



National Report Presented to
the International Cartographic Association's
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Paris, France
by the Swedish Cartographic Society

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Introduction

The national report of Sweden is written by the Swedish Cartographic Society. The recipients of the report are the delegates of the General Assembly 2011 of the International Cartographic Association in Paris, France. In Sweden, maps and geographic data are produced by national and local government authorities and institutions, commercial enterprises, scientific institutions, organisations, and individuals.

This report focus on cartographic production of map and map series, use of maps and geographic information.



The dessert on the way into the Society's hundred year gala dinner. Photo Lars Palm

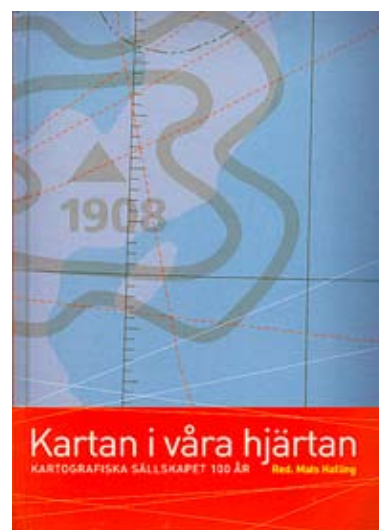
The Swedish Cartographic Society

Background

The Swedish Cartographic Society was founded in 1908, and is most probably one of the oldest of its kind. The Society's goal is to increase the interest in cartography and other topics related to mapping or the use of maps in Sweden and to try to encourage a development in the area. The one hundred jubilee in 2008 was a major event that year. The Society announced also the year 2008 as the Year of the Map and the purpose was to increase understanding and use of maps in Sweden. Map producers and users took part in this celebration. There were also roving exhibitions which visited some 60 locations in Sweden and the exhibitions had several visitors. The Society sponsored also a TV-series of 11 programs, each 5 minutes, "Alla tiders kartor" or "All times maps" that were shown on the Swedish Television several times.

Another thing that the Society did 2008 was to give out an anniversary book called "Kartan i våra hjärtan" or "The Map in our hearts". The

editor in chief for this book was Mats Halling from the Society's Cartography section. This book has about 340 pages and in the inside of the book cover there is also a DVD with all the 11 programs from the TV-series "Alla tiders kartor". The book describes the Swedish Cartographic Society and its history, surveyors and cartographers, and the use of maps in the history, present and future. The book was distributed to all the Society's members and is on sale at the Society's website.



The Society is organised in six sections: Cartography, Historical maps, Geographical Information Systems, Photogrammetry and Remote Sensing, Geodesy and Education. Each section has responsibility for its respective disciplines and among other things the sections arrange seminars, exhibitions and study visits.

A main activity of the Society is to organize the annual conference "Kartdagarna" or the "Swedish Map days". The conference is arranged in combination with a fair that presents products and services from more than 60 companies and authorities. The conference program includes seminars within the areas of Cartography, Historical maps, Geographic Information Systems, Photogrammetry, Visualisation, Geographic Information Technology, Remote Sensing, and Geodesy. The conference also includes a map exhibition, seminars on educations, management, pricing, politics and strategies. Social arrangements are an important part of the conference. The last years there have been more than 1,000 partici-

pants at the “Map days” and more than 600 participants only visiting the fair.

Four times a year the Society publishes the cartographic journal “Kart & Bildteknik” or “Mapping and Image Science”. The aim is that one issue a year should be focussed on scientific matters. During the last years the number of members in the Society has been about the same. In 2010, the amount of paying members was about 2,100. Our members are professionals, students, retired, and individuals with a common interest for maps. About one hundred of these are members from abroad. Anyone who wants is accepted as a member of the Society. The annual fee is SEK 150, SEK 100 for retired, and SEK 50 for students.

As mentioned the Society became 100 year in 2008 and this was especially celebrated in November 13th 2008, with workshops by the day and a gala ceremony in the evening at the City Hall of Stockholm.

At the gala ceremony there were two prizes which were handed out on the occasion of the anniversary.

The first prize was “Map of the year” and it went to two companies in Sweden, Eniro (www.eniro.se) and hitta.se (www.hitta.se). These two companies help hundreds of thousands of Swedes daily through their websites to find companies, people and places. They were awarded for spreading knowledge and for making maps on the web. The way they use geographic information on the web is a model for other companies and the services are evolving continuously.

The second prize was “The Swedish Cartographic Society’s anniversary prize”. This went to Jack Dangermond, USA, founder and director of ESRI,



The prize dealer Mr William Cartwright, President of ICA, the “Anniversary prize” winner Jack Dangermond and Peter Wasström, President of the Swedish Cartographic Society. Photo Lars Palm

a world leader in geographic information systems (GIS). He received the prize “For his longstanding and significant efforts to make maps and geographic information system to tool in everyday life for researchers, businesses, governments and other organizations worldwide”.

There were in total about 200 persons who took apart on the jubilee activities.

Committee board

The committee board consists of a president, a vice president, a secretary, a treasurer, seven members, and two deputies. In 2011 the president is Peter Wasström and the secretary is Karin Grånäs. The Society and its six sections are governed by the rules of the Society. The Swedish Cartographic Society represents Sweden in the International Cartographic Association (ICA), and has participated in the General Assemblies of Delegates in Paris 1961, in London and Edinburgh 1964, in New Delhi 1968, in Montreal and Ottawa 1972, in Moscow 1976, in Tokyo 1980, in Perth 1983, in Morelia 1987, in Bournemouth 1991, in Barcelona 1995, in Ottawa 1999, in Durban 2003, in La Coruña 2005, in Moscow 2007, and in Santiago de Chile 2009.

The Society will also be represented at the 15th General Assembly in Paris, France 2011.

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The prize dealer Mr Stig Jönsson, General director of Lantmäteriet and representatives for the prize “Map of the year” winners, Jan Procopec, hitta.se, and Christer Pettersson, Eniro. Photo Lars Palm

The Historical Section

The Historical Section of the Swedish Cartographic Society consists of a board of four persons, whose main duties are to arrange a session at the annual conference “Kartdagarna” and to acquire papers to the society journal “Kart & Bildteknik”. In addition, study visits and excursions are arranged and occasionally more extensive events as courses in early mapping techniques.

Study visits have gone to such obvious sites as the National and the Military Archives and to the Royal Library map exhibition, but also to map repositories in the Royal Palace Archives, the Bernadotte Library, the Skokloster Palace and the Fire Insurance Company.

Excursions might cover such themes as the transition from rural to urban settlement in the Stockholm area in connection with the Cadastral Map project run by the Royal Swedish Academy of Letters, History and Antiquities.

Conference papers tend to be either on the history of cartography proper or on the use of “historic” maps as sources for research within quite diverse fields, from plant genetics and the history of hop cultivation to the history of river logging or minority languages. The current project on Sweden’s unique heritage of early cadastral maps is frequently being reported. Conference papers are the main source for journal contributions, but shorter notices from other sources do appear also.

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The Cartography Section

The Cartography Section of the Swedish Cartography Society consists of a board of four members, whose main duties are to arrange sessions, map exhibitions and a cartographic quiz at the technical exhibition for the annual conference “Kartdagarna”.

The section also acquires papers or proposals of papers to the society journal “Kart- och Bildteknik”. In addition, study visits are occasionally arranged.

The Swedish National Report to the ICC is taken care of by one member of the Cartographic Section and also the Cartography part of the Society website.



The Swedish contribution to the Barbara Petchenik Award in Chile 2009. Photo Margareta Elg

Members of the Cartography Section regularly attend the ICA conferences and are also responsible for the Swedish contributions to the International Map Exhibition and to the Barbara Petchenik Map Competition for children at the ICC.

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The Geodesy Section

The education of surveyors and GIS engineers has changed a lot during the last 25 years. New places of education have been established and allow increased possibilities to recruit surveyors throughout the country. The conditions of educating surveyors, geodesists and GIS engineers at the level of Master of Engineering have not

changed in the same propitious way and the result is a decreasing number of candidates. It is a very alarming and negative trend in the present situation when so much is developing in the sector. The Swedish Cartographic Society is conscious of the problem and supports efforts in trying to turn this negative trend and create a debate about it. During the last few years the Cartographic Society has altered the program at the annual conferences (Kartdagarna) to be more a kind of education opportunity instead of just a traditional conference.

For a few years now the geodetic sector of the association has focused principally on subjects related to geodetic reference system and GPS. Recently, GPS surveying has, in many cases or perhaps most cases, replaced traditional terrestrial measuring. Static surveying using GPS has become a common tool in many organisations. In Sweden there are by now several hundred users of RTK based on own reference stations or RTK based on the National Land Survey Network-RTK service, named SWEPOS. Hence, satellite based positioning with centimetre accuracy is becoming more and more common. For efficient geodetic surveying and processing of survey data many users are in need of an unambiguous and stable geodetic reference system. Then, using Network-RTK based on SWEPOS there is also a need to have access to GSM and there is still a problem in some areas of not having access to continuous signals. More often the operator (the user of the surveying tool) has the surveying tool integrated in the general working tool, e.g. the excavator or the road grader and staking out as preparation for construction is no longer necessary. Information, such as drawings, maps or other geographical or numerical information is stored digital instead and presented graphically on screen and integrated with the positioning system. Hence, the need for a surveying engineer is reduced and his duty is taken care of instead by the excavator or any other operator, in most cases without specialist surveying knowledge. Consequently, the measurements need to be done unambiguously (e.g. without any alternative solutions) and with great reliability.

The three-dimensional and globally adjusted Swedish geodetic reference system SWEREF 99 has replaced the old two dimensional RT 90 as well as local systems being used by municipalities. In addition, a new geoidal model combined with a new height system makes it possible to use GPS for reasonably accurate height measurements. This will hopefully lead to a uniform reference system for all kinds of applications in the country.

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The Geographical Information Systems Section

The Section of Geographical Information Systems works both with geographical systems and new techniques in the area. The Section consists of a board of four persons, whose main duties are to arrange sessions at the annual conference "Kartdagarna" and to acquire papers to the society journal "Kart & Bildteknik". In addition the Section has arranged regional "Map days" such as a popular one in Västerås 2008 during the Swedish Map Year.

In the future plans are to develop a mentor programme for students where the Sections aim is to help the students to get mentors from the board of Swedish Cartographic Society and from companies who works with Geographical Information Systems.

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The Educational Section

The section for educational matters in the Swedish Cartographic Society was formed in 2004. The aims of the section include

- work with educational matters on all levels, both nationally and internationally
- promote increased competence development in cartography and related fields in Sweden.

Among the recurring activities is an annual conference for lecturers and others where educational matters are discussed. The location of the venue is changing every year and recent conferences have been organized in Karlstad (2010), Stockholm (2009), Lund (2008) and Uppsala (2007). The presentations are normally published



Anders Söderman (standing) presents his paper on standardization of map symbols at the annual teachers meeting in Stockholm (2009). Listening (from right to left) Lars Harrie (Lund Univ), Claes-Göran Persson (Natl Land Survey), Anders Wellving (U. of Linköping) and Stig-Göran Mårtensson (University College Gävle). Photo Hans Hauska

on the website of the Swedish Cartographic Society (KS). The educational section also actively takes part in the annual conference of KS, the so called Map Days, which are the biggest conference of their kind in Scandinavia

Cartography has long standing traditions in Sweden. Maps are widely spread throughout the society and their use is to some extent taught already in primary school. For example, maps are used in many outdoor activities and sports, like hiking, orienteering and rally. Many of the activities have their origin or strong roots in Sweden or Scandinavia at large. However, despite the widespread use of maps, there has never been a chair in the subject at any of the Swedish universities. Cartography is taught at several Swedish universities. Brandt (2008) prepared a comprehensive article on education in cartography in Sweden in a historical perspective. It was included in a special volume commemorating the 100-year anniversary of the Swedish Cartographic Society.

In order to try to reach some common understanding regarding contents of a basic GIS course, Brandt and Arnberg (2007) undertook to define a harmonized curriculum of a course for Swedish universities. Brandt and Mårtensson (2008) published an article on Education in mapping and measurement techniques in the 1998-2007 addendum to Swedish Mapping, a publication of the Swedish Cartographic Society. In this article they discussed the recent changes that have been taking place at Swedish universities.

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The Photogrammetric and Remote Sensing Section

The Photogrammetric and Remote Sensing Section of the Swedish Cartographic Society consists of a board of four members. The main duties are to arrange sessions for the annual conference “Kartdagarna” and to acquire papers to the society journal “Kart&Bildteknik”.

The section also focuses on education and the last few years courses in photogrammetry have been held during the conference. The use of images from digital cameras has increased; hence courses have focused on photogrammetric accuracy, stereo mapping issues and understanding the radiometry aspects of digital aerial images.

Early 2008 the section and Lantmäteriet arrange a seminar about digital photogrammetry, including a technical exhibition. Vendors like DAT/EM, ERDAS/Leica, PCI, ESPA and Delta DPS had their digital photogrammetric systems on display.

The start of the production of a new national elevation model by Lantmäteriet and increased

View from an aerial photographers “office”



use of laserscanning data in Sweden resulted in education and presentations about Lidar at the 2009 and 2010 “Kartdagarna” conferences.

At the “Kartdagarna” conference 2009 a panel debate about the aerial photography and photogrammetric market in Sweden was arranged with participation from municipalities, private companies and Lantmäteriet. This took place after a request from people who order photogrammetry in Sweden, complaining about both quality of services and data from the private sector and about results from Lantmäteriet. Lately the section has been trying to involve different types of professionals to produce a new Swedish handbook of photogrammetry to enhance the possibilities for the community when ordering photogrammetric services and buying data.

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Sweden's County Administrative Boards

Organisation

Sweden is divided into 21 counties, each of which has its own County Administrative Board (“Länsstyrelsen”) and County Governor. The function of the County Administrative Boards is to be a representative of the state in their respective counties, and serve as a link between the inhabitants, the municipal authorities, the Central Government, the Swedish Parliament and the central state authorities.

GIS/GIT Activities

Maps and databases are frequently used in many of the legislative tasks, such as permits or recommendations for a proposed expansion of some exploitation request etc., in the day-to-day work carried out by officers at the County.

The County Administrative Boards are both data consumers and data producers. In the day-to-day work officers make extensive use of background data from National Land Survey, the

Geological Survey of Sweden, the Swedish Maritime Administration, Swedish Meteorological and Hydrological Institute and many other data providers.

Internally produced data from surveys, analyzes and processes, are also used in large extent.

Those data are freely distributed throughout service platform “LstGIS” (www.gis.lst.se). Some characteristics of LstGIS service platform include:

- Over 1 500 GIS-related layers uploaded and provided by each County (www.gis.lst.se/lstgis)
- Over 20 harmonized layers with national coverage (www.gis.lst.se/lstgis/lstsverige). These layers are also provided as OGC WMS WebMapServices (www.gis.lst.se/lstgis/wms.asp)
- Approx. 10 GeoServices in application fields such as Environment, Crisis Management and Oil Spill recovery Atlas. Some of these webGIS-applications are public, others are password protected.
- Metadata are provided using core components from ISO19115.

Since its introduction in 2001, LstGIS download service platform has rendered over 200,000 downloads. The site www.gis.lst.se has some 1,000 unique visitors/day. Approx. 35 % of the users are consultants, 25 % communities, 20 % other authorities, 10 % universities and 10 % private persons.

The LstGIS service platforms will in the near future be changed to conform to the demands on Network Service outlined in the INSPIRE directive and the National SDI.

Technical Development

Recent technical development includes:

- An enterprise agreement with ESRI, which includes most of the server and client software from ESRI.
- Work with a “standardized” repository for internally produced data in ESRI's ArcSDE database.
- For customisation of GeoServices, both internal and external, we use ArcGIS Server Silverlight.
- Metadata application of core components from ISO19115.
- Database development for various applications.
- Participating in the National SDI collaboration and the National Geodata Advisory Board.

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LstGIS service platform

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The Local Authorities

Organisation

The 290 local authorities in Sweden have a well-developed self-governance and are by constitution, autonomic. To perform their tasks, geographical data and maps are used in several ways. There is a considerable need for different maps in a variety of activities and operations.

The role of the local authorities in providing basic large-scale geographic data becomes more important as its usage increases in a lot of old and new applications, where GIS offers good support. There is also municipal co-operation within regions as well as between the municipalities and the state, in order to provide society with quality controlled geographic data. Most local authorities produce and update geographical databases or maps within their organisation. In most cases, the organisations responsible belong to the town planning committee. Other local authorities purchase the service from commercial companies, and some perform the task in co-operation with other local authorities.

There are 830,000 people employed in the local authorities, which is equivalent to 20 % of the total sum of the employed part of the population. 6 % of the employed in local authorities work within the technical field.

Co-operation

Most local authorities have formed a group for the most frequent internal and external users of maps and GIS data. These groups usually deal with matters of co-operation, technical development and financing. There are also regional groups with focus on mapping- and/or GIS-development.

There is an extensive co-operation between the Swedish Association of Local Authorities and Regions (SALAR) and Lantmäteriet (the Swedish mapping, cadastral and land registration authority) concerning e.g. collaboration in constructing national databases. A framework agreement on this matter was drawn up in 2001 and has been renegotiated every third year in order to include more data at higher quality in exchange for higher economic compensation. The co-operation concerns addresses, buildings, other topographic objects and cadastral index maps, among other matters. Normative agreements have also been developed that the local authorities may use as a base, while making their individual agreements with Lantmäteriet. There is a similar set of agreements with Trafikverket (the Swedish Transport Administration) concerning the road network.

Lantmäteriet has together with the Geodata Advisory Board (i.e. other Swedish public sector

authorities and SALAR) created a National Geodata Strategy to establish a national geodata infrastructure, which is, at the same time, a part of the European infrastructure and the Inspire-directive. Local authorities and SALAR have taken an active part in the co-operation for an integrated provision of information within the geodata sector. The new geodata co-operation started off on the first of January 2011.

To supply basic data for new statistics on households and dwellings, Lantmäteriet has, with help from the property owners, compiled a new dwelling register. The dwelling numbers are then entered in the population register. Since November 2010, all 290 local authorities are responsible for the continuous updating of the dwelling register.

Co-operation is becoming more and more common. In order to offer map-users harmonious and highly accurate county-covering data, the local authorities in several counties work together with harmonious geographic databases covering the cities. In some regions, Lantmäteriet fills the gaps between the urban areas. The most frequent users are the transport sector, emergency and rescue services and the police force.

Development

E-government is of increasing importance to all sorts of activities within the local authorities and the applications also increase rapidly. A national strategy for local e-government was passed in spring 2011. The issue of national specifications of requirements for common functionalities for adoption in various administrations is in focus. Also, the discussion of creating a national system for electronic identification based on federation is of immediate interest for the municipal administrations.

Development of GIS-applications as e-services is constantly in progress. Many local authorities are looking forward to being a part of the new national geodata co-operation while others seem to prefer awaiting further developments. Lantmäteriet and SALAR are conducting a cost benefit analysis for local authorities becoming members of the new geodata co-operation.

The GIS-technology is commonly used within the municipalities. Considerable efforts were made while transforming data from CAD-systems, to data suitable for the state-of-the-art GIS-systems.

Still there are difficulties in spreading GIS technology outside the mapping organisation to other administrations such as schools, social services, and health care. Hinders may consist of poor resources, non-structured datasets, or pedagogical difficulties. Many local authorities have employed a GIS controller in order to stimulate the use of GIS.

Today the GPS technology is commonly used. Aerial photography, digital aerial images, orthophotos and photogrammetric mapping are often purchased at intervals of several years. About 20 of the 290 municipalities have their own digital photogrammetric software for collecting data from aerial images. LIDAR has been adopted as the standard method for assembling data for growth areas as for studies of climate change problems. This method generates digital terrain models as well as digital surface models at a reasonable cost. Altitude data are used, for example, for three-dimensional city models and for production of orthophotos.

In order to give a high-quality picture of proposals on spatial planning and infrastructure, some local authorities, have utilised the technology of Virtual Reality and Augmented Reality. Others are on their way to transforming their data into three dimensions for the purpose of visualising the urban environment in a more natural manner. To facilitate the processes of planning and building permit, oblique aerial imaging systems have been introduced in the largest municipalities.

The SWEPOS Network RTK Service has been expanded with regional one-year-long establishment projects and it has during 2010 reached national coverage. Still under growth, the network of reference stations had in December 2010 197 stations and the service approximately 1,580 subscriptions.

The changeover to SWEREF 99 and RH 2000, which are the Swedish realizations of the European reference systems ETRS89 and EVRS, is in progress within Government authorities and the municipalities. Out of 290 municipalities, 207 have so far changed to SWEREF 99 and 41 to RH 2000 (compared to concerned government authorities and state-owned companies 43 % and 47 % have changed to SWEREF 99 and RH 2000 respectively).

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Lantmäteriet – the Swedish Mapping, Cadastral and Land registration Authority

Lantmäteriet, originating from 1628, is a Government agency. The mission is to give support for creating an efficient and sustainable use of Sweden's real property, land and water. The organisation has three main activities, which also form the organisational structure: Cadastral services, Land and Geographic information services and Land registration. Support for these activities is provided by Corporate functions.

Up to now Lantmäteriet also has provided complimentary services on a commercial basis. These services have been carried out within a separate division called Metria (*metria* means measurement in the Latin language). According to a parliamentary decision Metria is organised as a separate state owned company from 1 April 2011.

Cadastral Services

The Cadastral authorities carry out cadastral-procedure activities, deal with regional coordination of geographic and property information, and provide different types of services, which are closely linked to their official duties. The cadastral services comprise real property formation through formal cadastral survey and maintenance of the real property register. Common tasks are sub-division of land into plots for building houses and recreational homes and reallocation to ensure the availability of land for building roads, railways and public utilities.

On the central level the division of Cadastral services has the responsibility for the supervision of, and to give support to, the regional Cadastral authorities. The most important task is to support the real estate formation process. That include law amendment, quality control, competence development, and development of techniques and methods in order to shortening the handling of cases and reduce the costs.

Land and Geographic Information Services

Land and Geographic Information Services include the analysis and establishment of demands and needs of geographic and real property information in society. It also includes the efficient collection, storage and administration of such information. The collection is carried out by Lantmäteriet itself or in co-operation with other public agencies or organisations in society. An important task is to make the information available and used by a broad spectrum of users thereby contributing to efficiency, improvement and renewal in the public as well as in the private sector. Dis-

semination of information is carried out directly as well as through resellers.

Land and Geographic Information Services are responsible for all kinds of basic information. Operations are subdivided into information areas for Topography, Geodesy, Real Property Information and Image services. The operations also include dissemination activities and co-operation, advisory services and support to other producers and users of information in society.

Lantmäteriet's role as co-ordinator of the Swedish spatial data infrastructure (SDI) has gradually been strengthened. These activities are described more in detail later on in this report.

Land registration

Lantmäteriet became the national registration authority for real property information on 1 June 2008. Land registration and related activities, such as the handling of stamp duty and fees are the responsibility of the Land Registration Division.

The division is responsible for checking registration transactions with regard to ownership, mortgages and other rights and charges and registering them in the Land Register section of the Real Property Register. The division also handles the collection of stamp duty and fees for these transactions. The major part of our activities is carried out in seven local offices each of which is responsible for handling registration transactions within its geographically defined area. The main office in Gävle is responsible for leading and coordinating registration activities.

The division has a staff of approximately 200 made up of central management and personnel at the seven local offices.

Corporate Functions

A Staff unit and Corporate services

The Director General's Staff unit works with strategic issues and long term planning. The unit consists of functions for strategic planning, finance and control, human resources, coordination of research and development, IT strategy, international relations and legal matters. The unit has in total 15 staff members, including the Director General and his assistant.

The Corporate services, working with more operational issues, consist of six units: Internal and external information, Process support, Economy and personnel, IT-System development, IT-Technical development and operation, and Coordination of international projects. The Corporate services have in total some 250 staff members.

Swedesurvey

Swedesurvey, is an independent company that markets, co-ordinates and provides services in land administration and surveying throughout the world, often in the form of institutional cooperation.

Swedesurvey has been active on the international market since 1980 and has always aimed to provide high quality services based on the requirements of the customer. Swedesurvey's status as a Government company guarantees impartiality, reliability, quality-consciousness and continuity.

Metria

Metria is – when this report is written – a separate division within Lantmäteriet with resources for collection and customization of geographical and real property information, surveying computation, map production, geographic information systems and physical planning. The services are carried out on contract and Metria operates in competition with other Swedish and international companies on the national market.

Based on proposals from a state review, which was fully supported by Lantmäteriet, Government proposed that Metria should be moved from Lantmäteriet and be organised as a separate state owned company. This company may later on be privatised. Parliament approved this proposal and the date for the change was set to 1 April 2011. All parts of the existing division Metria except for a unit called GeoSE, which is totally devoted to give services to the Swedish Defence, has been moved to the new company.

Already a couple of years ago the former part of Metria called KartCentrum, which was responsible for the publication of the national map series and other map products as well as a comprehensive cartographic production on a contract basis, was sold to a private publishing house called Norstedts. When this report is written Lantmäteriet is carrying out a public procurement for the printing and publishing of the national map series for the coming years.

The Swedish SDI

The Swedish SDI concept has been gradually developed since 1970's. The Land Data Bank System can be regarded as a forerunner. The system linked cadastral information from different state agencies and the municipalities and made the information easily available.

Today the Swedish SDI is based on a number of activities being described in a strategy document. The strategy describes a clear vision for the future, but also concrete and measurable targets for the short term actions. These action areas are:

- Development of efficient models for cooperation and coordination
- Development of models for structuring of geodata, i.e. to work out data specifications which fulfil a wide range of requirements
- Development of the technical infrastructure with a well-functioning Geodata portal and meta-data system
- Establishment of one single geodetic reference system for the entire country
- Stimulating of research, development and education within this field
- Simplification and modernisation of the legal framework having an impact on the handling and use of geodata
- Working out financing and pricing models that stimulates a wide use of existing geodata.

SDI Advisory Board

The Swedish Government has appointed twelve persons to form a high level SDI Advisory Board. They represent both producers and users of geodata.

Lantmäteriet has also been given a clear role as coordinator of the Swedish SDI, including being the national contact point for the Inspire Directive.

All partners having signed an agreement on co-operation and will be represented in annual meetings where strategic issues are decided.

Standardisation

In Sweden a standardisation programme for geodata has been running within the Swedish Standards Institute since more than 20 years. Via this programme Sweden has been active in the international standardisation work. The stakeholders have also developed a generic framework for carrying out standardisation, which has been used to produce standards for many data themes, such as transport networks, hydrologic networks, utility networks, addresses and buildings.

Geodata portal

A Geodata portal has been set up. The portal works as a clearinghouse for getting access to a large number of datasets being stored and maintained by the responsible organisation for each data theme.

The portal makes it easy to search for, look at and download geodata. It will also support the users when it is needed to transfer data between different coordinate systems or different data models.

The latest version, which was launched in January 2011, is based on open source software. The development work has been carried out in close cooperation with colleagues from Denmark, Norway, Finland and the Netherlands.

The Geodata portal is accessible via www.geo-data.se.

Agreement on co-operation

An important part of the development and implementation of the Swedish SDI has been to create a new model for co-operation between different organisations. The aim is to simplify cooperation between organisations being responsible for provision of geodata, facilitate for all kind of organisations to make use of existing geodata, and to contribute to the creation of new business opportunities within the geodata sector.

From a user perspective, the provision of geodata should be handled as far as possible harmonised and automatic. It must be easy to find the data, to understand the conditions for use and to get access to data on-line.

The new model consists of the following parts:

- Description of management, co-ordination and maintenance of the SDI
- Technical pre-requisites for participation, such as description of which standards should be followed when publishing metadata and network services
- A product catalogue containing information about all available data resources
- Conditions for use, i.e. licensing agreements for different kinds of use, such as for official purposes, for commercial use, for development work or for non-commercial use
- Economic conditions for participation in a data sharing model, which gives access to all available geodata for official use for one fixed fee per year. This licence fee is decided in advance and based on a number of fixed parameters.

Changes in how Land and Geographic Information Services are provided

Challenges

Rapid cost expansion, Inspire requirements, the needs of the upcoming e-government and what is known as the ubiquitous future, bring out an urgent need for renewal of IT-systems used by Lantmäteriet to store and disseminate geodata. Today the number of database solutions is large. Complexity is high. Systems are aging (although still working fine), and important businesses depend on them.

Vision

What Lantmäteriet needs most of all is a good and reliable analysis of the future that can foresee developments for a longer period. The Swedish SDI strategy, as described above, constitutes a vision and a plan for development of the national SDI. It is footed in the GI community and

it aligns to ongoing discussions on European public service delivery, as presented in the Commission's Communication on a European Interoperability Strategy (EIS).

Both the Inspire directive and the EIS aim at enhanced interoperability at legal, organisational, semantic and technical levels. This should progressively provide requirements for delivery of public services, built on cross-border interactions between public administrations and businesses. Such services may be the result of aggregating 'basic public services' provided at various levels of government. Lantmäteriet has within the Swedish administration, due to experiences from participating in the development of the European SDI, become one of the leading advocates for such ideas.

Re-engineering

When developing and renewing business processes and IT within Lantmäteriet the above ideas are guiding. Lantmäteriet tackles the task in two ways. One way is to provide public services, such as those demanded in Inspire, based on today's data sources and data structures. The newly published service "Topografiska webbkartan" is a result of that strategy. The other way, which is the main strategy, is to re-engineer. Lantmäteriet is moving towards unified workflow processes and unified technique for collection, storage, administration and dissemination of geodata. The key to success will be development and broad adoption of commonly agreed data specifications as a base for a broad selection of national and European public services. We look forward to an awkward and expensive procedure that will take long to complete. A pilot development for information on addresses, buildings and dwellings has recently been released.

Geodetic Infrastructure

Lantmäteriet provides both networks consisting of control points in the terrain and a network of permanent reference stations for GNSS positioning.

SWEREF 99, which is connected to the global ITRF, is the national reference frame for three

dimensional positioning in Sweden. A national height system, RH 2000, based on a nationwide levelling program, is available for accurate heighting. For the transformation of heights obtained from GNSS-measurements to levelled heights the geoid model SWEN08_RH2000 has been developed. Lantmäteriet recommends local authorities and others providers of local control networks to use the national reference frames.

SWEPOS™ is the Swedish network of permanent GNSS stations, providing real-time services on both metre level (DGPS/DGNSS) and centimetre level (Network-RTK), as well as data for post-processing. An automatic post-processing service is also available. SWEPOS has nationwide coverage and consists in December 2010 of about 200 stations with inter-station distances of about 70 km. SWEPOS Network-RTK-service has almost 2,000 users. Applications for SWEPOS services are eg. detail measurements, setting out, machine guidance.

The SWEPOS users want higher accuracy in height and therefore the SWEPOS network will be densified with another 200 stations during the time period 2011–2015.

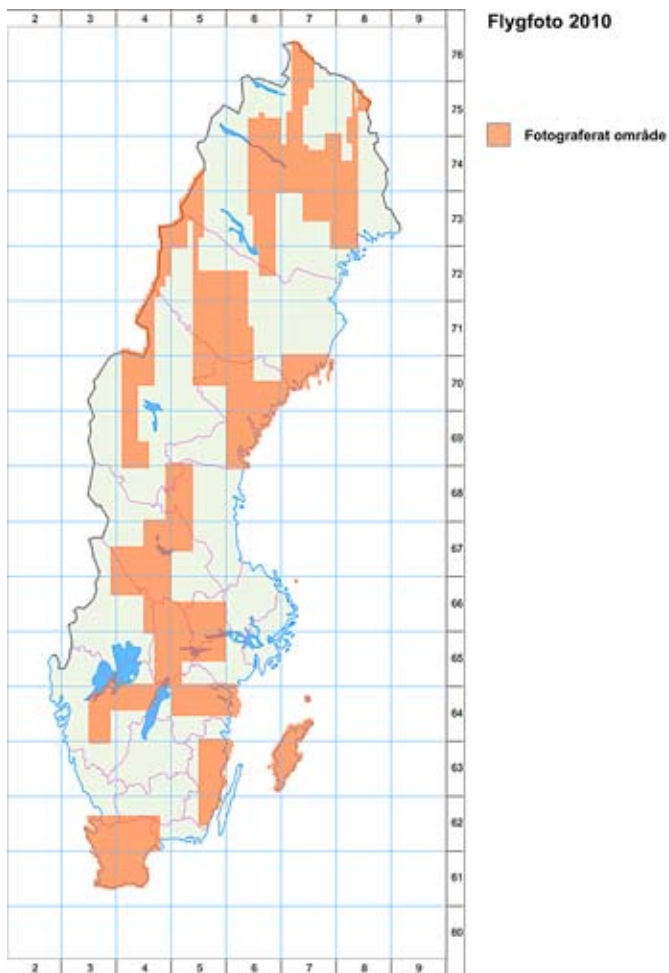
Aerial Photography and the Production of Orthophotos

Aerial photography is mainly carried out in order to meet the needs for aerial photos and orthophotos within the national mapping program, but at the same time the activities are planned with the goal to provide other users (municipalities, forestry companies, etc.) with appropriate information.

New aerial photos cover approximately 30 per cent of Sweden every year. Two Intergraph DMC digital sensors are used. The sensors simultaneously photograph black/white, true colour and infrared data sets. They are furthermore the first step in a complete digital production line in the mapping process, ending in digital archives and in further dissemination.

The aerial photography season starts in April and ends in September. It takes approximately 3 months from the flight to ready processed orthophotos, both in colour and false colour infrared,

Result from aerial photography by Lantmäteriet				
År	Photographed 5x5 km² areas	Percentage	Area (km²)	Photographed cities
2008	5 140	27	128 500	27
2009	6 072	32	151 800	14
2010	6 851	37	171 000	47



Coverage of the Lantmäteriets aerial photography, produced in 2010.

to be provided to users. Today there is a national coverage of digital orthophotos with 0,5 m resolution. In 130 larger cities the resolution is 0,25 metres. The amount of storage of aerial photos and orthophotos has reached 200 Tb and every year it increases with approximately 35 Tb.

2010 was the best season ever for aerial photography in Lantmäteriet, 171,000 km² or 37 % of the country was photographed with 0,5 meter resolution and 47 cities with 0,25 meter resolution.

Success, Satellite imagery database

The database of satellite imagery was released to the general public in mid-2008. The contents of the database are national coverages from mainly Landsat and SPOT from the 1970s, 1980s, turn of the century, 2005 and yearly from 2007. The available data are either as satellite scenes or as mosaics in true colours or in IR-colours. Thanks to a unique cooperation between a number of governmental agencies and some private companies the data are available to the general public and non-commercial organisations, including education and research, free of charge.

Web mapping

Today maps are consumed by the users mainly in digital form via laptops, smart phones, tablets

and other kinds of handheld devices. The rapid development of SDI solutions – with INSPIRE as an important driving force – implies a lot of benefits, such as reduction of costs for data collection and maintenance and improved access to data. These developments have led to a number of challenges for the users as well as for the producers of maps.

Designing maps for the web means making compromises. Good cartography for web maps is about what you show, how you show it and how fast. No matter how up-to-date, and correct your data is, such distraction as slow performance, inhomogeneous or cluttered symbolisation will turn off a demanding public. There are significant trade offs to be made in performance, harmonised content, cartography and functionality.

To meet these new requirements Lantmäteriet has developed a new map, a Topographic web map. The Topographic web map is a new dynamic map of Sweden adapted for screen presentation. It is possible to zoom to all scales up to an overview map of Sweden and the surrounding countries and the cartography has been selected to harmonize with all scales. The map shows a selection of the contents in most of Lantmäteriet's fundamental geographic databases and it also contains a separate layer with property information.

It is available as a WMS service and the public can access the map via the Swedish Geodata Portal, www.geodata.se.

National Map Series

Lantmäteriet is responsible for the national mapping at scales of 1:10,000 and smaller. Besides, Lantmäteriet is responsible for production of property maps and cadastral index maps at large scales. The national map series are:

The Property Map (Fastighetskartan)

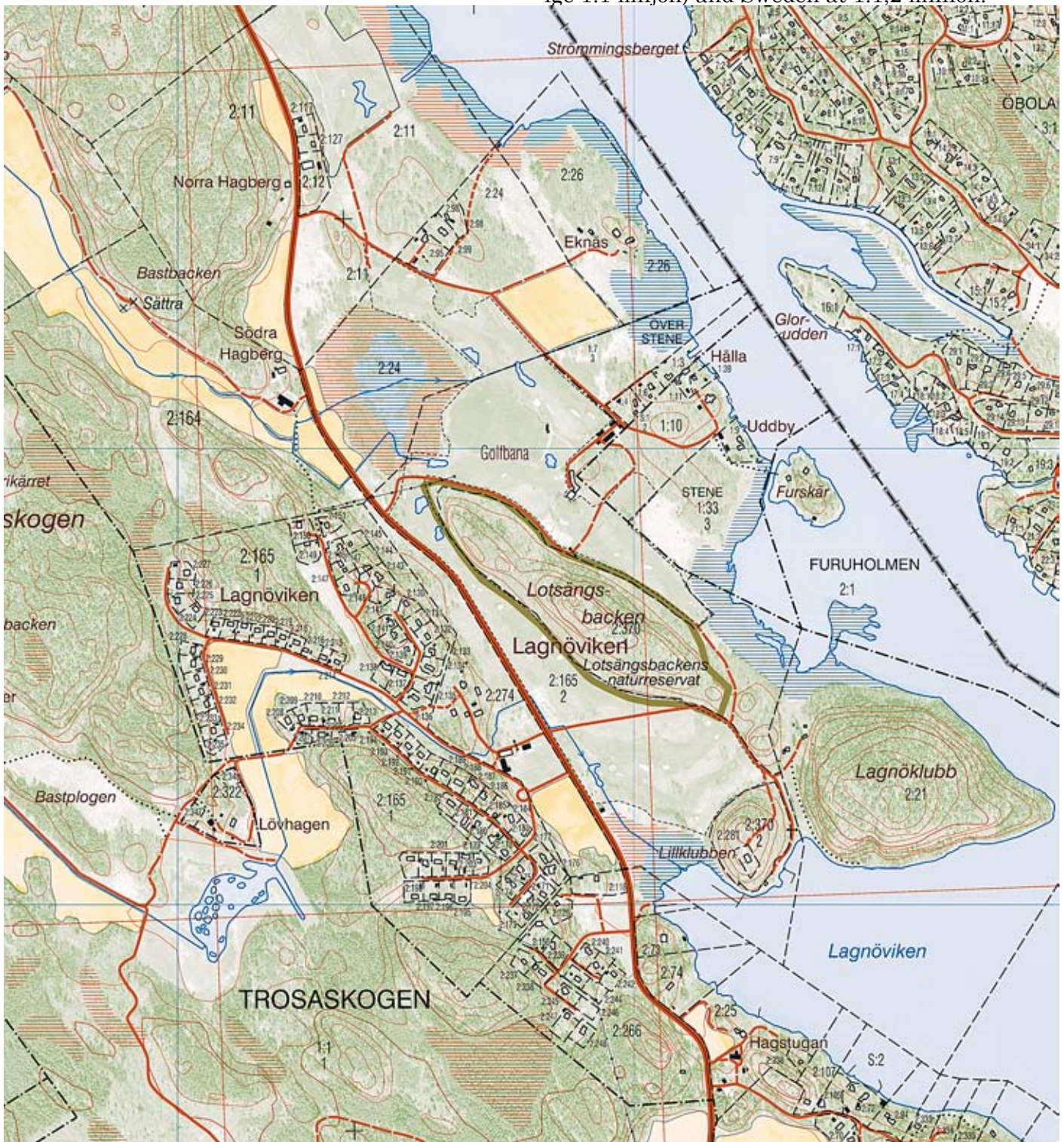
is produced in the scale of 1:12,500 and is delivered as a print-on-demand product in order to give the customer the most updated information that exists. The map includes:

- The orthophoto
- Boundaries, including property boundaries
- Names and register numbers of property units
- Place names
- Line enhanced planimetric details
- Arable land
- Contours at a 5 m interval

The Topographic Map (Terrängkartan)

series consists of 244 sheets at 1:50,000. It covers the entire country except for some parts in the mountain areas in the northwest of Sweden. The Topographic map gives detailed information

1:1 million) and Sweden at 1:1,2 million.



Fastighetskartan, the Property Map in scale 1:12 500

about land use, settlements and about all kinds of roads and footpaths.

The Road Map (Väghkartan)

This series has been designed to be used as a detailed and up-to-date national road map. The map series consists of 79 sheets in the scale of 1:100,000.

The Mountain Area Map (Fjällkartan)

This series is the topographic map at 1:100,000 for the mountain areas of Sweden. The maps have been adapted to cater for mountain hikers. Special in-

formation, for example about trails and shelters, is printed in purple. Some sheets in the southern part of the mountain areas are produced in the scale of 1: 50,000.

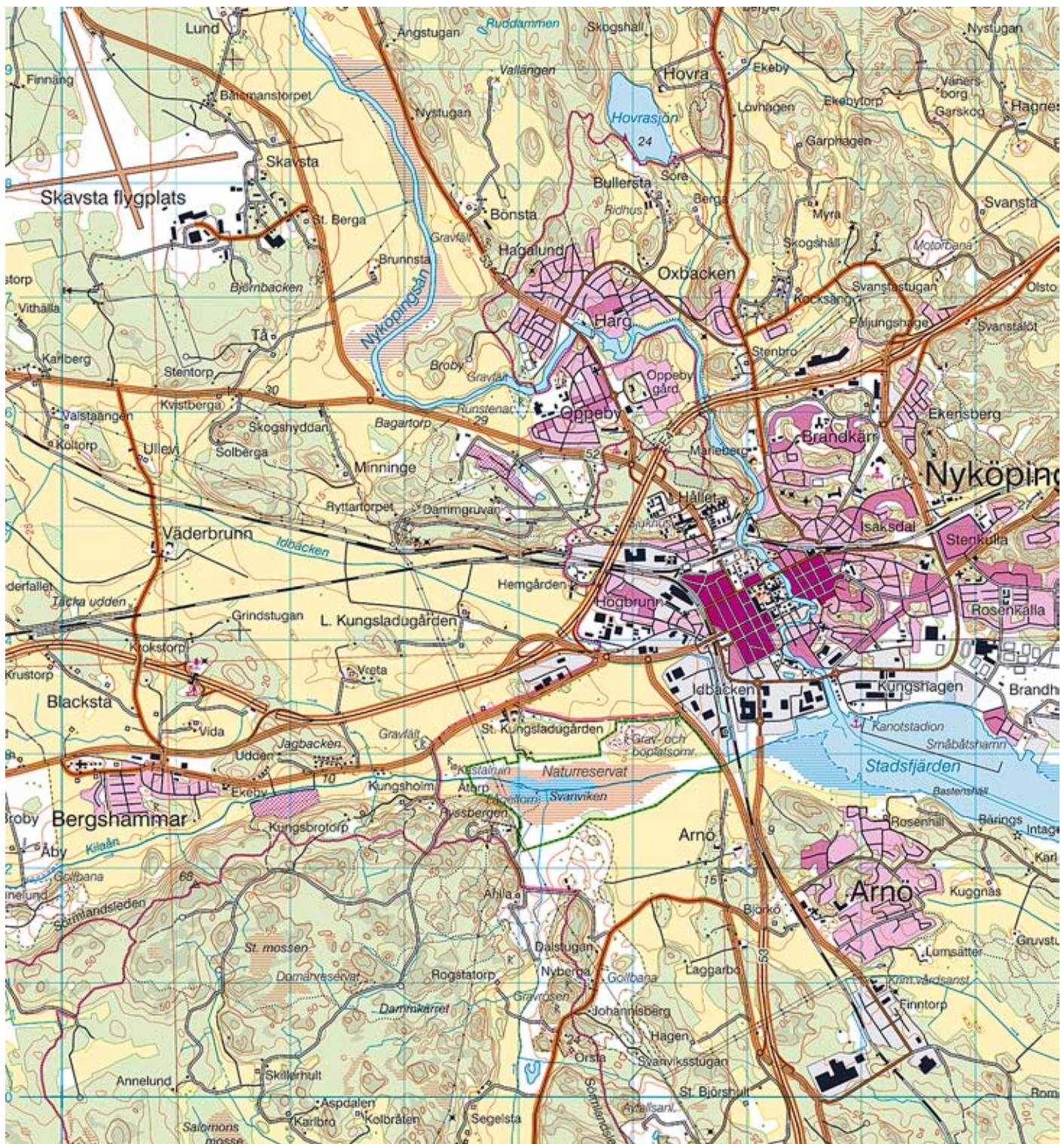
The General Map (Översiktskartan)

This consists of 21 map sheets in the scale of 1:250,000.

Small Scale Maps

produced at smaller scales include:

The latest version of Sweden at 1:1 million (Sver-



Terrängkartan, the Topographic Map in scale 1:50 000

A new National Military Map series

Between 2008 and 2010 Lantmäteriet has produced a new National Military Map series (NMK) for the Swedish Armed Forces. The map series covers all of Sweden and consists of 283 map sheets in total. The cartography in the NMK-maps is based on the Topographic Map (1:50,000) and the Road Map and the Mountain Area Map (1:100,000). The map layout is based on international military standards (STANAG).

GIS Activities – Geographic Data Sweden

In Sweden there is a large, and increasing, de-

mand 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 (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.



One map sheet from the new Military Map Series in use.



A sheet from the new National Military Map series, in action

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.

New National Elevation Model

Based on a recommendation made by the Climate and Vulnerability Commission in their report, the Government has commissioned Lantmäteriet to produce a New National Elevation Model (Ny Nationell Höjdmodell) with high and known accuracy.

Since 2009, Lantmäteriet is carrying out airborne laser scanning (LiDAR) in accordance with a plan embracing the requirements connected to climate change and other environmental issues. The aim is to produce a new Digital Elevation Model (DEM) in which the standard error is better than 0,5 m for grid points in a 2 metre grid. A hill shading picture of the test area demonstrates the accuracy of the new elevation model in an illustrative way. The image will show overall elevation and also it is easy to detect small details in the terrain. For example, it is possible to identify small ditches in the fields and even paths in the terrain covered by forest. The plan of the project is as follows:

- Production planning – Ongoing during the duration of the project
- Start of production – July 2009
- Production time – 7 years, of which the first 4 years will focus on laser scanning.
- Elevation available to customers – Approx. 6 months after the scanning of the current area.

During the first 3–4 years of the project, the focus will be collection of data (scanning). This means that, during this time, new elevation data will be available for almost all of Sweden in the form of geo-referenced and auto-classified laser point clouds. A 2 metre grid, calculated from laser points classified as ground points, will also be produced. Generally, these products will be available to end users approximately 6 months after scanning the current area. Edited products will be produced in accordance with user demands during the latter part of the project.

The scanning work is planned so that south of Sweden will be done during non-growing season, i.e. when deciduous trees do not have leaves and crops are short or absent, while north of Sweden may be scanned during any season. In practice, this means that south of Sweden will be scanned during early spring and late autumn, while north of Sweden will be scanned during summer.

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-Väggkartan)

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-Översigtskartan)

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.

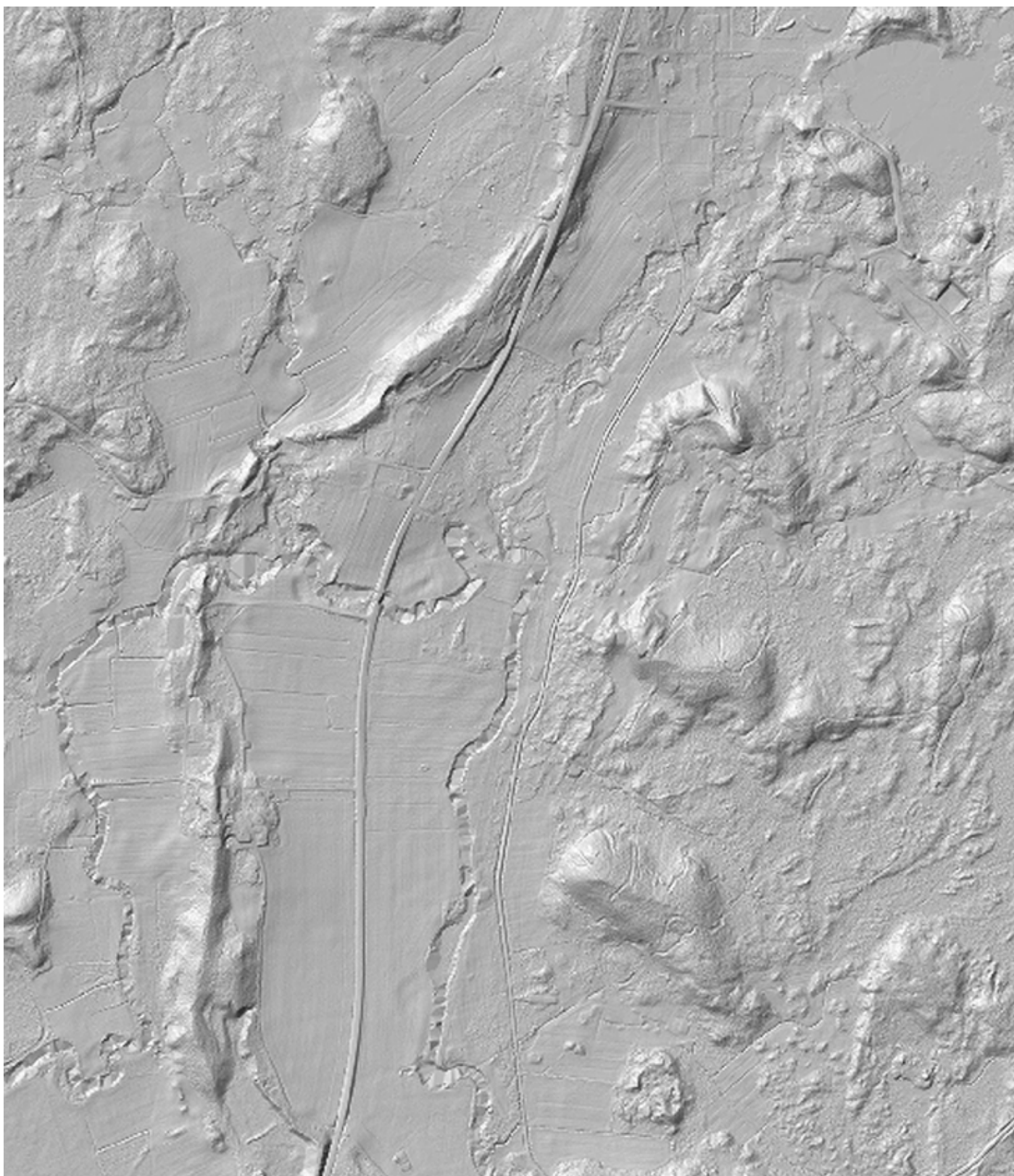
The Swedish CORINE Land Cover

is build from GSD-Marktäckedata. It meets the European CLC specifications and includes 44 classes. The last partial updating was in 2010.

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.



A part from the new Swedish National Elevation Model

Historical Maps

All property changes take place via a cadastral process. The results of any property changes are mapped and/or documented and archived for future reference in a cadastral file. All the original files belonging to cadastral processes since the middle of the 1700's have been stored at the county office.

The cadastral file includes all historical and current information describing a property's charac-

teristics and corresponding cadastral procedures. All rights which have been granted and decisions which have been made regarding new plans and alterations can be found in these dossiers.

Because of the abrasion of the dossiers in the archives, Lantmäteriet decided to digitise them. A project started in 2000 and with help from Media Conversion Center in Fränsta about 70 million documents were digitised under a period of nine years.

Lantmäteriet's archives contain maps and documents dating from 1630 and onwards: more than 2.5 million dossiers from cadastral procedures. These documents have been digitised and made accessible via the Internet. The Historical Maps website is a presentation of large parts of Lantmäteriet's unique and invaluable collection of historical maps and cadastral dossiers. The collection comprises more than a million maps from all parts of Sweden and these are freely accessible for the period prior to 1928.

The archives contain not only Lantmäteriet's own dossiers, they also include decisions made by municipal authorities and county boards.

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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 Administration (SMA, Sjöfartsverket). The Swedish Hydrographic Office (SHO) is responsible for the official Hydrographic Service including surveying in Swedish waters. The SHO prepares and issues official nautical charts and nautical publications including Notices to mariners. The SMA head office is located in Norrköping including the SHO. SHO staff consists of 113 employees. The Swedish Maritime Administration shall, according to its instruction, provide resources for high safety at sea and good accessibility. The major part of SMA's activities are financed through dues on ships and cargoes.

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 co-

operate on standardisation, development of exchange format and distribution system in all matters related to Hydrographic surveying, printed and electronic nautical charts and other things related to Hydrographic Service in both global and regional aspects. There are also regional Commissions such as the Baltic Sea Hydrographic Commission (BSHC) which is very active in international work and analyses. 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 information in the form of nautical charts and nautical publications in both traditional form such as printed charts, books and notices to mariners as well as in digital form for navigation in digital data systems in combination with satellite positioning systems (GPS). Co-operation with the Land Survey (Lantmäteriet) is extensive, one important example being the compilation of a common coastline and another a web-shop providing "print on demand" service for digital cartographic products.

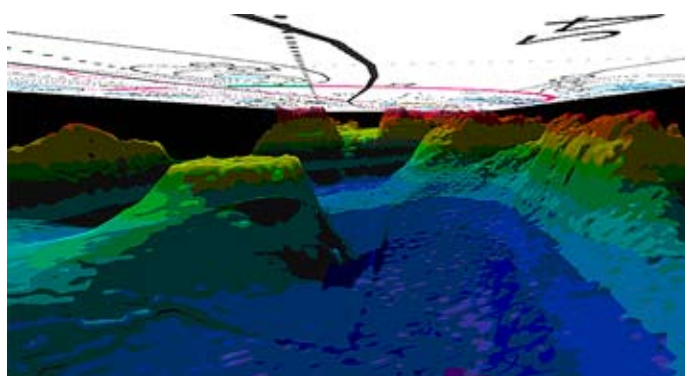
Hydrographic Surveying

Swedish waters cover an area of 165,000 km², mostly in the Baltic Sea and comparatively shallow, with 2,700 km of coastline. Archipelagoes are widespread and are a challenge to seafarers and especially challenging to surveyors. The Swedish Hydrographic Office together with those of affected neighbouring countries has introduced recommended deep water routes as an aid to shipping. However, winter ice in the north of The Gulf of Bothnia affects the routes usable by shipping. Altogether this means that these relatively shallow waters must be meticulously surveyed.

Ten years ago Sweden began implementing the IHO:s Standard for Hydrographic Surveying (S-44). This means that new surveyed areas are completely covered with soundings and that shallow areas where the margin between vessel and bottom (dynamic clearance) can be very small are controlled to a greater accuracy by an advanced method of mechanical detection.

Since 1995 the main method of surveying has been multi beam echo sounding which gives a wide, complete and accurate picture of the sea bed. Developments to this method have meant that footprints are smaller and more numerous giving improved resolution and a higher probability of detecting small objects. Improvements in positioning (RTK as an alternative to tidal measurements), acoustics, movement sensors, analysis etc. have resulted in an increase in the reliability, accuracy and amount of data produced. Reliable data directly at the acquisition stage means increased efficiency onboard and by follow up analysis swaths can be compared. Improved analysis methods applied directly onboard mean that anomalies can be identified and eliminated whilst the ship is still in the operation area.

The SHO has three vessels at its disposal with a staff of twenty surveyors which is sufficient to crew two vessels continuously.



A relatively new technical aid to shipping is AIS (Automatic Identification System) which is mandatory on all vessels of more than 300 tons. AIS has quickly shown its usefulness onboard as it can continuously display the position, heading and speed of other vessels directly on the electronic chart system. Each AIS unit sends a standardised message containing details of the host vessel which can be read by all vessels within the line of sight. AIS makes possible the supervision and recording of a vessels route which can then be used for risk analysis. AIS, together with the results of risk analyses, have therefore quickly become an important tool in the long term planning of hydrographic surveys.

The survey plan constitutes the basis for the requirement needs for survey resources and op-

erations. Advanced GPS, so called RTK and Network RTK, has been used for several years in hydrographic surveying and is now being tested and also used for other maritime uses. Constant real time monitoring of a vessels draught in particularly shallow fairways is an important safety and efficiency promoting possibility where we believe Network-RTK can be used. This method can even be used in preventive measures by increasing the knowledge of the dynamic characteristics of a vessel. The draught of a vessel is strongly influenced by its speed and the under-keel depth. Local shallows may need to be compensated for by a reduction in speed to avoid grounding.

Cartographic Activities

Nautical Charts

Nautical charts covering Swedish and adjacent waters are produced by the SHO, i.e. Skagerrak, Kattegat, the Baltic Sea and the Gulf of Bothnia. Canal charts exist for the three largest Swedish canals and consist of a nautical chart booklet and a section of text. The charts are divided and designated according to their scales and areas of use. Users are urged to navigate using charts of the largest possible scale as essential navigational information may have been omitted in the smaller scale chart depending on the purpose of the chart. Printed nautical charts are designated as follows:

General charts.

Scale range 1:500,000–1:1,500,000. The scale is usually 1:500,000. The charts are used for planning and navigation in open seas.

Coastal charts.

The scale is usually 1:180,000–1:250,000. The charts are used for navigation in coastal waters.

Archipelago charts.

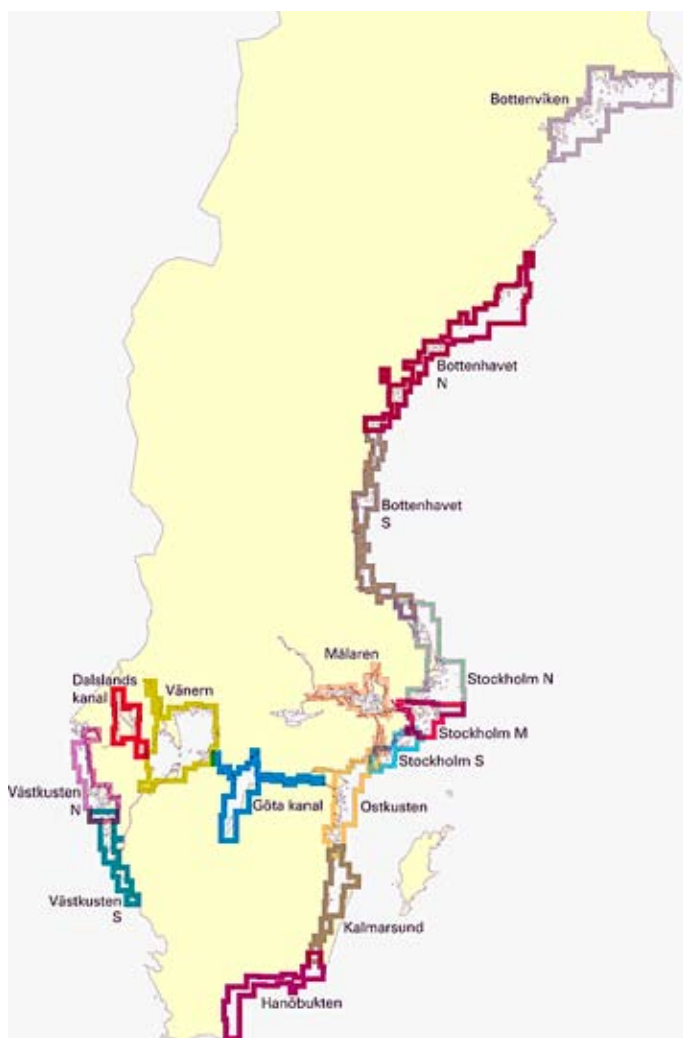
The scale is usually 1:50,000. The charts are used for inshore- and coastal navigation. The information on 1:50,000 charts is reduced where there are 1:25,000 charts.

Special charts.

The scale is usually 1: 25,000. The charts cover areas of heavy traffic, widespread archipelagos, certain harbours and approaches.

Small craft charts.

SHO also supply charts in a smaller format. Each edition contains 36-66 pages in size A3 and are attached with a spiral-binder and printed on a water-proof paper (Pretex). The contents are the same as in ordinary charts with additional information about marinas.



The Swedish Small craft charts

The Swedish Small craft charts

The digital and vector based Electronic Navigational Chart (ENC) normally used in the Electronic Chart and Display Information System (ECDIS) on board a ship connects the data as a continuous chart to be shown on a display. The ENC's are produced in defined cells in usage bands similar to the scale areas described above. The use of digital charts as an alternative to paper charts is regulated according to international rules stipulated by the International Maritime Organisation (IMO). In order to use ENC instead of paper charts the system must fulfil the requirements specified in "IMO Performance Standards for ECDIS". Swedish waters are completely covered by ENC and their use is steadily increasing. ENC is also available in most of the neighboring waters which increase the benefit for the users. Official ENC's produced by the Swedish Maritime Administration are distributed via Primar, which is a part of the Norwegian Hydrographic Service with head office in Stavanger, Norway. Primar stores ENC's from a number of national sea chart authorities and serves as a centre for ENC-distribution to the shipping sector.

The nautical chart of today is a comprehensive and complex document showing a detailed shore-line, detailed information on depths, even in shallow areas, an exhaustive Hydrographic map, characteristic landmarks, fixed and floating navigational aids etc. In addition a navigator is naturally provided with necessary navigational, traffic and port information, compass charts with deviations, chart limits etc. The geographical grid is WGS 84, the same as used in GPS. A navigator needs as much information as possible but at the same time not be cluttered with misleading information of no use for navigation. The information in the chart needs to be reliable since the navigator at the bridge has to rely on the depth information in the charts, as he cannot see under the sea surface. Therefore the production of nautical charts is a comprehensive and time consuming process in which a large amount of information from authorities, old nautical charts, large scale topographical maps, orthophotos, hydrographic survey results etc. must be compiled. During the previous decade much effort has been put into the digitising of existing charts, slightly more than 100, to produce a digital data base from which traditional paper charts and ENC for navigation as well as other digital and printed products are made today. However the use of old charts will mean some problems, as they are old in geometry, older positioning of shoals and other obstacles etc. Over the past few years a thematic review of the database has been in progress and a concentrated effort is being put into improving the information describing Sweden's long coastline together with the extensive archipelago with all its islets and shoals. Due to the constant rising of the land mass the northern charts need updating every 25 years or so. Improvement in positioning of nautical objects such as lighthouses and buoys also contributes to the improvement of database quality and of course new surveys are needed to ensure the quality of information in shallow areas. The average depth of the Baltic is forty meters and maritime traffic is extensive and increasing. Vessels are becoming larger and the archipelagos are cramped. The Baltic has been protected for a number of years now by being classified as a Particularly Sensitive Sea Area (PSSA) by the UN's Maritime Organization, IMO and there is a growing demand for chart and depth data for environmental purposes.

New editions of up-dated paper charts must be produced at least once a year and it is essential for all nautical charts that they be continuously maintained and up-dated. For the navigator it is done manually in the paper charts according to the weekly publication Notices to Mariners. Digital chart information for use on commercial ships

in ECDIS is available to the users through a co-operative work between several nations together with Primar. The SHO and other HOs 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 a CD directly into the navigators, on daily or 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 describe that which usually cannot be presented 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 in the form of small notices of warnings or of updates for printed charts together with other information essential for safe navigation in Swedish waters. The publication is also available on the internet (www.sjofartsverket.se).
- Notices to Mariners volume A (Swe: Ufs A) is a compilation of general information of nautical interest.
- Kort 1/ INT 1 contains symbols, abbreviations and terms used on Swedish and international charts.
- 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) is the central government agency responsible for questions relating to soil, bedrock and groundwater in Sweden.

SGU is organised to meet society's need for geological information. Our five departments reflect the broadness of SGU's expertise—we have an

economic-political as well as an environmental-political task from the government.

The SGU head office is located in Uppsala. We also have branch offices in Göteborg, Lund, Malå and Stockholm. The offices of the Mining Inspectorate are located in Luleå and Falun.

From maps to apps

In recent years we have seen map production undergo the transformation from hardcopy maps to web services. In the near future we are looking into new platforms such as the Android mobile market.

At the beginning of 2008 the Map Generator was launched. Since then an enormous increase in interest in acquiring geological maps has been apparent. The Map Generator offers a selection of SGU's database content and the maps are automatically generated, with legends and short descriptive texts. The Map Generator creates pdf maps showing Sweden's geology and can be downloaded. Some of the maps in the Map Generator are less detailed than our printed maps. We continually work to improve the technology and the underlying databases to deliver higher quality seamless maps. In addition, more of our geological themes will subsequently be added to the Map Generator.

Other map services from SGU include about 20 map-viewers designed to offer easy access to some of the information available in our databases. Many of these services also provide an overview of additional information that can be ordered from us. Continuous efforts to improve the visualisation are being undertaken.

The trend is that fewer maps are being produced as hardcopies. There has been an increase in maps available as pdf and in 2010 these became available for downloading directly from SGU's website.

National and international cooperation

During 2010 SGU joined geodata.se, the national infrastructure for geodata. This portal for web based geodata and services is based on INSPIRE, the EU Directive on harmonising crucial data. SGU is one of the main data providers to the portal with at present around 60 web services or datasets available. SGU has also been taking part in the work of harmonising datasets and visualisation prior to the launch of the innovative new web portal about geology in Europe—One-geology Europe.

Objectives, opportunities and obstacles

We aim to maximize usage by providing society with relevant geological information in the way users want it. Information must be easy to access

and be provided in the most suitable way for that user.

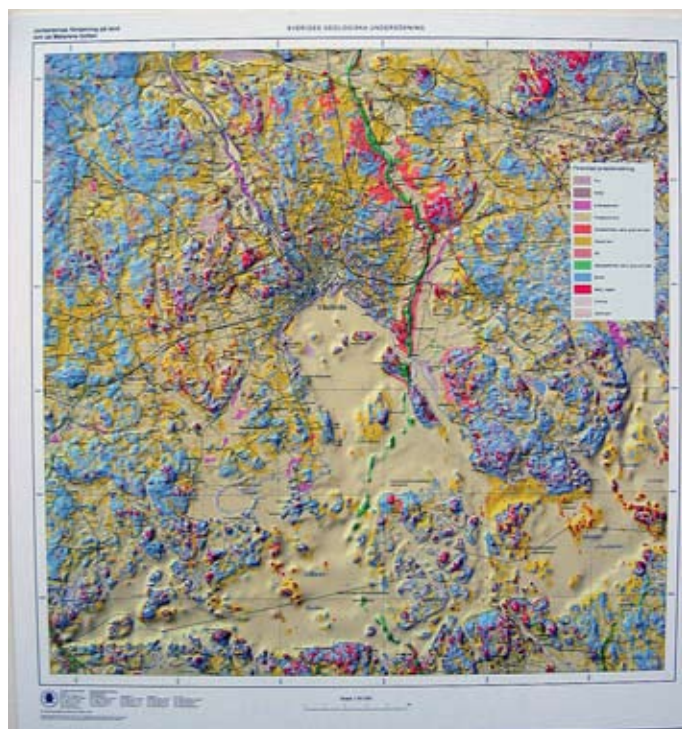
One aim is to present complex geology in an easily-understandable format for non-geologists during which a lot of new types of user-influenced maps have been generated. A goal for the forthcoming years is to produce more of these maps, automatically generated, by combining different databases and simplifying them. Examples are landslide pre-requisite, soil vulnerability to infiltration and other hazard themes as well as map services for geotourism.

Web-viewers and services provide great possibilities to present information at different scales. An overview of the information can be shown at zoomed out level. When the user zooms in he/she can see more detailed and extra information about the geology. This activity not only provides the information but also stimulates a totally different way of thinking about how and what can be exploited. The way of collecting geological information has, of course, changed in 150 years but the way of presenting it has been quite similar during that time period. A hardcopy map is a specific geological theme presented at a fixed scale. Suddenly we are faced with the opportunity of new ways of presenting the information. Themes and parts of themes can vary with scale. Databases contains information from data collected during the whole existence of SGU, 21st century meets 19th century.

Symbolisations create a great deal of problems in converting to new production methods and new media. We have faced the fact that we need to simplify the information in databases in zoomed out view. The databases are still just showing geology in one fixed scale or a fixed scale range. How do we, more or less automatically, simplify a detailed database designed for 1:50, 000 so as to be visible also in the scale of 1:3,000,000 whilst still providing the correct information?

Cartography also causes problems in the migration into new media. Geological maps are probably the most complicated maps that can be produced. A bedrock map consist of a surface model with polygons showing different bedrock types, their age (simple colours) combined with mineral composition (usually as patterns). Faults and other tectonic structures are symbolized with different lines. Single points are used to show sampling points, visited out-crops, mines and other small geological features. The final layer on top of this is the equivalent to a detailed land-survey map showing roads, railways, rivers, lakes, other infrastructure features, towns and communities etc.

The solution is not always to make more simplified maps. Though it's true for web services that it helps to simplify the geology—the demand still



The map of the year 2008

exists to make advanced and detailed geological maps. Migrating from the old systems to the new has provided more user-friendliness but fewer opportunities to produce advanced cartography!

Awards

With great pride SGU received the award for “The map of the year” 2010 as well as in 2006 and 2008 at the annual conference “Map days” arranged by the Swedish Cartographic Society. The 2010 Map of the Year were the bedrock maps “The Caledonides in northern Sweden” (K221:1 and K222:2). They are unique for SGU in the respect that it is the first time ever we used number codes in the legend boxes as well as on the map. The purpose of that is to make the map easier to read.

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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, Göteborg 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 using 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 1961–1990. 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 SCOBİ (Swedish Coastal Ocean Biogeochemical Model) the oceanographic model.

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Riksantikvarieämbetet (Swedish National Heritage Board)

Organisation

The Swedish National Heritage Board (SNHB) 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

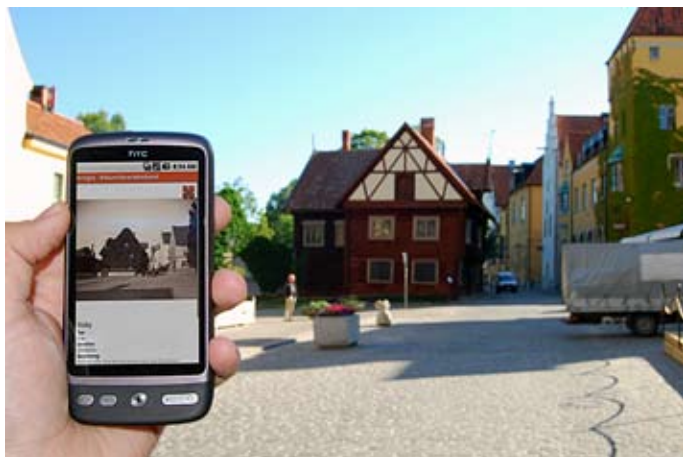
With more than 300 years of field studies, archaeological documentation and surveys the geographical approach has a long tradition in Swedish heritage management. From 1937 a national monuments survey was co-ordinated with the general mapping of Sweden by the National Land Survey. Although the SNHB is 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 national 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 SNHB, 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 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 SNHB has also had a major role in developing GIS-based methods for analysis, presentation and



FältGIS is a GIS-application developed by the Swedish National Heritage Board to record monuments and sites during survey. Photo Rikard Sohlenius



Kringla Android application for Smart Phones. Photo Johan Carlström

visualization of digital historical maps. Much of the GIS related activities in the SNHB are based on Standard GIS software packages (such as ArcMap, MapInfo, ERDAS etc). However, the SNHB has also developed applications for specialized purposes within the sphere of heritage management. Intrasis (Intra-site Information System) is an archaeological information system for recording and managing field data. It has been developed by the SNHB, dep. of Contract Archaeology and Service and LandFocus IS AB. Today Intrasis is used by various organizations in Sweden, Denmark, Norway, England, USA, Canada, Hungary and Iceland.

Digital Resources – databases, applications etc.

Furthermore, applications for registration and database search, as well as a community, have been developed. In 2003 the Archaeological Sites and Monuments database (FMIS) replaced the analogue National Monuments Record. It was launched after an overall digitalization of the record, which stretched over a few years. The database is updated with new information on a daily basis. It is searchable for the public through a webapplication, *Fornsök* (www.raa.se/cms/fornsok/start.html), which since 2008 comes with an integrated map. A log-in makes data download possible for further GIS-analysis and assessment. The database of built heritage (www.bebyggelseregistret.raa.se/cocoon/bbr/welcome.html) is another search resource. It was launched in 1998, and has been available on the internet since 2001. New information is added in cooperation between local authorities, county administrative boards, regional museums and the Church of Sweden. It contains information about approximately 80,000 buildings, dating from the medieval period to recent times (about 13,500 is listed buildings). Since 2010 it is possible to download data for further GIS assessment. Another webapplication,

Kringla (www.kringla.nu/kringla/), show information from several databases for cultural heritage harvested through an aggregator deployed by the SNHB (K-samsök). Kringla also offers an Android application for smart phones which view the geographical positions in relation the location of the user. *Platsr* (www.platsr.se/platsr), is a new service just recently deployed. It is a community where the user creates a geographical location and adds descriptions, photographs, connect stories, form groups or share memories. *K-samsök* (Swedish Open Cultural Heritage) is available for anyone who wants to use the information in the development of applications. The SNHB:s Photographic database contain photographs with coordinates, and the work to locate positions for them is being carried out continuously. New photographs of outdoor environments are given a GPS position. In 2010 all of the SNHB:s information services were adjusted to the national geographical reference system SWEREF 99 (which is a Swedish realization of the European reference system ETRS 89).

Address

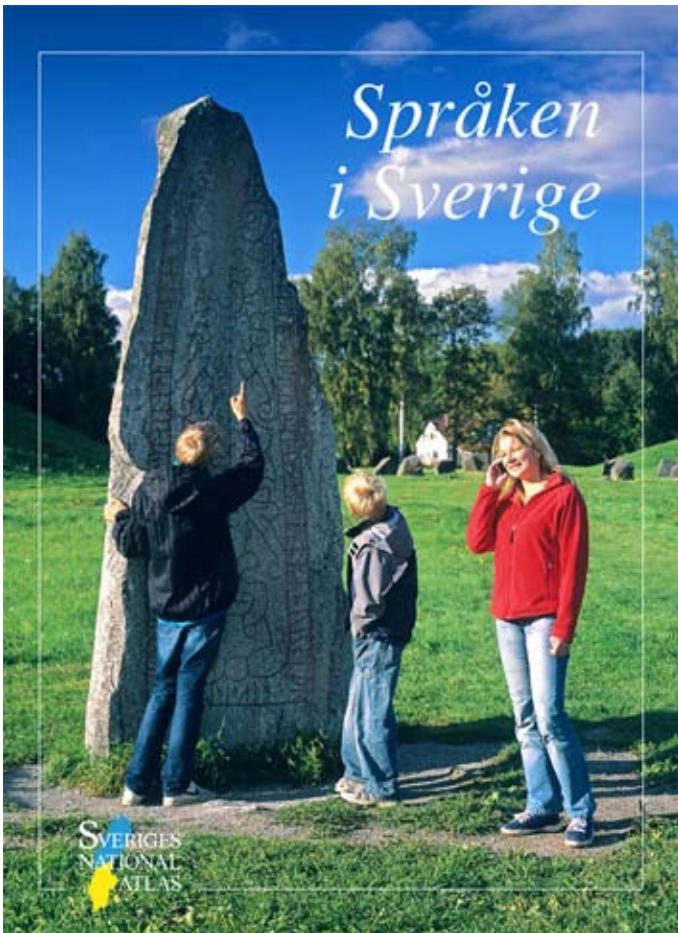
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The National Atlas of Sweden (Sveriges Nationalatlas/SNA)

Principal for the National atlas of Sweden was The National Land Survey until 2009 and since then it is The Norstedts Publishing Group.

18 volumes about national topics and a summary volume were produced in the period 1990–2000. The books were published in Swedish and English. The atlas was also distributed as a PC-atlas/CD-ROM product within this period. This original part of the national atlas was produced within the governmental budget and following volumes were included: *Maps and Mapping – The Forests – The Population – The Environment – Agriculture – The Infrastructure – Sea and Coast – Sweden in the world – Cultural Life, Recreation and Tourism – Work and Leisure – Cultural Heritage and Preservation – Geology – Landscape and Settlements – Climate, Lakes and Rivers – Manufacturing and Services – Geography of Plants and Animals – Public Health and Health Care* and the summary volume *Geography of Sweden*.

Being richly illustrated with photographs, drawings, diagrams and charts, the National Atlas of Sweden differs somewhat from traditional



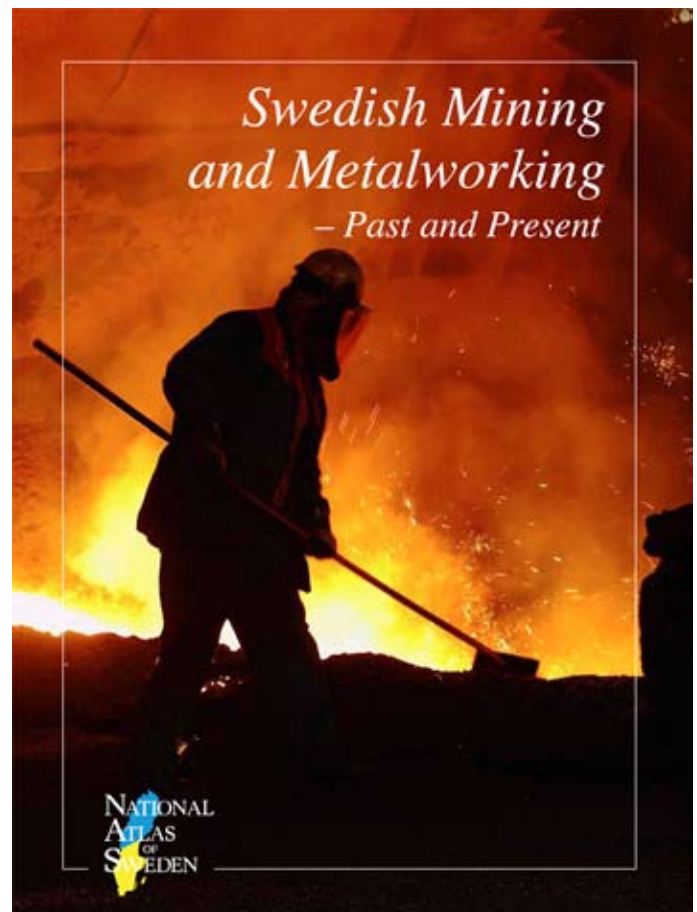
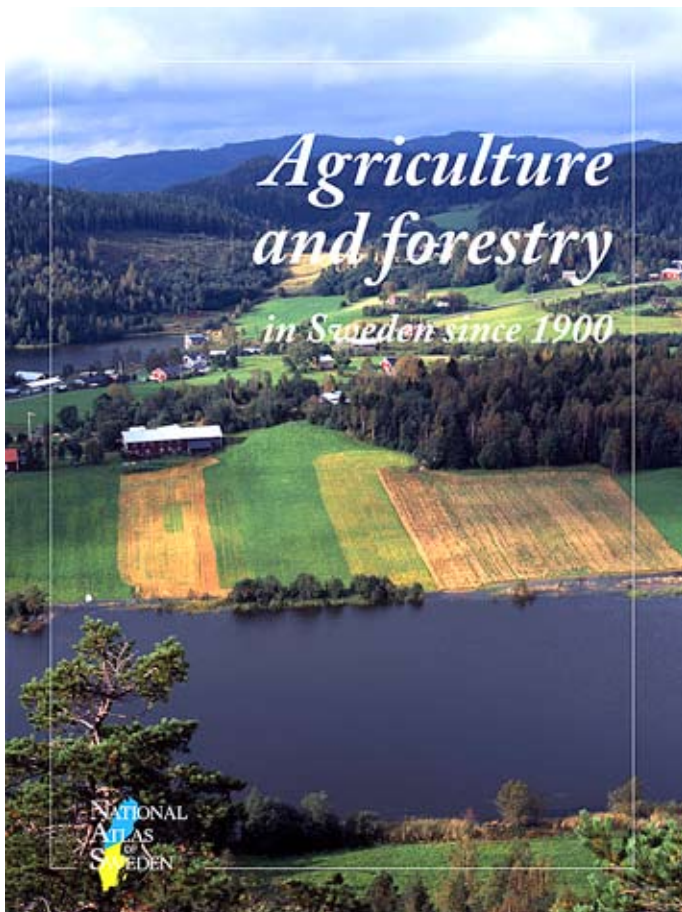
Språken i Sverige (Languages in Sweden) was edited only in Swedish.

national atlases. It has been highly appreciated and each volume has been sold between 13,000 and 25,000 copies, which makes the edition the most successful national atlas in the world, per capita. The original governmental financed national atlas has been followed by complementary regional atlases and national volumes about new topics financed by external sources.

The first regional atlas *Atlas över Skåne* was published already in 1999 and was followed by further two covering the county *Västra Götaland* (2004) and *The Stockholm–Mälaren Region* (2008). In 2010 an atlas about the languages in Sweden was published (only in Swedish). The title was *Språken i Sverige*. Another two national volumes will be published in 2011 – *Agriculture and Forestry in Sweden since 1900* and *Mining and Metalworking – Past and present*.

The policy for updating the National Atlas of Sweden is a web-based GIS services on Internet, free available at www.sna.se. Two of the regional atlases is now available on this new concept and will in the end of 2011 be followed by a new expanded version of Swedish Geography – an comprehensive and updated summary of the earlier published book volumes

Editor in Chief: Leif Wastenson, Professor
Book editors 2007–2011: Ulla Arnberg, MSc, Pär Aspenberg, BSc, and Margareta Elg, MSc
IT-editor: Mathias Cramér, BSc



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T-Kartor

Organisation

T-Kartor Sweden AB was founded 1985 by Sten Ravhed. The company initially focussed purely on map production.

T-Kartor Group comprises the parent company T-Kartor Sweden AB; subsidiaries include T-Kartor Product AB, T-Kartor Norway, T-Kartor Finland, T-Maps USA, T-Kartor GB and T-Mapy Czech Republic. T-Kartor has offices in Sweden, Norway, Finland, Czech Republic, England and USA, as well as additional employees in Denmark. Total group turnover of approximately SEK 75 million. It employs over 110 people.

The first major task for the company was to produce maps for Televerket/Telia. These were for inclusion in their telephone directories.



Activities

T-Kartor works with cartographic based information to create effective solutions and decision support for its customers and their end users/customers.

T-Kartor's vision is to use geographic data and transformed it into cartographic visualisation, to create meaningful information.

This information can then be used in solutions based on a product or service targeted to meet a customer's specific purposes and goals.

Expertise areas

The company has a broad experience and expertise to truly combine mapping with modern information technology. The digital revolution has changed the requirements and conditions for the cartographer and has also influenced the production of the map. Modern information technology offers powerful tools for spatial data management.

The interaction between technology and cartography has unfortunately not always been as obvious and smooth as could be expected. Cartographers and GIS professionals were simply not talking the same language. T-Kartor has achieved success by being a company with both cartographers and GIS professionals.

Among other things, T-Kartor was among the first to make full use of modern database technologies to streamline the production of relatively traditional cartographic products.

Over time, the company has broadened its areas of competence, both in terms of information collection (for example in remote sensing, field inventory) but also in the development of systems and solutions for distributing geographic/cartographic-based information (desktop, web, PDA).

Products and services

A large proportion of T-Kartor's activity is still mission-based production. It can be ranging from a few basic map products for printing through the production of the entire map series with thousands of map products to multi-year projects for construction and maintenance of large national databases.

Since the late 1990s a big part of the business focus has been on supporting customers with system development, design and customisation of customers' production lines.

Typical customers include national authorities needing to streamline and ensure the quality of production processes with large amounts of geographic data in the image and/or vector format.

The best systems solutions in these contexts are based on the right combinations of standard software, and proprietary adaptations specific on customers' cartographic requirements and other customer-specific conditions.

In recent years, T-Kartor also had a growth of application development of networking solutions for the provision of geographic information and



maps. Both in terms of internal decision support systems, but particularly in the development of public web-solutions.

Examples of current products and activities

Public Transport

A large part of T-Kartor's work is in the public transport sector, where the T-Kartor are producing many of the maps that Transport for London (TfL) publishes to inform their passengers of public transport systems in London.

Among the tens of thousands of unique mapping products T-Kartor annually produces for TfL are bus maps, spider maps, etc. in the form of billboards, posters and printed leaflets.

Other things include for every single bus stop (about 14,000 units) in London, a unique map with information on the nearest point of sale for tickets. This would not be feasible without an underlying database method for efficient map production and updating of information.

T-Kartor has also contributed, with products, to Legible London (LL), which is a concept that aims to make it easier for pedestrians to navigate around London's streets on foot.

The Cartographic solution contains a lot of innovative features that prioritize information to pedestrians and cyclists at a higher level than in the traditional city maps. The LL maps have characteristic buildings shown in 3D to increase ease of recognition.

Perhaps the most noticed and appreciated new development is that all the maps on the map

stands are orientated "heads-up" (or forward-up), which means that the maps are always orientated in the direction of the viewer, (instead of the more traditional "North-up"), which has been shown to be much easier to use for the general public. In this case T-Kartor's database concept for produc-





tion comes in very handy when there is a need to rotate each 3D cartographic product to its correct angle.

Air Navigation Maps

A growing area of activity in T-Kartor is map production for air navigation. In this area, T-Kartor is active both as a producer and as a system supplier.

The assignments are in both military and civilian organizations. Among other things, T-Kartor has for many years produced all aeronautical charts for the Norwegian Armed Forces, both as printed products and digital maps use in CADRG format (NATO standard).

The Norwegian Air Force work includes updating and maintenance of a seamless national geographic database which T-Kartor developed and implemented using their Source Data Manager (SDM) concept.

With the rigorous requirements for safety and reliability in air navigation the information management is especially challenging.

Navigation at Sea

In sea navigation T-Kartor contributes primarily with system solutions for production and information management. Customers, includes amongst others United Kingdom Hydrographic Organization (UKHO) as a user's of T-Kartor's SDM concepts in their production.

T-Kartor is also developing systems for the production of ER, ENC and paper charts from the same database.

Internet

Many of the web solutions that T-Kartor developed since the mid 90's, are focused on the publishing of maps in combination with customer

specific information, mainly intended for public websites.

For example, solutions for store-locators, property information, municipal services, etc.

Over time there is also trend in a significantly growing demand for software solutions, in order to share/distribute spatial information within or between large organizations over the internet.

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Liber

Organisation

Liber has a cartographic editorial unit within the Liber Group. Liber produces and markets maps, atlases and electronic map products for both the domestic and international markets. The department employs at present 4 cartographers with long professional experience.

All 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 the central sales and marketing department within the Liber Group.

Technical Development

Today all maps produced at Liber are "computer made". Our editors manage the whole production process from concept, manuscript and design to the final printed or electronic product. To their help, they have a variety of sophisticated software at hand, allowing experimentation with content, colours, different types of design effects, and layout etc.

The basis for Liber's map production are our own databases, which are stored as vector databases in Adobe Illustrator using a cartographic GIS plug-in called Avenza MAPublisher. In addition, we have a wide selection of pixel data in TIFF format and name databases.

Liber uses software from Safe Software, FME, to migrate data into our production system. FME also allows us to solve many of the cartographic problems around the GIS platform. Custom maps are also produced using importing data from different commercial GIS databases.

MAPublisher introduces rule-based cartography concepts into Adobe Illustrator. Graphic styles, symbols and textstyles are joined with category

codes and attributes in the map data. We call this new type of database eMap.

Thematic maps can also be created from statistical information imported into the databases, allowing us to freely choose map projection and make very flexible classifications.

In house development has been focused on automating the process from database to final files. Software has also been developed to make indexes from our name databases.

In the last step in the production process, layout software like Adobe Indesign is used to make the final map design and create files for printing. Normally output to prepress is platform independent Adobe Acrobat PDF files. Data are transferred fast and easily to prepress and printers all over the world using the Internet FTP protocol.

Large format printers with widths of up to 165 cm are used to print verification plots of our maps. The new plotters are colour calibrated and generate 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

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–:4 million
- Africa, Asia, Australia, North and South America 1:10–1:25 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, electronic products 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.

Within the schools programme, Liber produces a variety of school atlases and sheet 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 sheet maps are approximately 500.

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

Future activities

Liber will continue to produce maps as traditional printed products, print on demand-maps and maps for Internet use.

New products for the future will be maps and map-related information for interactive whiteboards, 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.

The new and alternative production methods now being developed will help to rationalise and increase flexibility in our production of well-designed, quality cartographic products for educational purposes and general use.

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esri Sverige

Organisation

esri Sverige is the distributor of esri's ArcGIS software in Sweden. The company has 150 employees in Stockholm, Malmö, Gävle, Falun, Karlskrona, and Växjö. The head office is situated in Gävle. For 2010, the turnover was about SEK 200 millions. esri Sverige is a part of a larger group of companies – S-GROUP. This group also owns esri Finland, Halda, Market Decider, Gemasoft, Pro-gira, S-group solutions, Kordab Spzoo, and Kordab uab. These companies have business focus on geography. Thus, the group has business in Sweden, Finland, Lithuania, and Poland, where the major customers are within GIS-solutions for transportation, logistics, retail, defense, local government, and tele communication. The company and the group, as well, have grown annually with about 15–20 percent since 1995.

Main activities

The main objective for esri Sverige is to create value and benefit for our customers and their businesses from a geographic perspective. A major part of the customers are GIS centric, where

our products is used to capture data, store and maintain data, distribute data, and use data (analyze, visualize etc.). These GIS centric customers use ArcGIS, in large extent. The other customers see GIS as an enabler. GIS is just a supporting system to make their own business to work more efficient. These customers see the benefits in taking better decisions for higher efficiency, better environment, higher safety/security, and for better co-operation.

ESRI S-GROUP has three major businesses: In order to create a holistic product for the customer, the company also delivers:

- Geographic data, retailer to e.g. Navteq, Tele Atlas, and Lantmäteriet
- Hosting of data, application, software, platform, and web services
- Support and training
- Software retailing, e.g. Cityworks, FME, GeoSystem, Cellular expert, RouteSmart, con terra, ArcCadastre, and Lizardtech.

Future and directions

There are five major and important GIS trends in Sweden. esri Sverige is one of the most developed international distributions to esri Inc., thanks to our Swedish customers. The reason for this is that Sweden and the Nordic countries have well developed geographic infrastructures, built up by central and local governments. This is very important in the development of and adaption to the EU's Inspire directive. It is important to meet the directive with sustainable products, infrastructure, and services. Here, esri Sverige works together with partners, like the German company con terra to be deliver future-safe solutions. These solutions are based on ArcGIS for Inspire. In the future, many government bodies and companies will build business applications, e-services, and other critical systems based on geographic web services in the cloud. GIS in the cloud is here, and it will be here for the future. The cloud will be a complement to GIS solutions on desktop, server, mobile, and web. The ArcGIS software can be used in the cloud – today, in for example, the Amazon Web Services (AWS).

GIS will also be more integrated in business systems, in the future. Today, many customers use GIS separately, but the trend is going for enterprise systems, where GIS is well-integrated, like any other supporting systems, e.g. CRM (customer relationship management), ERP (enterprise resource planning). Embedded GIS with web publishing or CMS (content management systems) is also a growing trend. It should be easy to just embed a GIS to any web page or application. esri Sverige have developed Geo-secma to meet the demand of integration and



GeoLogistics has become an important business for esri Sverige. Transport intensive customers in areas like forestry, news paper distribution, fleet management, and retail merge into GIS-enabled logistic solution.

embedded possibilities. The last major trend in the GIS business in Sweden is outsourcing of GIS-solutions and employees. In Sweden, the lack of knowledge and increased costs force many companies and governments to outsource much of their GIS activities. This point out customers needs of holistic solutions – knowledge, products, solutions, services, data, and hosting. This is esri Sverige!

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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. Produc-

tion 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 27 Swedish inland lake charts at various scales, and 53 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. Hydrographica 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.

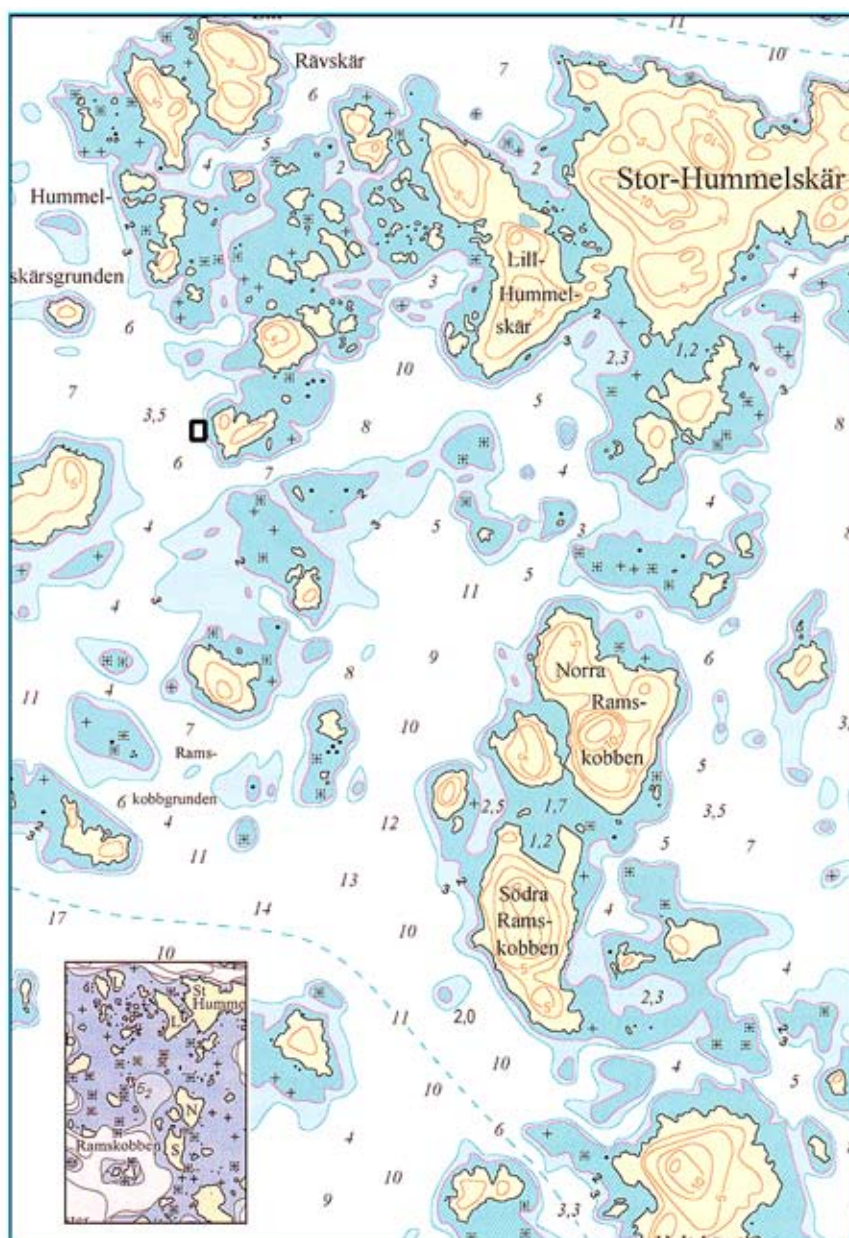
Cooperation

Hydrographica cooperates with the Swedish Maritime Administration, and supplies data to international chart producing companies such as Garmin, Navionics, C-map a.o. Hy-

drographica 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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Example of chart from Hydrographica