DataBase, NVDB. The database is of great importance to the information infrastructure of Sweden. Many internal and external GIS-applications are employing the National Road DataBase. The quality of the database are critical when visualizing or analyzing data in GIS.

The SRA is participating in the standardization work within the subject area of geographic information on a national level, particularly in the domain of roads.

The SRA is also active in GIS in the field of environment. The noise dissemination from the roads is to be surveyed for the whole country. Another example of using GIS is when the SRA is giving priority to future bicycle paths along the governmental roads.

Future Activities

One of the challenges for SRA in the future is to ensure the data quality of the National Road DataBase (NVDB) and other related databases. These are used in important internal activities of the SRA as well as for external use.

Some web map services are used from other public organizations, but not as far as could be desirable. Using web map services from the original sources could lead to better basic data for decision-making and save costs for data storage. The SRA will probably provide web map services within a few years for external use containing road and traffic information.

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Liber

Organisation

Liber has a cartographic editorial unit within the Liber Group owned by Wolters Kluwer, Holland. Liber produces and markets maps, atlases and electronic map products for both the domestic and international markets. The department employs at present 13 cartographers with long professional experience.

Our own map products and maps produced for other publishers as well as maps for schools and the consumer market are marketed and sold by a central sales and marketing department within the Liber Group.

Technical Development

Today all maps produced at Liber are "computer made". Our editors have a wide variety of sophisticated software in their hands to produce maps. They can experiment with colours, different types of design effects, and layout etc. thus making new types of maps.

The basis for our map production is our own databases. We store our vector databases in Bentley Microstation, pixel data as TIFF files and name databases in Microsoft Access. Besides that we have many small thematically and special maps in Adobe Illustrator format. Liber also produces maps from different commercial GIS databases. By using software as Intergraph Map Publisher and ESRI ArcGis, we are able to design high quality maps and export the data to different file formats.

During the last two years the production of thematic maps from statistical information have been transferred to GIS-production software with the possibilities to integrate information from different sources, choose map projection and make classification more flexible.

In house development has been focussed on automating the process from database to final files. Database driven software now produces the scripts needed to manage the whole process of map making. Several programs have been developed to manipulate data in our databases, both MicroStation and Illustrator. New software has also been developed to make indexes from our name databases. This software is based on the new character sets that are introduced in new operating systems, namely Unicode. It is possible now to take control of all the characters that exist in different languages.

In the last step, we use layout software like Adobe Indesign to make final map design. Normally output to prepress is platform independent Adobe Acrobat PDF files. Data are transferred fast and easy to prepress and printers all over the world with the Internet FTP protocol.

With new large format printers, width 165 cm, we are able to print verification plots of our maps. The new plotters are being colour calibrated, and generates reliable map proofs before sending the pdf-files for printing.

Liber maps can be found in our Internet site at www.liber.se and ordered at several Internet bookstores as well as in any bookstore in Sweden.

Cartographic activities

Liber uses Bentley Microstation for building and maintaining databases in vector format. Intergraph Map Publisher is used for cartographic map design. Vector information from these map databases is also transferred to desktop programs such as Adobe Illustrator and Photoshop for product definition and design. Page layout and montage is done in Adobe Indesign.

There is a demand on converting existing data into GIS databases. Liber uses software from Safe Software, FME, to accomplish this task. FME also allows us to solve cartographic problems around the GIS platform

The following fully owned databases are used for cartographic production: Stockholm 1:10,000 – 1:30,000 Malmö 1:10,000 Swedish town plans 1:30,000 Scandinavia 1:650,000 Europe 1:2 – 1:4 M. Africa, Asia, Australia, North and South America 1:10 million. The World 1:30 – 1:60 million

Other databases from municipalities and the National Land Survey of Sweden are also used for cartographic production.

Many of the map products, which Liber sells, are designed and produced in collaboration with our clients, with whom we discuss content, map design, and layout. Liber does all the research, editing, origination, and technical production. The final products can be delivered as digital data, CTP-files (Computer to Plate) for printing as well as printed products.

For the *general market* in Sweden and abroad, Liber produces world atlases in different sizes and languages. Other products for both the Swedish and Scandinavian market are road atlases and tourist maps. A number of products are also being produced for petrol companies and tourist organisations.

Within the *schools programme*, Liber produces a variety of school atlases and wall maps for the Scandinavian countries educational publishers. New products are developed in collaboration with each client, who provides information about the educational needs in their own country. The number of thematic maps available for use in atlases and wall maps are approximately 500.

A variety of maps of Stockholm, Gothenburg, and Malmö include taxi maps, tourist maps, and cycle maps are produced and published by Liber.

The production also includes many different map products for promotional purposes for commercial companies, such as world atlases, desk pads, and wall maps.

Future activities

Liber will continue to produce maps as traditional printed products, print on demand-maps and for Internet use. New and alternative techniques are being developed to rationalise the production methods and to produce well-designed cartographic products for educational purposes and general use.

New products for the future will be maps and map related information for interactive whiteboards and computer tests and assessments for teaching geography in all levels of education. GIS for schools is also a new area of product development in coming years.

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The GPS Atlas of Sweden is a traditional road atlas but at the same time offers users with GPS equipment navigational information that could be used in electronical devices. The mapframe has coordinates in three different systems: latitude/longitude, RT90 (the old Swedish system) and SWEREF 99 (the new Swedish system).

GOLFBANOR

A6 GK F 23 640_45 (554 59 Jonköping) 57%6',14°13' Abbekås GK M 3 611_41 (27451 Skivarp) 55%24',13%6' Albatross GK O 156 640_31 (425 38 Hisings kärra) 57%7',11%7'

Ale GK O 20 643_33 (44691 Alvhem) 58'0;12'11' Alfa-Edsbyns GK × **71** 679_55 (822 91 Alfta) 61'20',16'2' Alingsås GK O 157 641_35 (441 96 Alingsås) 57'53;12'33' Allerum GK M 154 622_35 (260 35 Ödåkra) 56'8',12'43' Allerum Park M 154 622_35 (260 35 Ödåkra) 56'8',12'43' Allerum Park M 154 622_35 (260 35 Ödåkra) 56'8',12'43' Allerung GK O 27 645_31 (472 92 Stillingson) 58'12,11'48' Amunge GK O 27 645_63_67 (740 10 Almunge) 59'51',18'11' Alvesta GK G 13 631_47 (342 94 Alvesta) 56'5'8',14'34' Annebengs GK N 157 637_32 (434 48 Kungsbacka) Björnhults GK N 10 631_34 (311 71 Falkenberg) 5656,1226 Bodaholm (Björklidens GK) AB 52 661_65 (195 33 Märsta) 5939,17%49

Bodens GK BD 127 730_80 [961 50 Boden] 65°45',21°45 Bokskogens GK M 155 615_38 [233 92 Svedala] 55°33',13°13'

Bolidens GK AC 110 720_74 (936 31 Boliden) 6453',2014' Bollestad GK O 156 642_31 (42:93 Kareby) 5754',1153' Bollnas GK × 66 679_58 (823 30 Kilafors) 6116,1632' Borås GK O 21 639_37 (504 45 Borås) 574'1,1257' Bosjöklöster GK M 3 619_40 (243 39 Hoor) 5553',1333' Boltkyrka GK AB 158 656_66 (147 34 Tumba) 591'0,1751' Bredareds GK O 21 640_37 (504 97 Bredared) 5748',1255' Brevikens GK O 21 640_37 (504 97 Bredared) 5748',1255' Broitsta GK AB 158 666_64 (197 40 Bro) 553',1735' Broitsta GK AB 158 666_64 (197 40 Bro) 553',1735' Broitsta GK AB 158 666_64 (197 40 Bro) 553',1735' Broitsta GK AB 152 660_68 (186 97 Brottby) 59'35',18'18' Bromma Golf (Bjökildens GK) AB 158 658_56 (168 74 Eksjö GK F 23 638 _49 (575 39 Eksjö) 57738;1475' Elisefarms GC M 3 618 _40 (242 93 Horby) 5549';13'34' Emmaboda GK H 8 626 _53 (380 60 Vissefjärida) 5672;15'36' Enköpings GK C 51 661 _62 (745 44 Enköping) 59738;17'9' Eskilstuna GK D 40 658 _58 (53 62 Eskilstuna) 59'22;16'34' Eslova GK M 2 618 _39 (241 93 Eskilstuna) 59'23'

Fagersta GK U 49 664_54 (737 30 Fagersta) 5958',1545' Falkenbergs GK N 10 630_35 (31172 Falkenberg) 5654',1235' Falkoping 6K O 29 645_41 (521 96 Falkóping) 58°13',1338' Falsterbo GK M 155 613_36 (239 40 Falsterbo) 55°23',1249'

Falun-Borlánge GK W **57 671_52** (791 93 Falun) 60°33',15°31' Figeholm G&CC H **15 636_59** (572 75 Figeholm)

57°23',16'36' Finspångs GK E **31** 650_54' (612 44 Finspång) 58°41',15°50'

An extensive index with all the names in the atlas is provided with reference to the map pages and with Postal zip-codes and latitude/longitude. The index has more than 50,000 names. There are also two separate index with all the golf links and rest areas in Sweden.

HYDROGRAPHICA

Hydrographica is a highly specialized private company producing nautical charts exclusively for pleasure cruising purposes. Hydrographica charts are complementary to the official Swedish HO charts, in areas where a more detailed product is needed.

Organisation

Hydrographica is privately owned, and employs at present five persons. Three of them are qualified cartographers with a background as lecturers in cartographic education at Stockholm University. Hydrographica was founded in 1983, and is based upon a surveying technique using aerial photo interpretation/photogrammetry in bathymetric mapping.

Chart production

Hydrographica produces charts over marine and coastal areas as well as over inland lakes. Production of inland lake charts are normally initialized by local yacht clubs or communities wanting a professional chart over Swedish inland waters where no ordinary HO chart exists. From 2000 Hydrographica also have a permission from military authorities to survey coastal areas where ordinary surveys are old and/or unreliable. Hydrographica now produces large scale marine charts, and at sea the Hydrographica charts are a parallel to the orienteering maps on land. At present, Hydrographica have produced about 25 Swedish inland lake charts at various scales, and 36 marine charts at a scale of 1:10,000. All charts are planned, produced and published within Hydrographica. The in-house competence spans over the whole production chain. All Hydrographica marine charts are printed on polyart, a synthetic paper with excellent properties for use at sea.

Surveying techniques

Chart production starts indoors with aerial photo interpretation and photogrammetry. Hy-

drographica have developed a technique where water depth down to 4-5 meters normally can be penetrated and measured with high accuracy through stereoscopic analysis of aerial photos. Bathymetric contours for 2 and 3 meters can be drawn and water depth on separate shoals can be established. All photo interpreted data must be confirmed through field surveys, but the field work can be considerably more efficient since the positions of all shoals are already mapped with high precision. For field surveys Hydrographica owns three boats for shallow water mapping specially equipped with suitable echo-sounders, side scan sonar, positioning tools and other nav-aids.

Cooperation

Hydrographica cooperates with the Swedish Maritime Administration, and supplies data to international chart producing companies such as Garmin, Navionics, C-map a.o. Hydrographica is a MapTech acknowledged partner in producing digital raster versions in BSB-format. Paper charts published by Hydrographica reach the market through a substantial amount of retailers in Sweden, but also through Hydrographicas own website, a system that is highly appreciated and well functioning. Digital versions of Hydrographica charts can be downloaded directly from the website. Hydrographica also cooperates with a nautical publisher in producing guide books for pleasure cruising along the Swedish coast.

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Hydrographica chart at 1:10,000 reveals deep and trafficable water as well as isolated shoals in the same area.

Official chart from Swedish HO at original scale 1:50,000 (enlarged) show large areas järh as shallow and non trafficable (blue tint). Loppen borg 9 3 0,8 5 3,5 0,9 2,0 10 Stockholm + Kalmar ,2 0 3,8 5 .+. Lilla Enbusk-VÖ skär