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ICC SPECIAL ISSUE **2011**

CARTOGRAPHY & GEOINFORMATICS IN FINLAND

Useful and usable map services.

Insights into the development of spatial data infrastructure in Finland.

- GIS is coming to schools
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- Automated generalization of topographic data
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- Global forest mapping for carbon sink assessment
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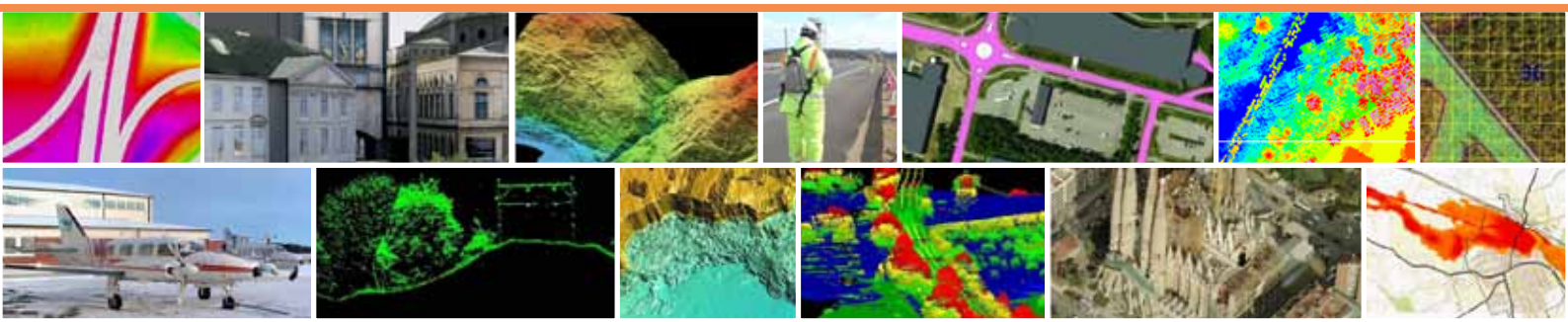

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Opening access

You are reading the third edition of the special issue of Positio magazine. It reports some of the progress made in Finland in the geoinformation field. The previous issues were published in 2007 and 2003. This issue is also our national report to the International Cartographic Conference in Paris 2011 which is celebrating its 25th anniversary. The Cartographic Society was responsible for editing this issue and it is published in co-operation with the National Land Survey of Finland (NLS). I would like to thank the NLS and the advertisers for their financial support.

The main trend you notice reading the articles is that access to geoinformation has improved and government policy on its data is going towards open and even free access. I read today in a Finnish newspaper that a geographic app has taken the number one place in the Apple's App Store, and this application is using free data from the NLS.

Another much used application in Finland is the Journey Planner of the Helsinki Region Transport. It is promoting the use of public transport by making it easy to find the routes and connections and it even supports the planning of cycling and walking. It includes information on steep hills, coffee shops and users can add new information. This is a good example of using the power of social networks.

Loisto (in English sector light), software of Karttakeskus offers automatic routing along waterways. It combines marine charts with topographic data offering a clearer visual experience for both professional and leisure users. If you never have experienced the archipelago of Finland, I would strongly advise you to do so, it is an unforgettable experience.

An important aspect of "opening access" is ensuring that people have skills to utilize new technology. PaikkaOppi service is bringing GIS to the Finnish schools promising users aware of geographic data resources in the future. The research on GIS maturity model for the first time provides organizations with a systematic means to evaluate whether they utilize GIS in full extent and what are the disabling factors in their case.

Last but not the least importantly, there is strong ongoing work on implementing the Spatial Data Infrastructure in Finland. The Finnish Geoportal has been opened and it received the innovation prize from Excellence Finland in their public sector series. It is built up with open source code and therefore is available to others as well.

Understanding the history is important, and we also include an article of Swedish military mapping in Finland just before the war between Sweden and Russia in 1808. Finland will be hosting the International Conference on History of Cartography in July 2013 (*www.ichc2013.fi*) with the theme "Four elements – the Essentials of the History of Cartography". There will be many exhibitions, one including the Nordenskiöld map collection. This collection is in the list of the UNESCO world heritage. *A. E. Nordenskiöld* was the first man to complete the Northeast Passage.

We hope you find the articles in this issue interesting and inspiring in opening access to geoinformation. ◀

Antti Jakobsson
chair of the Cartographic Society of Finland

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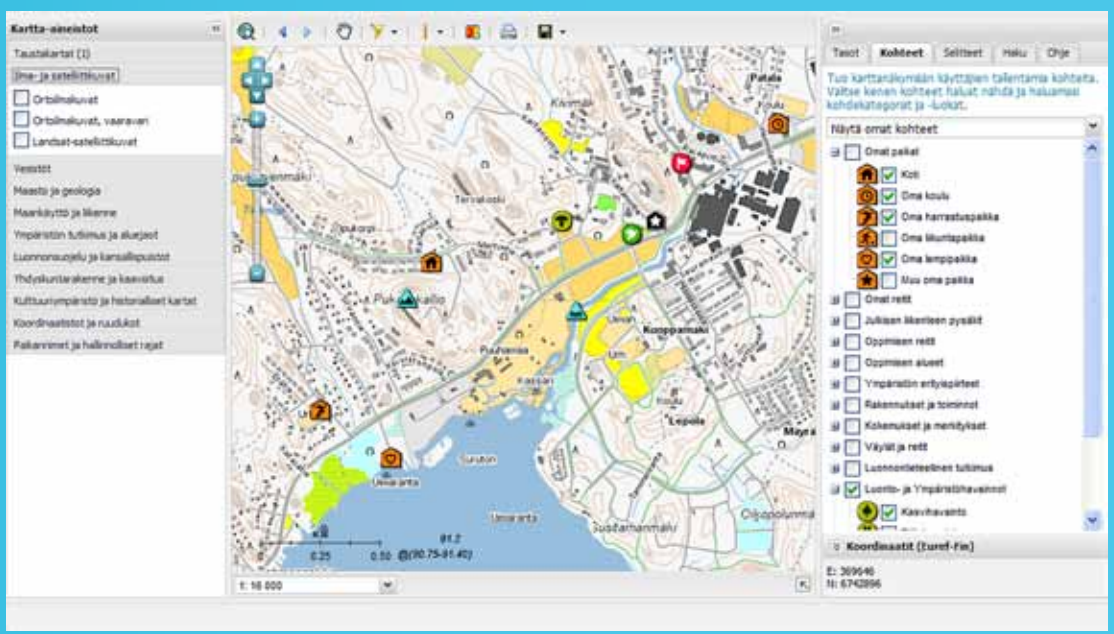
▶ TUULI TOIVONEN & JUHA RIIHELÄ

PaikkaOppi brings GIS to schools

Imagine yourself as a school kid having easy access to spatial information of your neighbourhood. Supported by an enthusiastic teacher, you could examine the patterns and interrelations of the environment. How does topography relate to vegetation, soils with land use, and what can you see from aerial photos and satellite images? How do your own field observations fit to the mapped reality? Such an idea – learning geography through own discovery – has been the basis for developing PaikkaOppi service for Finnish schools.

PaikkaOppi user interface is easy to use and intuitive. It allows analyses of detailed map data and aerial photos from all parts of Finland.



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Finnish curricula for upper secondary schools changed in 2003. The renewed curricula introduced such themes as active learning, technology and society, active citizenship and media skills to all subjects. In the curricula for geography, applying GIS as a tool for making your own regional analyses become reality – at least on paper. In practice, teachers were puzzled by the world of different GIS software, data formats and all the technical fuzz. Data products by Finnish authorities were highly prized and buying them from different sources was considered too time-consuming. The principal idea of using GIS for active learning was brilliant, but the practical realisation seemed impossible in many schools. Students were about to become unequal, depending on the technical interest of the teachers and the budget and data policy of the municipalities.

PaikkaOppi provided a solution

PaikkaOppi project started as a pilot during the year 2008 with the aim to create a web-based GIS for Finnish schools. The idea was to combine spatial data of various topics to a pedagogic web mapping interface. The coverage had to be the entire Finland, to ensure equality among the students. The data had to be so detailed that geographic inspections could take place in the school surroundings. The content had to be thematically extensive to allow multiple inspection angles to the environment. In addition, the service had to support active learning, so that your own mapping exercises, sharing your own data with others and reporting to teachers had to be enabled. Importantly too, the service had to be easily usable and technically stable to make teachers to adopt it.

Map work and group work

After several rounds of improvement, the developers of PaikkaOppi can be quite satisfied. The service has a well-functioning map interface. It allows visual analyses of the most detailed environmental data sets in Finland, from different topographic maps and aerial photos to information on soils, fluvial system, infrastructure and population. From some areas, also historic maps are included. Most data are available from scale 1:20 000 onwards, covering the entire country. The data sets are up-to-date: Most maps are fetched on-line from the servers of different data providers. The only major data deficiency relates to a common data policy problem in Finland: Local scale statistics on demography and population have not been available for the service with a reasonable price. Population data is nevertheless available on a municipality level and it can be visualised with

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interactive thematic maps. Users can set the classification and colours for maps, and thus, also study the basics of thematic cartography.

Your own point and track data can be entered directly from a GPS device. These data may be classified to different attribute classes represented with different symbology. Your own interpretations can be drawn on top of other data layers as points, lines and polygons with attributes. Students have used these data production options to map out social values in their own environment, create nature paths or digital herbariums with pictures and texts.

Sharing reports with others is supported by PaikkaOppi design. The map outputs can be saved as workspaces to be opened later in the map service, or they can be stored as images to be exported to PaikkaOppi's own wiki workbook. The wiki workbook provides each user his or her own space where content can be added. Students can use the space to save documents and assignments or simply as a library to store their map outputs. All content saved to a workbook can be shared with all users and even with non-users since browsing the workbook does not require registration.

PaikkaOppi in use

The first courses using PaikkaOppi were arranged in pilot schools in the autumn of 2008. Since then, the platform has been widely used in geography courses. The users range from students on lower grades of basic education to those on special courses of geography in the upper secondary schools. Recently, the service has aroused interest also at the university level.

In geography courses, students have used PaikkaOppi to study the basic geography of Finland. This is facilitated by the broad content of the service and the observations made with GPS devices. The basics of GIS become familiar when studying the environment: Students work with different datasets, browse through them and their metadata, and compare them by overlays in the map service.

PaikkaOppi has been seen useful also for disciplines other than geography. Especially biology, history and social studies may benefit from the GIS tools and datasets provided by PaikkaOppi. One example of the cross-disciplinary activity is a landscape history course arranged in the city of Turku during the spring 2010. The course was planned jointly by the teachers of geography, history and landscape studies. The aim was to study changes in the landscape and how particular physical features or man-made structures have changed over time. PaikkaOppi's map service was used to study and compare original maps dating from the 18th century to the current maps and aerial photos. Datasets were overlaid in the map service and basic visual analyses were executed.

Experimental group effort

The development of PaikkaOppi has been a technological experiment. The service has evolved at the same time with web mapping techniques, tools and standards. The service has been developed using open source tools taking advantage of the recent web mapping and data sharing standards. The content building has benefitted from the implementation of the INSPIRE directive in Finland, as the number of WMS and WFS services has grown during the development years.

The development of PaikkaOppi has been truly a group effort. The lead of the project is in the hands Lounaispaikka network, coordinated by the Regional Council of Southwest Finland. The technical expertise comes from a private GIS company Arbonaut and the Geodetic Survey of Finland. Schools in the cities of Joensuu and Turku have been crucial in commenting on the pedagogic part. Universities of Helsinki and Turku have provided further pedagogical expertise. Development has been financially supported and directed by the National Council of Education. The increased number of users has provided important feedback for the developers.

Bright future of the service?

The pilot phase of PaikkaOppi began with three schools in Joensuu and Turku regions. Since the year 2008, PaikkaOppi has been taken in active use in dozens of schools around Finland. Today, the number of registered teachers is well above 400. The number of monthly users has climbed to around 5 000. The service has been noticed also by the geoinformatics community: PaikkaOppi received the GIS innovation price of the Finnish ProGIS society last year. There are still many things to develop and improve in the service. Currently, the biggest development challenge is, however, administrative in nature: Who in our project-oriented society should maintain permanent services like PaikkaOppi? ◀

USEFUL AND USABLE MAP SERVICES TO EVERYBODY

Efficient map production today and in the past

MenoMaps: multichannel maps

Hikers in the near future will have the possibility to choose which media to use for interacting with their maps and to retrieve hiking information for planning the hikes: paper maps, web maps, mobile maps or maps on a multi-touch screen.

▶ TAPANI SARJAKOSKI & L. TIINA SARJAKOSKI

Indulging in outdoor leisure activities, such as hiking, has become a trend in Finland. Maps have always played a dominant role in planning the hike and in ensuring that you are on the right trail. Outdoor leisure activities still lack useful services for personal navigation, even though many users need easy-to-use mobile guidance while hiking in the forest.

Hiking is more than just the act of going out into nature. Preparing, planning and reminiscing about the trips are also a part of the hiking experience. For such purposes, printed graphic maps, newspapers, web and mobile phones together form an interface to information on nature. Map-based multichannel services open up new opportunities for developing versatile geospatial services. The challenge of such services involves how to exploit their interaction possibilities in such a way that the user would have a holistic user experience with a single service, even when utilising different media channels while interacting with the service.

The voluntary updating of spatial data by social networks is another trend that should be considered when developing map-based services. Users are willing to share their knowledge and information about unknown environments in the form of comments, photos, videos, and so forth with other users and user groups. When users adopt map-based services as a part of their everyday life the user requirements and usability of the service should be considered more thoroughly than ever before. Furthermore, we need to develop services that are also fun, entertaining, and aesthetically pleasing.

A service to be exhibited

The "Multi-Publishing in Supporting Leisure Outdoor Activities" (*MenoMaps*) project was carried out between the years 2008 and 2010. The main outcome of the project was a map-based multichannel service prototype. The follow-up project "Map Services for Outdoor Leisure Activities Supported by Social Networks" (MenoMaps II) is being carried out between the years 2010 and 2013 and is being funded by Tekes – the Finnish Funding Agency for Technology and Innovation. The service prototype will be further developed during the MenoMaps II project, and it will be exhibited at the end of 2012 in the new Nuuksio Nature Centre, which is close to Helsinki in Finland, and also in the Töölö Sports Hall in Helsinki.

The project also aims to discover new kinds of possibilities for business models for multi-channel map-based services. We are currently studying different kinds of development challenges. This includes addressing the following questions: What kinds of business possibilities are provided by the new interaction techniques of the map-based services? What kinds of new user experiences and interaction possibilities could the business models being studied provide when designing the user interfaces?

The project is being carried out in co-operation between the Finnish Geodetic Institute (FGI), Department of Geoinformatics and Cartography, and Aalto University, School of Art and Design, the Department of Design. The other partners in the

project represent the entire value chain for leisure outdoor services[1].

Channels and architecture of the MenoMaps

The MenoMaps map-based multichannel service allows the user to access the same spatial information contents from a single data core through different channels such as printed maps, a web map, a mobile map application, and a map application on a multi-touch screen. The channels of the service are linked through the UpCode data matrix technology, supporting users' easy switch from one channel to another.

Architecture

We implemented the MenoMaps service according to the three-tier architectural style. The presentation tier displays the maps on the client side through the channels. The data access tier supplies the geographical data requested by the clients. MapServer is used for supplying the raster data together with the TileCache caching service, and TinyOWS supplies the vector data. The data storage tier contains and delivers the source data on the server. The data is stored using GeoTiff image files for raster and PostgreSQL database for vector data.

Web map application

The web map application is directed to a use case before or after a hike: exploring the area and planning outdoor activities as well as memorising and sharing the activities. The web map user interface aims at providing a complete tool to interact with the maps being delivered and it shares a similar design with the other channels. We applied the "minimalist" and "direct manipulation" design paradigms to the user interface design, which make it easy to use and spares the user a certain amount of cognitive overload.

We implemented the web map client application using Asynchronous JavaScript and XML web technologies. We used HyperText Markup Language (HTML) for creating the general website layout, the appearance of which we defined using Cascading Style Sheets. The web map interactivity with the user has been produced with JavaScript programming language, which enables the dynamic modification of HTML through the Document Object Model. The web map functionality has been realised using OpenLayers API, a free and open source web map user interface programming library in JavaScript that takes care of the Open Web Services data requests, data rendering and map interaction.

Mobile map application

We implemented the MenoMaps mobile map application on the iPhone platform based on an in-house built framework. The base framework handles flexible map navigation, data downloading, storage, and presentation. For instance, the map can be oriented according to the walking direction of the user, stored maps can be viewed offline and data can be accessed through standardised Open Web Service interfaces. In addition, map symbols can be used to deliver multimedia in a variety of forms to the users, such as verbalising the environment in audio, presenting a scenic photo or playing back a video of a possible target location.

We further developed the base as part of the project and created an extension specifically for the MenoMaps project. The extension adds a coherent visual interface with the other publishing channels to the base application and allows the UpCode data matrixes to be used to deliver map data to the mobile media. In future

1) THE PARTNERS ARE: NUUKSIOKESKUS LTD. (FINNISH NATURE CENTRE), FOLKHÄLSAN UTBILDNING AB (A SPORTS INSTITUTE), UPCODE LTD. (MOBILE DATAMATRIX SOLUTIONS), TUNTURILATU RY (AN ASSOCIATION FOR FINNISH OUTDOOR ENTHUSIASTS), KARTTAKESKUS LTD. (MAP PRODUCTS AND SERVICES), THE CITY OF ESPOO, THE CITY OF HELSINKI, METSÄHALLITUS (NATURAL HERITAGE SERVICES), THE NATIONAL LAND SURVEY OF FINLAND, ATLASART LTD. (A PUBLISHING COMPANY), TRACKER SOFTWARE INC. (OUTDOOR MOBILE SOLUTIONS), SITO-GROUP (INFRASTRUCTURE, TRAFFIC AND ENVIRONMENTAL SERVICES), AND ARBONAUT OY (GIS-SOLUTIONS FOR FORESTRY).

MenoMaps delivers maps for hikers from a single spatial data core through different channels: paper maps, a web map, a mobile map application, and a map application on a multi-touch screen.

PHOTO © FINNISH GEODETIC INSTITUTE

Additional information, such as the current weather forecast for the area, may be linked to the maps by UpCode data matrix technology.

releases, the extension will be extended, for instance, to deliver data for the other publishing channels, such as photographs of visited places.

Multi-touch screen

The MenoMaps map application is also being implemented on a multi-touch screen. This is a natural user interface where the fingers of users act as input to the system, much like a mouse and keyboard would on a traditional computer. When users touch the screen surface, the multi-touch screen recognizes the users' finger movements as gestures. These gestures can be used to control the interface directly and intuitively. The users can, for example, move, rotate and scale pictures just by touching them or complete more challenging tasks, depending upon the application logic. A multi-touch screen has the advantage of not limiting the number of touch points on the screen surface, which means that, theoretically, any number of users can interact with the interface at the same time. Multiple users, using several different fingers for input, present many challenges for the map interface design, such as non-linear workflows.

MenoMaps maps

We have utilised the FGI's test environment for ubiquitous geospatial services for the project. The environment includes various spatial datasets and covers Nuuksio National Park and the adjacent outdoor areas. The data core for the MenoMaps service includes the FGI's LIDAR point cloud, LIDAR DEMs with a resolution of 1–10 m, real- and false-colour orthophotos with a resolution of 0.2 m, and a GPS-based trail database. In addition, we utilised the topographical data sets from the National Land Survey of Finland at the scales of 1:25 000 and 1:100 000.

All of the maps designed for the MenoMaps consisted of information at two levels: 1) static background maps and 2) dynamic thematic contents, including hiking routes and point-of-interest (POI) data. We stored all of the background maps on the server as raster data, while making the overlaid thematic content available as vector data. We developed the design of the vector data to fit together with the background maps.

In the design core, we fixed the use of six scale levels for the web maps (1:1500 – 1:48000) to be able to cover the full visualisation potential of the available data sets, to satisfy the expected user needs of the national park visitors and to serve as the starting point for adapting the design to the other channels. Furthermore, related to the use contexts (generic, hiking, biking, skiing), we created the design for several map types, which we named the "Topographic map", the "Relief map", the "Forest map", the "Orthophoto maps" and the "Winter map".

Usability testing

We have conducted usability evaluations according to the user-centred design approach for the web map application, the mobile map application on an iPhone and printed maps. We evaluated the printed maps by utilising questionnaires that were distributed to an information centre in Nuuksio National Park. Three of the maps accompanying the questionnaire were test maps created at the FGI and one of the maps was part of a "Karttakeskus Nuuksio-Luukkaa outdoor map" available on the market. We received a total of 538 completed questionnaires, and we are still in the process of conducting the final analysis. The MenoMaps multi-publishing service, as well as the different channels, is being further developed, and we are considering the results of the usability evaluations during this process. The consistency of the multi-publishing service is one of the key issues to ensure and it is also one of the greatest challenges in designing multichannel services.

Welcome!

The final goal of the MenoMaps project is – on top of the research challenges – to encourage citizens of today's technology society to find their way to the recreational activities in nature and to have fun. If you pass through Helsinki during autumn 2012, you are welcome to visit Nuuksio Nature Centre and to see how the MenoMaps meets this challenge! And if you cannot come to Finland, you may still go to the Internet and click on the MenoMaps web map (*www.fgi.fi*, available August 2012) with soundscapes: you will hear birds singing in Nuuksio National Park. ◀

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Open interface of Journey Planner encourages application development

Journey Planner has served users of public transport in Helsinki region already for a decade. It serves tens of thousands route requests daily. A parallel service is helping cyclists to find suitable routes, and new applications are emerging now that an open access to the data is provided for developers.

The Journey Planner is a service for users of public transport in the Helsinki region (Helsinki, Espoo, Kauniainen, Vantaa, Kerava and Kirkkonummi) providing the users with intermodal door-to-door routing. The service is based on timetable data including bus, metro and commuter trains with information on both sudden and anticipated route and timetable changes; all street addresses in the region and plenty of other place names; and routes including the pedestrian access to stops and stations. The service is maintained by Helsinki Region Transport (HRT) at *www.reittiopas.fi/en*.

Attraction to public transport

An efficient traffic system is a necessary condition for the vitality of Helsinki region where traffic levels have been increasing both within the metropolitan area and between the surrounding municipalities. A key factor in ensuring the smooth flow of traffic is that as many people as possible use public transport. Thus, public transport should be made as viable and attractive as possible to residents, commuters as well as visitors to the area.

A large part of the 1.3 million inhabitants of Helsinki region are potential users of public transport and, thus, of the Journey Planner. When developing information services, one has to think about how to adapt the solution for a large number of users as well as for different devices, and how to achieve the highest user potential for the service. On the other hand, it is important to meet individual user needs.

Competition of mobile apps

In spring 2011, HRT organized a mobile service competition. The aim of the competition was to develop services for users of mobile devices that encourage them to cycle, walk and use public transport. Competition entries could be almost anything from a sensible and efficient aid for weekday travel to a game inspiring people to embark on an urban adventure. Entries could be services and applications working on mobile devices that were already in use, ones that were developed especially for the competition, or ones that were still in the demo stage. The only requirement was that the timetable and route information must be based on the data provided by HRT's APIs.

The competition also sought to find new insights into how applications should work and what kinds of advanced technical solutions the participants have utilized. At least the following trends are discernible in the development of HRT's electronic services: personal location and location of vehicles, the use of real-time information, authentication and payment. There were no separate categories in the competition but the panel of judges sought to award entries made for different purposes and in different stages of development in a balanced manner.

Using public transport routes always include walking or cycling. Including other modes of transport to public transport routing helps users to manage all the stages of their journeys. HRT wants to promote low-emission transport and encourage people to cycle and walk.

HRT supports the development of services that combine information provided by users. An open

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operating environment makes it possible to link the routing to other information. A journey always has a purpose. It can be related, for example, to an interesting place or event. Information provided by other users can facilitate the route choice or make the journey more enjoyable.

Open Journey Planner interface

HRT grants access rights to the Journey Planner interface for development and test use provided that the new application promotes public transport and availability of passenger information. The development and test use of the interfaces is free of charge. Commercial use of the interface has to be negotiated separately.

At the moment, there are two possible ways to access the timetable and route data:

- ▶ HTTP GET interface which gives a response in XML format
- ▶ Nationally specified XML database dump file which carries all data in a single file.

In most queries, it is possible to limit the values in the response with URL parameters, and for example, the coordinate system and language used in the response can be selected.

The API server has the most recent timetable data provided by HRT. Due to security and load reasons the API server has been separated from other parts of the Journey Planner system. However, the API server is automatically updated with new data simultaneously with the other parts. The timetable data is updated weekly. ◀

PHOTO © ANTERO AALTONEN

WALKING AND CYCLING ROUTES FROM JOURNEY PLANNER

The Journey Planner provides you with the best cycling routes in Helsinki region. Whether the best route is the shortest one or a route via you favourite places is up to you. The Planner also tells your energy consumption during the journey expressed as pieces of chocolate.

The Journey Planner for Cycling and walking is available in parallel with the Journey Planner of public transport at ***http://pk.hsl.fi/en/***. You can search for routes by clicking a place on the map or by entering a street address and you can define points along the route via which you want to go. Where possible, the suggested route follows pedestrian and cycle paths. You can also search for routes that favour asphalt or gravelled roads. The route is shown on a map or a satellite image.

Cafes and steep hills

In addition to routes, the service provides you with lots of other useful information. You can, for example, view national cycling routes, the entire route network of the Helsinki metropolitan area presented on an outdoor map, sports venues, steep hills, cafes and lodges, construction sites and traffic signals.

In addition to finding routes, the Journey Planner tells you how many calories you burn during the journey. The energy consumption is expressed as pieces of chocolate. The “chocolate calculator” tells your energy consumption during a journey made on foot or by bike. Energy consumption is calculated for a 70 kg person so that cycling burns 25 kilocalories per kilometre and walking 50 kilocalories per kilometre. One piece of chocolate (10 g) is estimated to have 52 kcal.

The number of users has been steadily increasing. Last summer the number of users was 10 000 on the busiest days and on average there were 5 000 – 6 000 daily users.

▶ LAURA ERTIMO

Navigating the Baltic Sea labyrinth

Thanks to its geologic history Baltic Sea has one of the world's most beautiful and yet treacherous archipelagos. This makes navigation in the area a challenge, as well to merchant ships and SAR vessels as to the hundreds of thousands of leisure boaters that sail through our short summer. *Loisto* is trying to ease the challenge by versatile functions and vector maps in various navigation programs.

LAURA ERTIMO IS A GEOGRAPHER WORKING AT KARTTAKESKUS OY AS A PRODUCT MANAGER.

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– Loisto software finds you a safe route

Last few Ice Ages have formed a basin with labyrinthine rocky shores and relatively shallow waters between Finland, Sweden and the Baltic countries and their major ports. These conditions form a geographical setting for both merchant shipping and utility traffic as well as yachting. Navigational conditions in Finnish waters differ highly from those on e.g. Mediterranean or North Sea areas and requirements for both map data and navigation programs are particular. In comparison with larger seas with strong currents and tidal waves to consider, seafaring in the Baltic Sea is mostly about navigating to avoiding islets and rocks underwater. Loisto navigation programs are designed to meet these special conditions.

Loisto software for pros and enthusiasts

Hannu Säles, the creator of *Loisto* navigation software, started out with a strong programming background, experience in leisure boating and an order from The Finnish Maritime Administration. In 1994, he was asked to create a program to aid the maintaining and improving of fairways. At the beginning of 2011 Hannu Säles sold Loisto software making Karttakeskus the developer and distributor of Loisto programs.

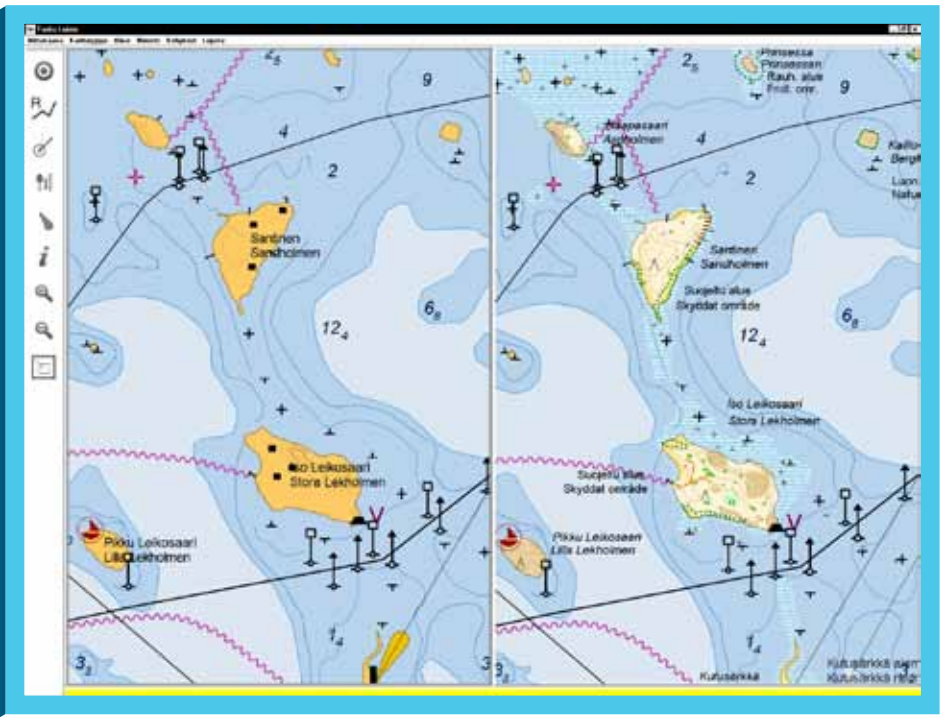
There are 8 200 kilometers of coastal fairways and 8 000 kilometers of inland waterways with over 33 000 aids to navigation – that is lighthouses, beacons, buoys and such to maintain. Every year ice shield covering most of the Finnish waters moves and damages these crucial aids and makes maintenance both time-consuming and expensive. The most versatile of Loisto programs, Iso Loisto, is made for professional use for the maintenance of ports and fairways.

Other professional users of Loisto software include members of The Finnish Lifeboat Institution. Iso Loisto and Uusi Loisto programs are installed in computers on board on over 100 SAR vessels. These programs provide several special functions designed for rescuing purposes. They include the generation of search and rescue patterns for rescue vessels and helicopters as well as the generation of night navigation

PHOTO © SHUTTERSTOCK

notations from an automatically created route plan.

Although Loisto programs were initially designed for professional use there is a growing group of leisure boaters, recreational fishers and sailors using Uusi Loisto and the newest addition to Loisto family Tasku Loisto II. The basic elements of Loisto programs are visual and digital positioning (when connected to GPS device), two to four parallel map views with different scales, map data or content and route planning options. Uusi Loisto and Iso Loisto programs can be connected to self-steering gear, compass, radar and anemometer, for instance. When connected to required devices Uusi Loisto produces data about sailboats performance and diverse log information.



SCREENSHOT © KARTTAKESKUS

Combining marine chart and topographical data. This screenshot of Tasku Loisto II route planning view gives an idea of the advantages in combined map data. There is a plain marine chart on the left hand side and the combination on the right. Combining data is no news in geoinformatics but it is rarely seen in navigation programs.

Combining marine chart and topographical data

One of the key elements that set Loisto programs apart from chart plotters and other navigation programs is the high quality of the map data. The data for the Finnish territorial waters is obtained from the Finnish Transport Agency's Maritime Services. WGS84 vector data in the modern INT-FI format allows versatile functions such as automatic routing on waterways, specific information on aids of navigation and other chart objects, and adjusting chart display options. Many boaters find it easier to read Loisto maps that have the same colors as printed sea charts in comparison to chart plotter maps that tend to have the opposite color schemes.

INT-FI data provides more elaborate information for small vessels and leisure boating that use shallow waterways and move also off fairways than data produced within S57 standard for large merchant shipping vessels. Loisto programs also have a unique option to combine marine chart data with the topographical vector data from The National Land Survey of Finland in order to create even a more detailed picture of the coastal areas. This is one of the features cherished by the SAR troops as they need to be able to move where ever help is called for.

The combination of a marine chart and topographical data can be viewed as a safety issue. Vessels have to be able to give way to each other and move away from the fairways which can prove to be hazardous on narrow channels. When topographical data is added to marine chart shallow ridges and reed beds appear more clearly. The combination of topographical and marine chart data is visualized emphasizing the marine chart data.

Automatic routing along waterways

Thanks to the high quality of INT-FI marine chart vector data, Loisto programs are able to automatically route a vessel from a given point to any destination along the waterway network within the Finnish territorial waters. This is an option familiar to all users of car navigation systems but far less known in marine conditions. In chart plotters tracks are created manually point by point. Loisto programs create routes simply between a starting point and a destination and variations for different weather conditions are easy to check by just adding a point on the route.

In Uusi Loisto, routing can be modified to suite the vessel in use by giving its draft and so the program will only use deep enough waterways. Users can add their own routes to the route network and include them in automatic routing. Routing options are also applicable on mainland. All Loisto map packages include Digiroad ® dataset for the Finnish roads.

The datasets for Loisto programs cover all the Finnish territorial waters and those navigable lakes that are charted by the Finnish Transport Agency's Maritime Services. Topographic data covers all Finland. In addition to the Finnish data, there are marine chart datasets also for Estonia and Sweden. ◀

- Karttakeskus Oy is a Finnish geo-information company that provides GIS software solutions, outsource services, GIS consultation, spatial data and a large variety of domestic, foreign and customized map products.
- Iso Loisto and Uusi Loisto are versatile navigation programs for PC/iMac users.
- Tasku Loisto II is easy-to-use multi-platform software that operates in Windows CE and Symbian systems as well as in ordinary Windows environments.
- The name Loisto stands for "Sector Light" in Finnish, so Iso Loisto is "Big SL", Uusi Loisto is "New SL" and Tasku Loisto is "Pocket SL".

▶ VEIJO PÄTYNEN & RIITTA SAIRINEN

Piekka generalizes topographic data for small scale maps

An application for vector-based generalization of geographic data was developed at the National Land Survey of Finland and has been used for the production of small scale maps for a couple of years now. The quality of map databases as well as the efficiency of the production process is well improved.

Until 2006, the production of digital small scale maps at the National Land Survey of Finland was organized as separate production lines of each map scale. The 1:100 000 scale map was generalized from the Topographic Database of 1:10 000, but the rest were scanned and vectorized from printed maps. The needs of the customers of that time were fulfilled, but the suitability of the produced digital maps for present-day needs would have been inadequate.

A far automated process

The development project of the new production system was carried out in 2003 – 2006. Three system designers and three application developers worked in the project that created the generalization application called *Piekka*. The basic idea of the production system was to avoid interactive work on the generalization and to use automation whenever it is possible. The production process is general in a sense that it is not intended for any specific map portrayal.

The generalization application is based on ArcGis by ESRI. The ArcObjects technology provides a wide component library for developing your own generalization tools. The tools in Piekka are developed using Visual Basic and C# scripts and integrated into an ArcMap application. The database format is ArcGis FileGeodatabase. In the database, the topological relationships between features are maintained with ArcGis topology tools.

The whole generalization process is done in vector format. The tools can be used for the generalization of different scales after the parameters of a desired generalization step have been defined.

Selection by ▶ Attributes of features ▶ Length or size
Grouping together ▶ Reclassify attribute values
Collapsing feature type ▶ Polygon à line ▶ Polygon à point ▶ Line à point
Eliminate smaller than regional minimum
Model-based river network selection
Line fusion and line merge
Polygon aggregation (fusion, merge) using control rules
Removing branch lines under minimum length
Simplification ▶ Simplify bends ▶ Straighten twists
Displacement of buildings lying near road line ▶ Move from nearest ▶ Move to nearest
Typification of dense building clusters (maintain the general pattern of buildings shown in their approximate locations)

Table 1: The generalization tools of Piekka.

The Piekka application contains all necessary generalization tools for the selection, simplification, combination, collapse, typification and enhancement of points, lines and polygons. The tools are listed in *Table 1* below. They include tools for both automated and interactive editing.

Parameters control the generalization

The parameters of the generalization steps are based on the minimum sizes or widths of objects or the minimum distances between objects, depending on the desired scale of generalized data. All parameters for controlling the generalization process are pre-defined and stored into the tables of a separate control database. This ensures that all data are generalized in the same way and the users of the system cannot use wrong parameter values by mistake.

Many functions of the Piekka application are based on finding and exploiting the center lines of polygons; Delaunay triangulation is applied to find these center lines. For instance, there is a tool for collapsing narrow rivers represented by polygons to lines. This tool finds narrow sections of river polygons, automatically creates the center lines and connects lines to tributaries, and then deletes the redundant river polygons. This is shown step-wise in *Figure 1*.

The tools for polygon aggregation, especially, are very versatile. All the different classes of land cover (agricultural areas, rocky areas, wetlands, etc.) can be generalized in the same process as the application

Figure 1. Step-wise collapse of narrow river polygons.

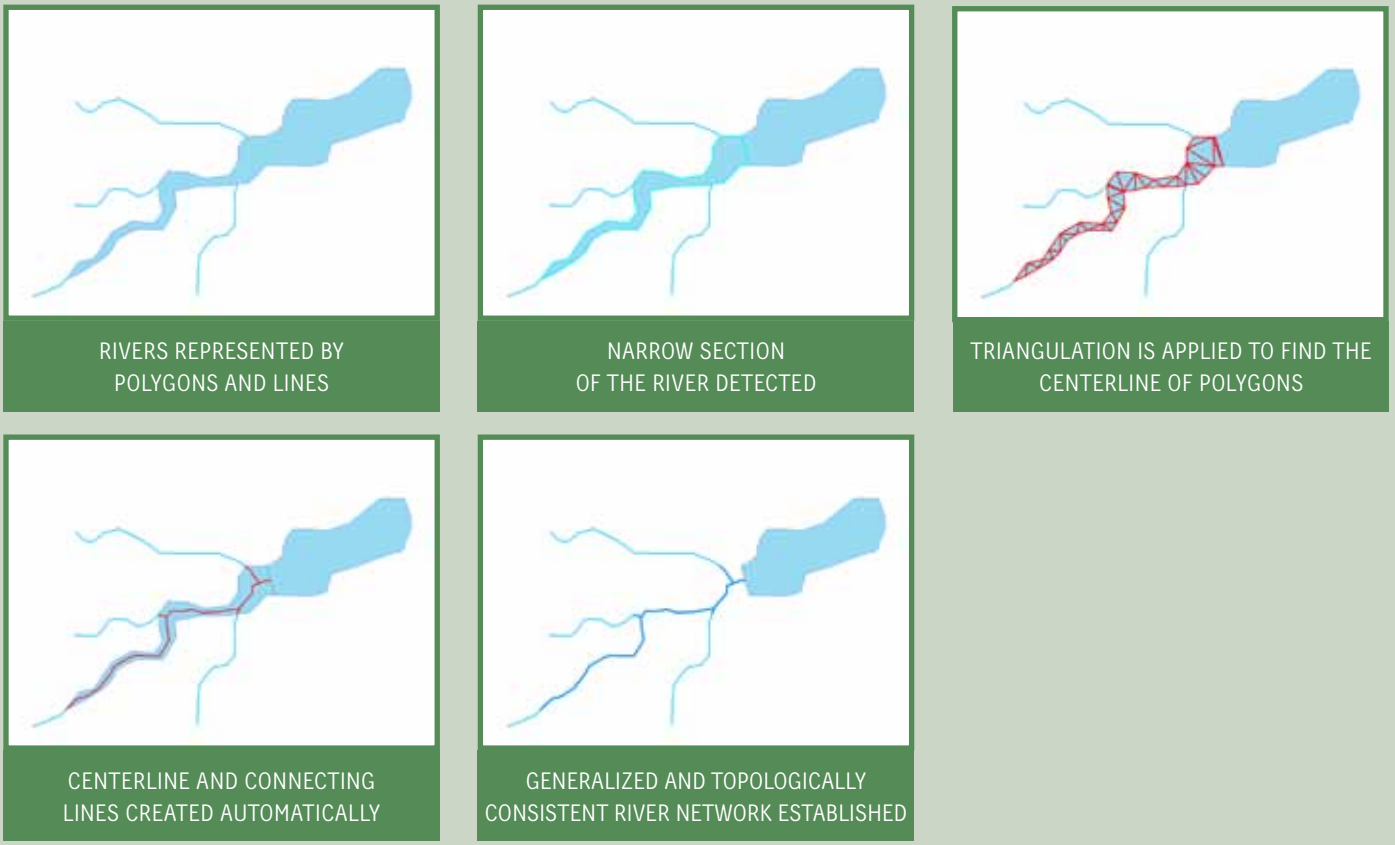
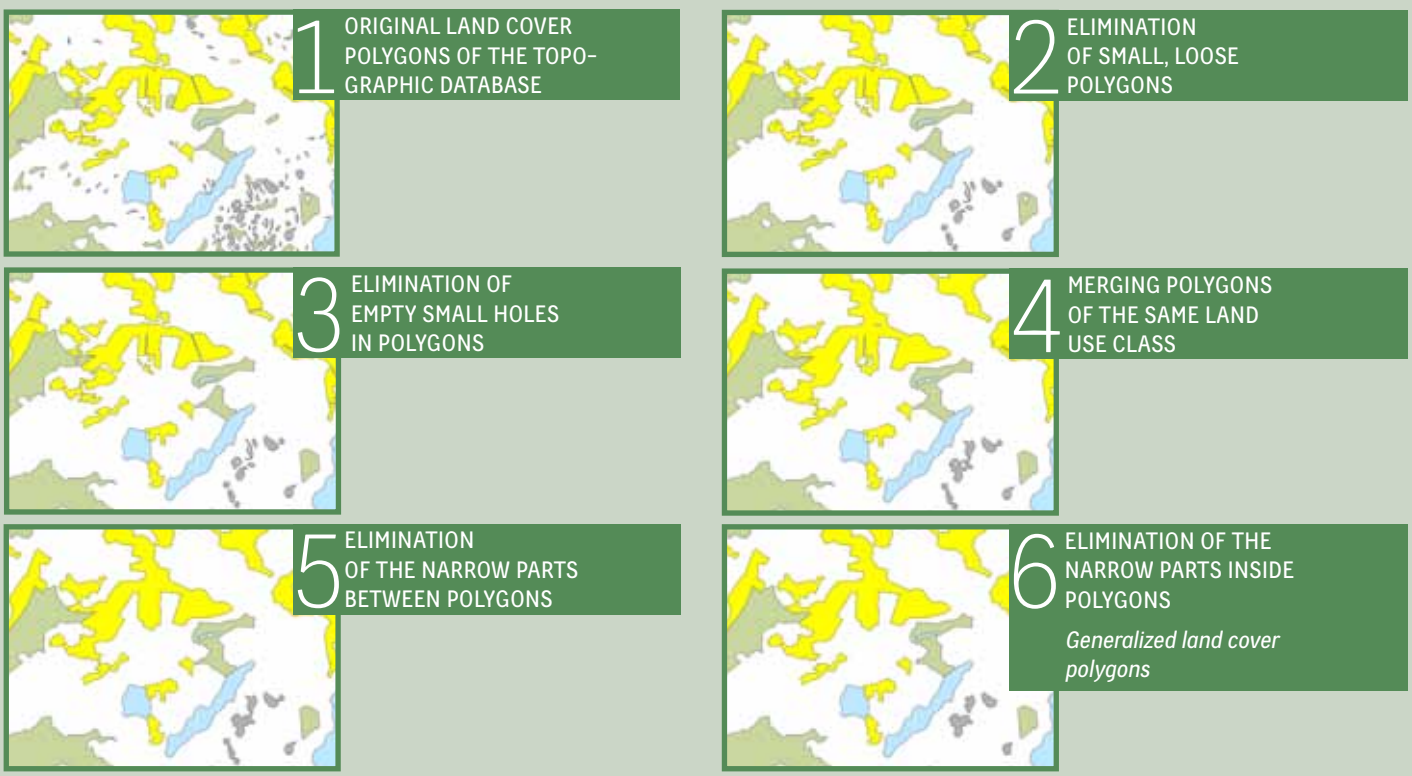


Figure 2. The generalization process of land cover data shown stage by stage from the original data to the generalised polygons.



controls the priority and processing rules of different area classes. The rules for controlling the process are pre-defined and stored into a separate table of the control database.

The different types of rules are:

- ▶ Priority rules
  Specifying the importance of features
- ▶ Geometry rules
  Concerning distance, size, or shape
- ▶ Blocking rules
  Preventing areas to spread over certain areas
- ▶ Similarity rules
  Allowing fusion of similar features

Figure 2 shows the stages of the generalization process of areas in different classes of land cover.

Two map databases are produced already

The source data for the generalization is derived from the Topographic Database that incorporates the most accurate geographic data about the Finnish topography corresponding the scale of 1:10 000. In the first phase, the 1:100 000 scale map database was produced. The full coverage of Finland, 390 000 km², was achieved at the end of 2009. The production continued with the 1:250 000 scale map database that was generalized from the 1:100 000 scale data. This database was completed at the end of 2010. Production continues with the map databases of scales 1:1 million and 1:4.5 million. Around 10 operators are involved in the production.

Efficiency of the new process is remarkably better than that of the old production system. The Piekka application enables the establishing of homogeneous, high-quality small scale databases that cover whole Finland. The application can be used for the generalization of different scales just by defining the parameters. The Piekka application in its current form is intended for the creation of databases. Development work for an appropriate maintenance system of these databases is still to be done. ◀

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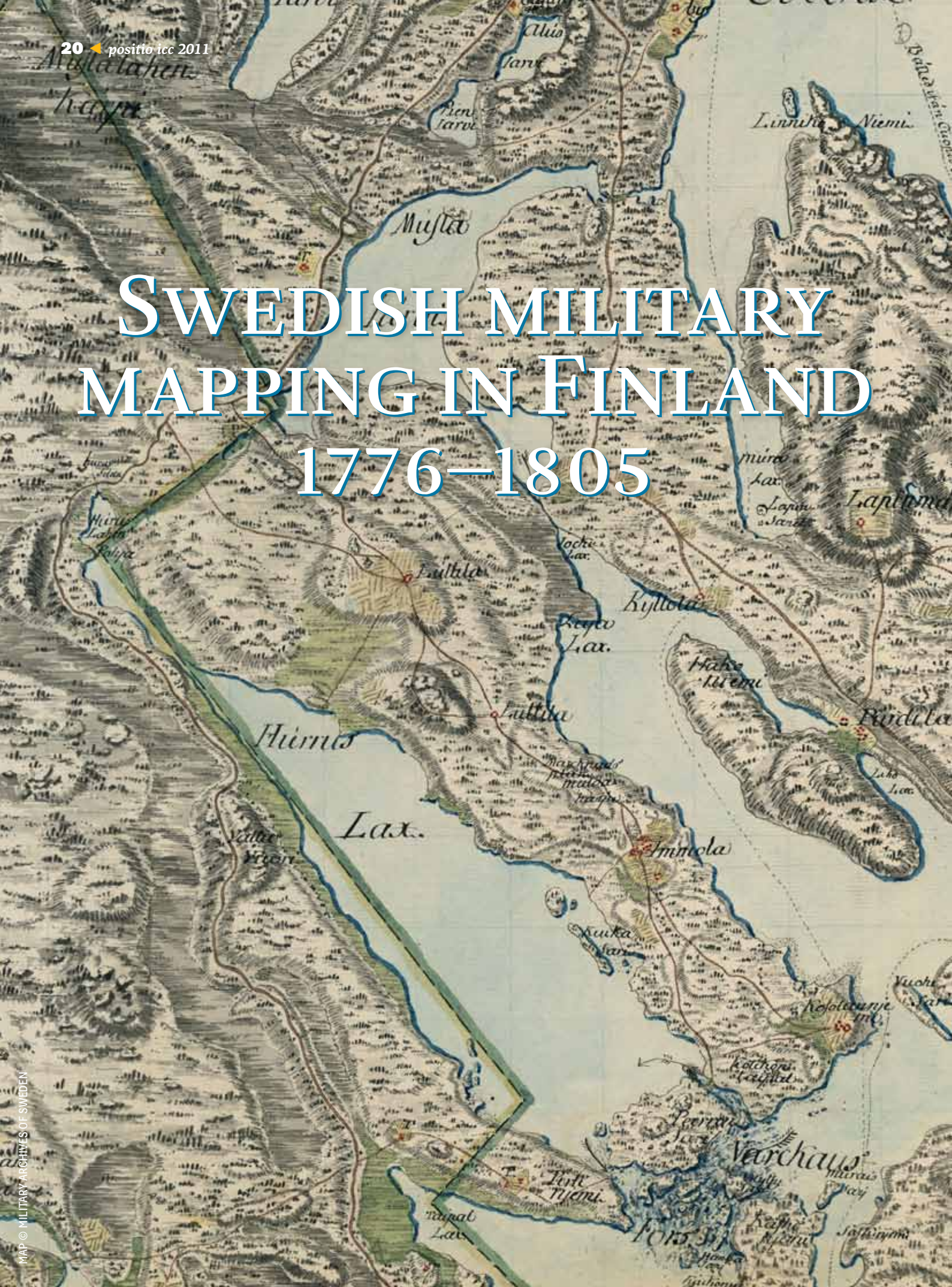
Swedish military mapping in Finland 1776–1805



▶ ERKKI-SAKARI HARJU

Topographic maps of the scales from 1:20 000 to 1:160 000 have been found in the Military Archives of Sweden, and research on them is now giving new information about the 18th century mapping of Finland.

The Swedish military carried out a large military mapping in Finland during the years 1776–1805. This mapping is not at all well known, one reason perhaps being that practically all maps that are left are located in Stockholm, Sweden, in the Military Archives. Now the maps have been found again and the research on them has started.

Large scale topographic maps were found very important in the military operations of Sweden during the 18th century. The art of map making had been learnt during the era of Sweden as a Great Power from Middle-Europe, mainly from Germany and France. The production of military maps was based on the updating of civilian, mainly cadastral maps, with the important military objects.

The military mapping in Finland started on 7th August 1776 by the order of King **Gustaf III**. The primary area of the mapping was in southern Finland, the lands west from the river Kymijoki that was then the border to Russia. Colonel **Fredrik Jakob Nordencreutz** was ordered as the chief of this mapping area. The other mapping area was in Savo, where Colonel **Göran Magnus Sprengtporten** had started the mapping of Savo and Carelia areas without an order from the king. In 1781, the mapping areas were incorporated and Colonel **Carl Nathanael af Klercker** was nominated as the chief. The mapping area was enlarged and was now over 110 000 km² extending from the Bothnian Bay to Lake Ladoga and from the Gulf of Finland to the line of Pori–Tampere–Jyväskylä–Kuopio–Joensuu.

The military mapping produced map series in a standard sheet division system on the scales of 1:20 000, 1:40 000, 1:80 000 and 1:160 000. In addition, the officers produced special maps of objects with military interest on the scales of 1:4 000–1:10 000. A special group of maps were the reconnaissance maps from Russia. The volume of the maps was remarkable as the number of map sheets of 1:20 000 and 1:40 000 scales was approximately 1250 and the number of map sheets of 1:160 000 scale was 64. The maps were not printed; normally 3–4 fair drawn and colored maps per one sheet were produced. The sheet division system based on the map sheets on the scale of 1:20 000. The origin located at the Svartholm fortress close to Loviisa and extended from there as a rectangular system to West and East and to North.

In 1790, the mapping area was extended to cover the coastal areas of the Gulf of Finland. Gustaf III had modernized his navy with ships that were capable of moving in the shallow waters of the archipelago. These ships needed exact maps from the shoaly waters that are typical in the archipelago. By 1796, the coastal waters were mapped and plumbed from the mouth of the river Kymijoki to the Porkkala peninsula on the scale of 1:20 000.

The field work was completed on manuscripts of 1:20 000 scale. For the military purposes the manuscripts were updated with roads, settlements and names. Maps were fair drawn and coloured and filed in the Drawing Office of the Southern Mapping Area in Helsinki or in the similar office of the Northern Mapping Area in Kuopio. One set of the maps was sent to Stockholm to the Map Archives of the King.

When Sweden had lost the war against Russia, in the Peace Pact of Hamina on 17th September 1809 Sweden was ordered to deliver to Russia all military maps covering Finland. Maps were delivered, but not all of them. A part of the maps was still in the Map Archives of the King, from where they were later moved to the Military Archives of Sweden. Due to the deliveries to Russia, the map series are not complete. For example, the Southern Mapping area is covered both with the 1:20 000 and 1:40 000 scale maps, but the northern area only with 1:20 000 scale maps. Only one third of these maps are fair drawn, the remaining area is in the stage of manuscripts or maps are missing. The only uniform map series that covers the entire mapping area is the road map of 1:160 000 scale. Only one set of this map has remained. It consisting of nine map sheet assemblies glued on linen cloth. ◀

Part of the mapsheet XXVIII of Savo region in the scale of 1:20 000. The original mapsheet belongs to the Military Archieves of Sweden.

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ArcGIS Online provides a common platform to find, share, and organize geographic content and to build GIS applications. Through **ArcGIS.com**, the Web interface for ArcGIS Online, you can access maps, apps, and tools published by Esri and other GIS users, and share your own content with a broad community of users.

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BUILDING UP SPATIAL DATA INFRA-STRUCTURE

Easy access, common reference frame, standard interfaces.
Assessment and cooperation.

▶ RISTO NUUROS

Opening access to spatial data

Public administration possesses data that should be opened to the public and be reusable free of charge. Suggestions of this kind have gained support in the discussions about social development and in international connections. The National Land Survey has opened some of its datasets to gain experience for further actions.

The role of information as a basic infrastructure is included as one of the themes in the new national strategy of information society in Finland. The EU commission requires measures of the member states to improve the utilisation of the potential of public data. The enhancement of open data is considered as an important new element in the development of information society in Finland as well as in Europe.

Keen discussions

Open data is a widely discussed topic. The issue of open data is currently on the agenda of several administrative working groups in Finland. Discussions are essential in order to achieve a common understanding, but as an extensive network of actors is involved, the common decision-making becomes time-consuming. At the same time, the Ministry of Transport and Communications has published a guidebook on public data, which aims to explain how data resources can be opened up in a controlled manner.

Also the government is doing its share and has promised to define the policies that allow opening the information held by the public sector without jeopardising data protection. For this, the Council of State has given a resolution on improving the availability and promoting the reuse of public sector information resources. The aim is that digital information resources become openly available and reusable under clear and common terms of use that are equal to all.

The government believes this to promote innovation activities, the development of digital products, services and markets as well as the efficiency, impact and transparency of public administration and citizens' participation in decision-making. Promises are made to develop an open data infrastructure and maintain it by providing long-term funding. The implementation of the resolution will be assessed in the government programme drawn up after the parliament election held this spring.

Progress is slow?

Spatial data is an essential subject in this discussion. The PSI (Public Sector Information) and INSPIRE (Infrastructure for Spatial Information in the European Community) directives and their national implementation play an important part. However, open data is not a new subject as such. When discussions about the shared use of spatial data started in 1980's, the possibility of freely available data was debated. A firm belief is that sharing data held by the public sector free of charge is advantageous on the whole, but it is rather based on opinion than on facts. Some studies have been carried out over the years that have resulted in various effective estimates and there are a few examples at the international level. Open data still seems to strongly divide opinions.

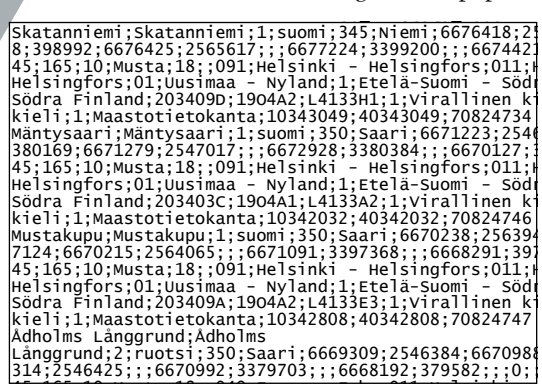
The progress of opening data has been slow partly due to the fact that after the previous economic recession a model was created to increase cost awareness and understanding of the fact that

always someone has to pay the costs. Presently, the public is aware that the data held by the public sector is not free of charge, but if desired, can be made available to free use. Several data systems are created on the basis of current data and their principles of use. Changes of these cause additional work and need for structural changes. Besides, it is difficult to give up and change established procedures.

Onward with pilot projects

So far, the assessments of open data are merely indicative. The use continues to increase in administration, and businesses provide product ideas on how to utilise free data. Final decisions on opening data – from the resolution through the government programme to legislation and budgetary decisions – take time, perhaps even years. However, it is not appropriate to stay put and wait through the whole process. What is now required is unprejudiced experimentation. Owing to wide public data resources of good quality and technical know-how, Finland seems to be in a particular position to become a trendsetter as an open data society.

The government resolution also encourages us to continue. Along with its preparation it was stated: ”Let’s launch pilot projects and follow experiments already in progress for improving the reuse of data held by the public sector, making in particular the proceedings or tools for assembling and distributing datasets and contents as well as opening and promoting reuse of popular data resources (for instance spatial and map data) the objects of assessment”.



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NLS is already experimenting

It is better to rely on experiments rather than on mental images, to encourage the utilisation of data and observe what happens. Some experiments are already being carried out in Finland in various administrative sectors. The National Land Survey (NLS) has recently opened the place name register and the one-to-one million scale datasets to be freely used in business and by citizens with extensive rights of use. The NLS has offered the *Citizen’s MapSite*, a service for viewing maps free of charge, for about 15 years. The public sector authorities are able to use the datasets of the NLS free of charge when carrying out official duties. The NLS also has experience of providing the municipalities with a chance to use its datasets free of charge for a fixed period of time. The use of data resources increases continuously. For instance, in 2010, the increase was 10 per cent.

The idea to expand the range of open data to spatial datasets is incorporated in the resolution of the Council of State. Related to this, the NLS is currently establishing in collaboration with the Ministry of Agriculture and Forestry whether the basic map data in raster form could be opened up in the near future under more open policy on pricing and conditions of use. Consequently, we could determine the effects of different alternatives in the pricing and availability policies, as regards this one particular dataset entity. The working group on pricing policy set by the Ministry of Finance has not yet provided their final proposals.

Ready to proceed

The basic map data is an entity of adequate size for experimenting. It is one of the essential spatial data resources supporting the digital services of public administration, and for its part, forms the foundation of the national spatial data infrastructure. The topographic database, on which also the basic map is based, is compared with the society’s basic registers in the Act on data administration.

Publishing open data is in line with the strategic objectives of the NLS, which aim at making data resources available to be used widely and increasingly by the public. Increased use means that more impact is derived from the investments made during decades on topographic data and the entire topographic data system. As to the NLS, required policies should be defined as soon as possible and a common will among the different actors should be found in order to achieve desired results. The results must be assessed, and consequently the use of map data has to reach the potential level. ◀

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▶ ANTTI RAINIO

National Geoportal in the core of the spatial data infrastructure

More than an overview of spatial datasets is available at the national geoportal of Finland. In addition to the basic services of geoportals, the Finnish portal enables design and publishing of embedded maps by building on the web service interfaces of many data providers at the national and local levels. Eventually, GIS is transforming little by little from systems to services.

The roots of the national geoportal in Finland dates back to 1980's when the first spatial data directory service was released. In the mid 1990s, the Map Site offering the browsing of topographic maps was opened in the Internet and since then the service has been one of the most popular web sites in Finland with annual 100 million map searches.

The National Geographic Information Strategy 2005 – 2010 set the target for the implementation of a national geoportal. The National Land Survey of Finland started a pilot project in 2008 and the pilot portal was opened in July 2009. The pilot portal was available for about one year while the national geoportal was under construction. The national geoportal of Finland, *Paikkatietoikkuna* in Finnish, was introduced in June 2010. The portal is composed of open source components and its development continues by agile system development methods so that several new functions have been released after the opening.

In November 2010, the portal won the Quality Innovation of the Year award in a competition organized by the Excellence Finland.

Map window for viewing data

The geoportal provides spatial data discovery and view services as well as guidelines for implementing the Inspire directive and for building the national spatial data infrastructure. In addition, the portal enables the publishing of embedded maps. All the services are free of charge which limits the supply of datasets to some extent.

Today, the map user interface is the most popular part of the portal offering the browsing of more than 150 different map layers provided by 20 data suppliers. They include both national agencies and major cities. The maps are available in various categories, such as terrain, real property, soil, land use, and transport networks. In addition to ordinary functionalities, the maps can be viewed as transparent layers on top of each other.

The view services are based on standard web map service interfaces (WMS). In addition, the portal enables standard web feature services (WFS) and browsing of features in an integrated view where data are visualized as maps and tables of attributes. The downloading of data for reuse is coming available, but the availability of data products will depend on licenses and user profiles.

The map window client running in a browser is supported by the geoportal server that takes care of rights management and visualization of features, for example.

Metadata is available for discovery

Metadata of spatial datasets have been collected in Finland at the national level since 1985. Today, the creation of metadata is based on the international standards and the European implementing rules. Now the metadata covers not only about 200 datasets but also some 30 service interfaces.

On the national geoportal, the browsing of the metadata is based on the standard Catalog Service for Web (CSW) interface, which allows all queries listed in the Inspire guidelines. The national metadata service is implemented by applying GeoNetwork that is an open source code library for the purpose. In 2010 in the Nordic cooperation project, GeoNetwork was developed further in order to reach better flexibility and modularity.

To users, the spatial data infrastructure manifests itself as data products available for reuse. The geoportal contains a schema service that allows the browsing of data product specifications including their xml-schemas.

Embedded maps bring benefits

The geoportal allows users to design embedded maps. Using the map publisher wizard, the user can choose background maps or ortophotos and other map layers to be included in the embedded map. Moreover, the publishers can customize the map size and even select tools like an index map, scale bar, address search etc. The usability is nurtured with the reliable principle "what you see is what you get".

The development of the design interface for publishers of embedded maps is challenging when the number of alternative map layers increases. It is even more challenging to integrate in the interface some functionality for analysis and visualizations that a publisher may want to offer to end users.

An easy-to-use map design service may stimulate partners to take benefit of the spatial data infrastructure. Depending on the national data policy the benefits are available for a minor or wider audience. Today the technology is not any more a barrier to apply spatial data. ◀

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SCREENSHOT © NATIONAL LAND SURVEY OF FINLAND 2011

GEOPORTAL BUILT UP WITH OPEN SOURCE CODE

The Finnish geoportal is implemented by applying open source code libraries and the results of the development are available as open source code under EUPL or MIT licenses. The portal is based on the Liferay platform and the map window portlet is built up mainly with the OpenLayers and the Ext Java Script code libraries.

INSPIRE IN FINLAND

Legislation
- ▶ SDI law 17.6.2009, SDI act 12.10.2009
- ▶ concerns 20 national agencies and all municipalities

National Council for Geographic Information
- ▶ representatives of seven ministries, municipalities and enterprises

National Inspire Network
- ▶ 300 experts, 140 organisations, 6 working groups

National SDI strategy 2010 – 2015
- ▶ high quality data, smooth cooperation, improving processes, research and training

Technical guidance
- ▶ administrative recommendations on the spatial data sharing

▶ JAANA MÄKELÄ

GIS maturity model as a tool for developing the utilisation of spatial data

Implementation of the INSPIRE directive enables the extensive use of spatial data. However, are the user organisations ready to take advantage? A GIS maturity model is a tool for the user organisations to measure their capabilities in the utilisation of spatial data resources and to set development targets.

The implementation of the INSPIRE directive and the national spatial data infrastructures enable the extensive use of spatial data both in public organisations and in private companies. Organisations can improve decision making, increase productivity or develop new products and services by spatial data when they get an easy access to the data. However, many factors in the organisations may hinder the utilisation of spatial data in full extent.

The capabilities of an organisation can be assessed by a GIS maturity model. A maturity model provides a formal framework for the assessment. It defines the levels of GIS maturity that describe the capability of a user organisation to utilise spatial data and related technology in order to realise its business goals. The level of maturity has a direct impact on the extent of social and economic benefits that the organisation is able to achieve.

We are developing a GIS maturity model at the Aalto University based on IT maturity models and research on what matters in GIS maturity and its evaluation. The SDI utilisation group of the Finnish Inspire Network has been actively involved in the development of the model. The testing of and feedback on the model from pilot organisations have been invaluable in the development.

JAANA MÄKELÄ IS PREPARING HER DOCTORAL THESIS AT AALTO UNIVERSITY ABOUT ENHANCING THE USE OF SPATIAL INFORMATION IN COMPLEX SYSTEMS. SHE WORKED OVER TWO DECADES IN BUSINESS OF GEOINFORMATICS BEFORE RETURNING TO ACADEMIA.

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Enabling and disabling factors

The SDI utilization group carried out a survey that gave valuable information for the development of the model. 86 public organisations that use spatial data answered a questionnaire. The organisations were asked to name factors that enable or disable the utilisation of spatial data in their activities. Almost half of the respondents named the lack of both financial and human resources as the largest constraint. The second largest obstacle was the lack of competence of employees in using spatial data in their duties. Also, the lack of information about the availability and benefits of spatial data was named as an internal obstacle as were the uninterested attitudes, old practises and lack of cooperation.

On the other hand, the respondents named an enthusiastic atmosphere, employees' skills and activeness and good internal and external cooperation as enabling factors in the successful utilisation of spatial data and services. All actions that make the availability of spatial data easier were stated to increase the utilisation. Many of the respondents stated that the support of management is a prerequisite for the growth of the utilisation of spatial data and technology.

Five levels of GIS maturity

A GIS maturity model can be used not only to assess the current GIS maturity of an organisation but also to set a target level for the future development. The content of our GIS maturity model is based on theories on maturity models, systems thinking, systems intelligence, and the results of the survey. The maturity model embodies those key areas and subareas that are identified to be meaningful to the development of GIS maturity.

The maturity model takes into account both the enabling capabilities and the execution abilities that are vital for the utilisation of spatial data. The key area of *IT architecture* includes sub-areas such as spatial databases, applications and technologies that enable the use of spatial data. The second key area *processes and services* reveals how extensively an organisation uses spatial data in internal processes or in customer services. If the maturity of the third key area *capability* is high enough, the organisation is able to execute its vision of a spatially enabled entity. The *capability* includes sub-areas such as leadership, communication, competence, and cooperation. For example, human capability includes both the technical competence of using spatial data and technology and the will of promoting the utilisation of spatial data to potential users. Cooperation means the capability of an organisation both to cooperate internally and to network with different stakeholders.

The model comprises five levels of maturity. An organisation can increase its

maturity from the ad hoc to coordinated and finally to the strategically optimised utilisation of spatial data. The maturity model defines level by level those factors in every sub-area that must come true.

Some examples of the contents of the maturity model:

- Level 1 – The utilisation of spatial data is dependent on one or few enthusiasts. (Human capability)
- Level 2 – The discussion about the benefits of spatial data is confined to one single line of business. (Communication)
- Level 3 – The versatility of spatial data has been identified. All processes in which spatial data are utilised or could be utilised have been documented. (Processes and services)
- Level 4 – A strategic plan directs the comprehensive use of spatial data in the organisation and the development of competence of the potential users. (Leadership)
- Level 5 – The organisation provides user friendly ontology-based services for spatial data discovery and assessment. (Spatial databases)

The future target level of GIS maturity is always organisation-specific because the business goals of organisations are different and thus their needs to utilise spatial data are divergent. The target level should be chosen to be achievable and reasonable for the organisation.

"We have never discussed together so much about the possibilities of spatial data"

Six organisations that are members of the SDI utilisation group have tested the model and assessed their GIS maturities. The detailed results of the evaluation are not yet available, but the general feedback from the organisations has been very positive. Those who were in charge of the GIS maturity assessment founded out that the assessment process gave them a good reason to talk about spatial data and technology with the managers of business. One of them commented that "we have never discussed together so much about the possibilities of spatial data in our organisation". At the same time, participants were astonished about how differently spatial data users, spatial data professionals and managers evaluated the level of maturity of certain sub-areas.

The Finnish Inspire Network is planning to use the maturity model as a tool for measuring the development of the national spatial infrastructure. Therefore, a user friendly Internet version of the maturity model will be implemented. Then every organisation has a possibility to assess its GIS maturity and compare their results with those of similar organisations. More details of the model and the maturity assessment will be published later in a scientific paper. ◀

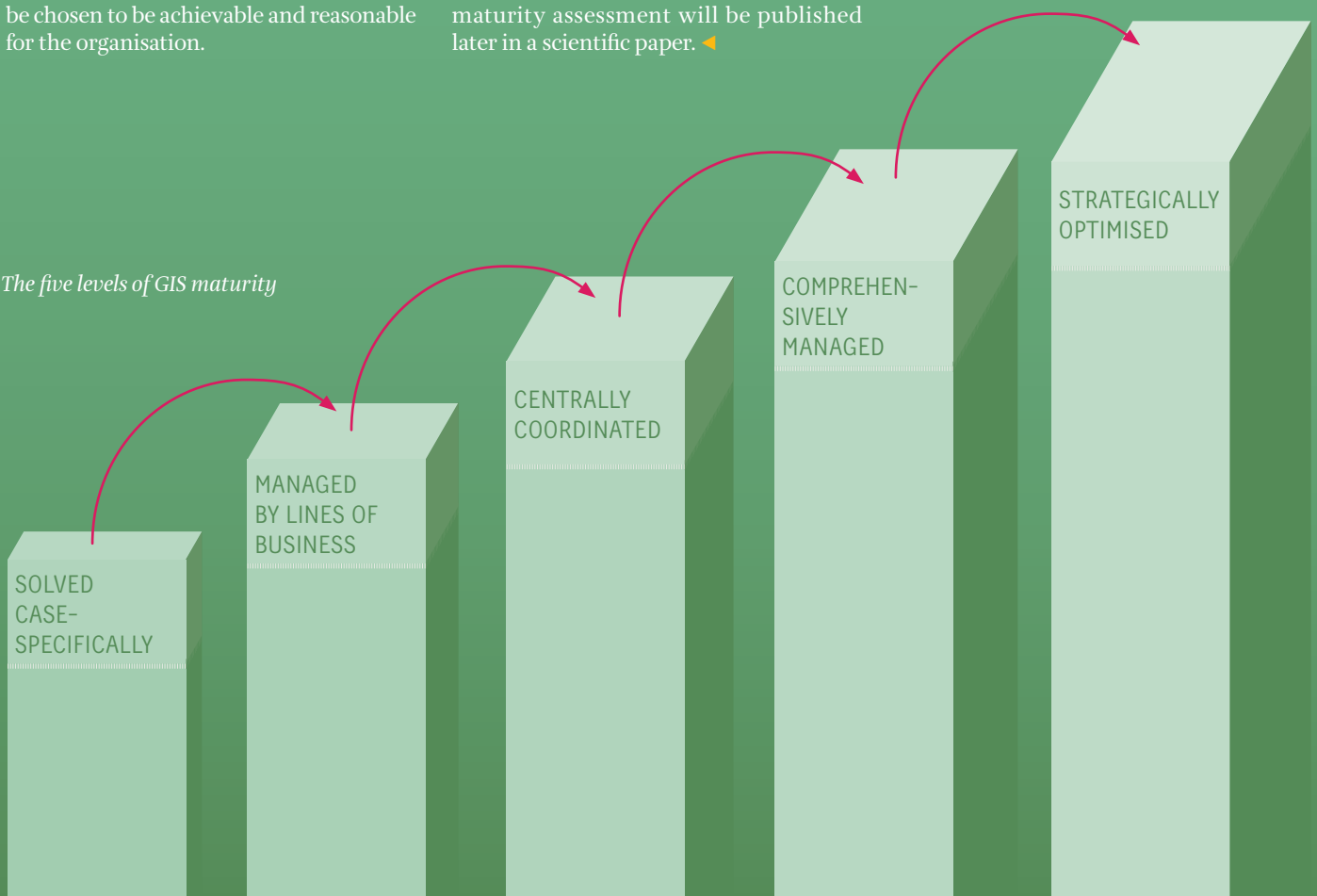
AALTO UNIVERSITY

Established in 2010, the Aalto University is a new university with centuries of experience. It was created from the merger of three Finnish universities: The Helsinki School of Economics, Helsinki University of Technology and The University of Art and Design Helsinki.

The combination of six schools, four of them representing technology opens up new possibilities for strong multidisciplinary education and research. The new university's ambitious goal is to be one of the leading institutions in the world in terms of research and education in its own specialized disciplines.

Teaching of cartography, geoinformatics, geodesy, photogrammetry and remote sensing is given by the Dept. of Surveying in the School of Engineering, but research relating to geoinformatics is wide spread in the University.

www.aalto.fi/en/

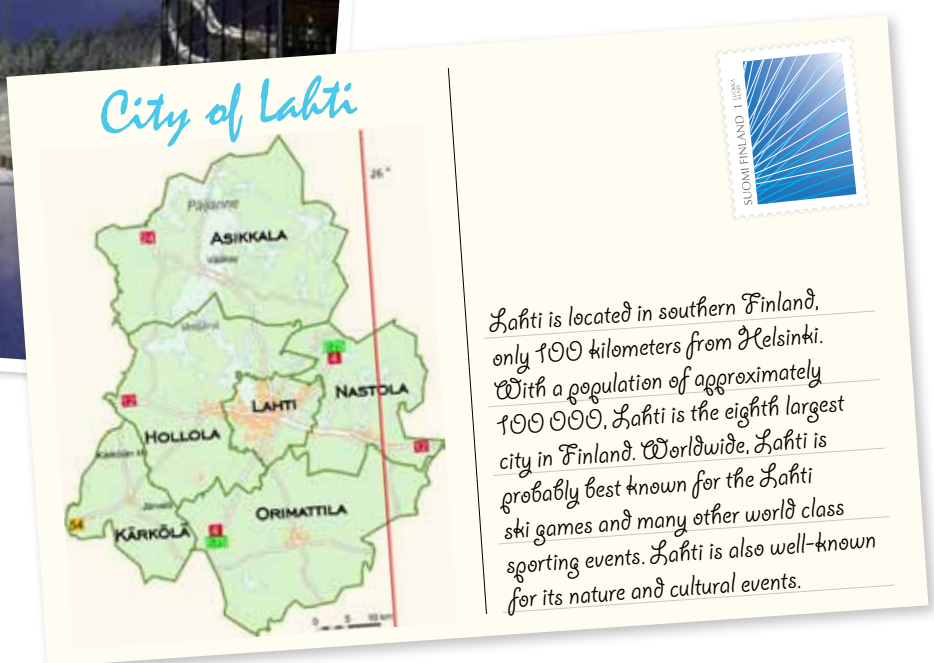


The five levels of GIS maturity

Lahti leads the way in the transformation of local coordinate systems

A new reference frame EUREF-FIN and a new national height system N2000 in Finland keep surveyors busy. Transformation to the new systems is a current project in several Finnish municipalities. The city of Lahti is giving an example.

▶ PETRI HONKANEN



PETRI HONKANEN
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Increasing regional co-operation and consolidations of municipalities have created the need for the harmonization of spatial data and the introduction of common coordinate systems. The municipalities of the Lahti region have carried out long term GIS co-operation. One of the main projects has been the creation of a common GIS database for all these municipalities.

The main requirement of a common GIS database was the quantification of common coordinate and height systems in the area of co-operation. Originally, the municipalities of the area used the old national grid KKJ and the local system of Lahti as their plane coordinate systems and N60, N43 and the so called Lahti system as their height systems. Land in Finland rises approximately 3 – 9 mm annually. The uplift alters heights, and this is the main reason for updating the height systems.

First the plane coordinates

The city of Lahti was the first Finnish municipality to begin the EUREF-FIN transformation process in 2004. In the first phase, the land use department of the city of Lahti measured EUREF-FIN coordinates to the 10 first order control points in its area. The network was connected to FinnRef ® that is a network of permanent GPS reference stations, the backbone of the Finnish realization of EUREF. Transformation between the new and the old systems was carried out by a 7-parameter affine transformation. Helmert transformation parameters were determined for later use as well. The RMS values of the affine transformation were calculated as 19 mm.

Because of the lack of practical references, the basics of the transformation and its testing were carried out on an extensive scale. One of the main interests was the changes in the areas of real estates caused by the transformation. The areas were investigated and compared between the old and new systems. Relative changes of the areas turned out to be 0.182 ppm. In practice that means that the area of an ordinary 1000 m² real estate decreased by 0.09 m².

Testing included the measuring of the plane coordinate network of Lahti. The results showed that the network is homogenous and there was no need for local transformations. So Lahti was the first Finnish municipality to introduce the EUREF-FIN coordinate system with ETRS-GK26 projection in November 2005. In 2006, the land use department of the city of Lahti executed similar transformations in other municipalities of the area of co-operation.

Then the height system

During 2008, the National Land Survey measured enough N2000 height control points in the area of the city of Lahti and the transformation of the height system could be carried out. The height difference between the Lahti system and N2000 was solved by leveling N2000 heights to the 94 control points of the Lahti system. The height difference was determined to be 382 mm. Leveling showed that the height network was homogenous and the transformation could be carried out by using one rigid vertical correction for the entire city area. The GIS database of the city of Lahti was transformed to the N2000 system in January 2010.

A laser scanning of the area was carried out in parallel to the transformation process, and now the city has an accurate elevation model and contours of 1 meter interval in the new height system.

The transformations of the height systems in the other municipalities of the co-operation area are being realized this year. They are carried out again by the land use department of the city of Lahti. The experience gained during the transformation process in Lahti can be applied.

Information campaign proved useful

EUREF-FIN has been the operational coordinate system in the city of Lahti now for more than five years. Before the transformation procedure, the city ran an extensive information campaign aimed at planning and construction industries as well as the general public. Because no major problems appeared after the transformation, it seems that the campaign was worth the effort.

The common plane and height systems have benefited subsidiary and private companies working with GIS-solutions in the Lahti area. Dealing with many transformations is now unnecessary when only one plane and one height system is in use in the operational area. Also data transfer between the municipalities and governmental institutions is now more straightforward than it was when dealing with m any local coordinate and height systems. ◀

EUREF-FIN is the Finnish realization of the European ETRS-89 reference frame.

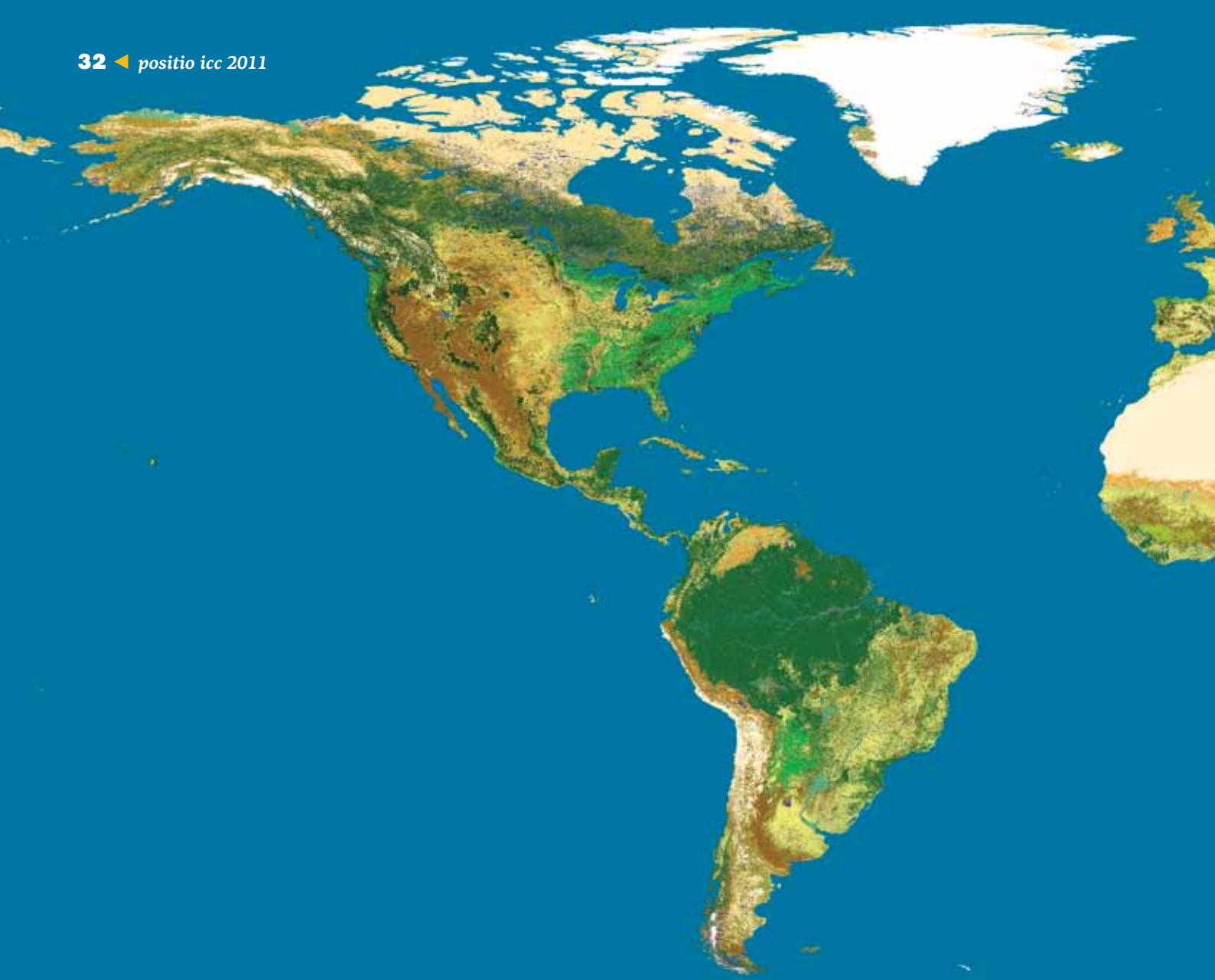
ETRS-TM35FIN is a coordinate system used with EUREF-FIN and intended for small scale mapping. It is based on the transverse Mercator projection. One projection zone of 13 degrees covers the whole country. The central meridian of the projection zone is 27°.

ETRS-GKn is a coordinate system used with EUREF-FIN and intended for large scale mapping. It is based on the Gauss-Grüger projection and the projection zone is recommended to be one degree wide in maximum. Letter n gives the zone number of the central meridian. So ETRS-GKn consists of 13 zones that cover the whole country.

FinnRef® is the fundamental EUREF-FIN network in Finland, operated by the Finnish Geodetic Institute.

N2000 is the new Finnish national height system. It is based on the Third Levelling of Finland that was carried out during 1978–2006. N2000 is the Finnish realization of the European Vertical Reference Frame 2000 (EVRF2000).

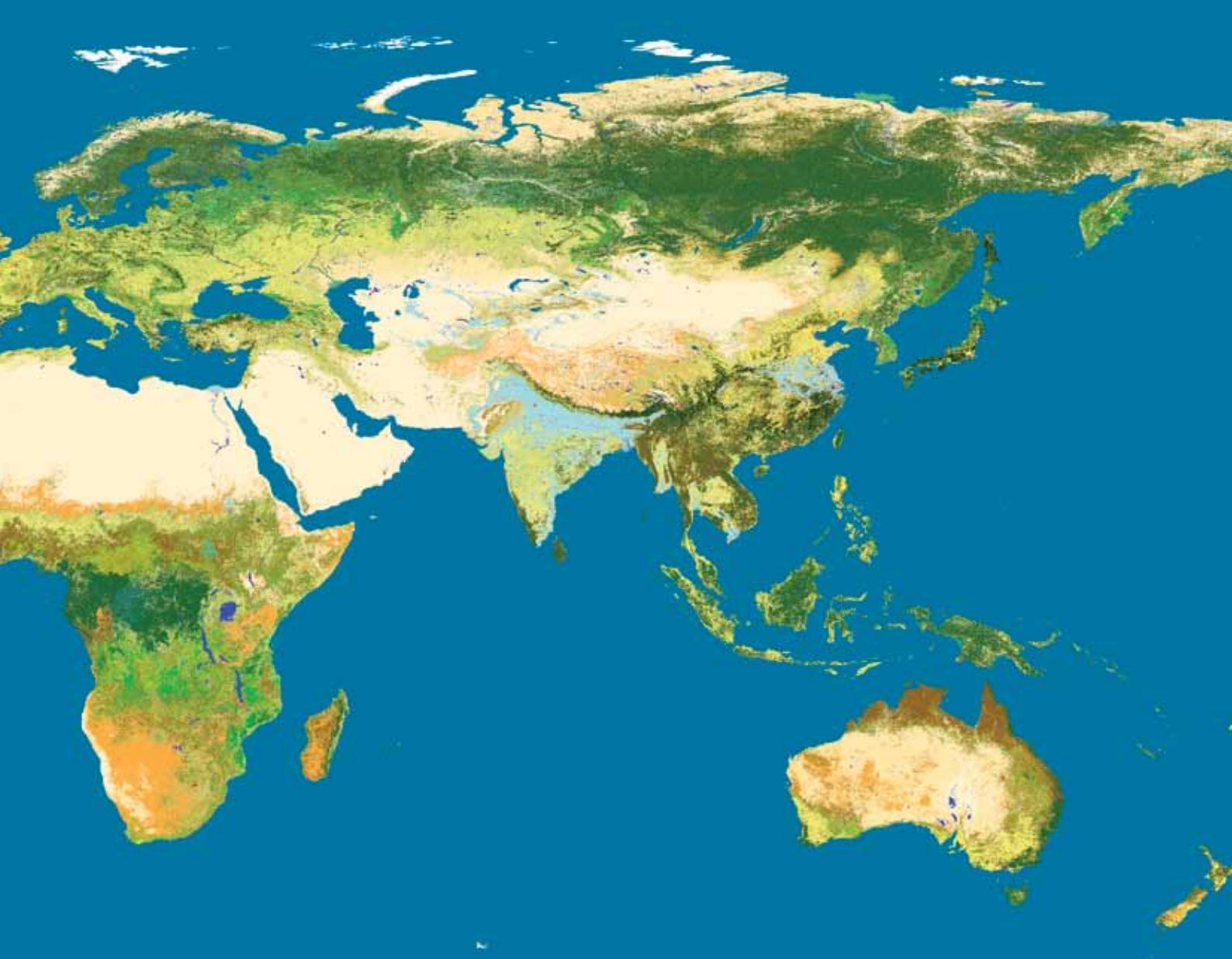
EUREF-FIN, ETRS-TM35FIN, ETRS-GKn and N2000 are defined in the public administration recommendations JHS 153, JHS 154 and JHS 163.They also provide transformation parameters and formulas.



▶ TUOMAS HÄME

Global forest mapping for carbon sink assessment

Natural resources satellites that circulate the globe frequently collect images that can be used for forest monitoring from local to global extents. VTT Technical Research Centre of Finland is developing a satellite image based forest monitoring system that improves the accuracy of forest resources assessment from satellites. The system is developed in the Recover project that is VTT led study with an international consortium.



The world's total forest area is just over 4 billion hectares, which corresponds to an average of 0.6 ha for every man. The forests store 289 gigatonnes (Gt) of carbon in their biomass alone. However, the global carbon stocks in forest biomass decreased by an estimated 0.5 Gt annually during the period 2005–2010. The main reason for this is considered to be the reduction of the tropical forest area. In Europe and Asia, the forest area has increased.

Forest is decreasing – or is it?

The most reliable statistical data on global forest extent comes from the Forest Resources Assessment of the Food and Agriculture Organization (FAO) of the United Nations. The assessment is based on questionnaires that are filled in by the UN member countries. The quality and time of information collection vary from country to country.

The information becomes more unreliable when characteristics more complex such as the biomass are concerned. Some researchers think that increased forest growth largely has compensated the carbon reduction by deforestation. On the other hand, particularly the tropical forests are degrading. This means that the ground remains forested but the biomass has permanently decreased. Deforestation and forest degradation are estimated to contribute for more than 15 percent of global greenhouse gas emissions but the figure is uncertain.

Natural resources satellites that circulate the globe frequently collect images that can be used for forest monitoring from local to global extents. An attractive idea is just to make a satellite image map of forests and forget the laborious and expensive forest inventories and questionnaires.

Several global forest and land cover maps have actually been done. The most accurate global mapping so far has been made under a contract by the European Space Agency ESA. This map has 300 meter ground resolution.

However, the comparison of such a map and other coarser maps with each other and ground data has shown that although such maps are applicable

to give a general picture on forest distribution they are unreliable as a source of forest inventory data. Even the satellite maps with thirty meter ground resolution can include systematic over or underestimates of forest area, which endangers their use as a source of reliable statistical data.

SilvaSat helps forests to Recover

VTT Technical Research Centre of Finland is developing a satellite image based forest monitoring system that takes into consideration the drawbacks of the present methods. The principal idea is to combine satellite images that have a coarse ground resolution with a sample of very high resolution images. The coarse images can cover the whole area of interest "wall to wall", up to the whole globe.

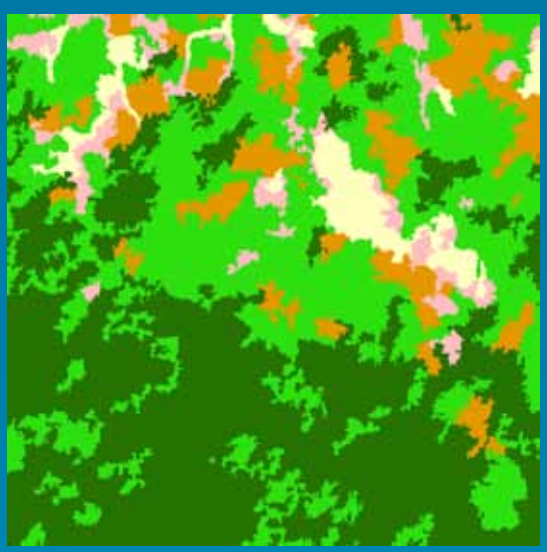
The sample of accurate images gives reliable information on the extent of forest area and the degree of degradation. With the help of ground measurements and possible airborne laser scanner data, also forest biomass can be estimated. Combination of "wall to wall" maps with the sampled information makes it possible to compute reliable statistical data on forests everywhere.

Presently, the very high resolution images are collected by commercial satellites on order basis and they are concentrated in urban regions. VTT has suggested launching a specific forest satellite, SilvaSat to collect the very high resolution image sample globally. Such satellite would cost approximately 50 million euros.

VTT is leading an international consortium to apply and further develop the SilvaSat concept and other methods for the monitoring of tropical forests. The project is funded by the 7th Framework Program of the European Commission. The team includes both research organizations and private enterprises. The project, Recover, started in November 2010 and will last three years.

The services that are developed by Recover are particularly meant to support the REDD program – Reduction of Emissions from Deforestation and forest Degradation. The REDD program is an effort to create a financial value for the carbon stored in forests. It offers incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. The Recover has its study sites and user partners in Latin America, Africa, and Oceania.

The methods that are developed can be applied globally to improve information on forest resources and their changes and thus to further sustainable forest management. ◀



LEGEND

- Natural forest
- Disturbed forest
- Scrub
- Cleared forest
- Farmland

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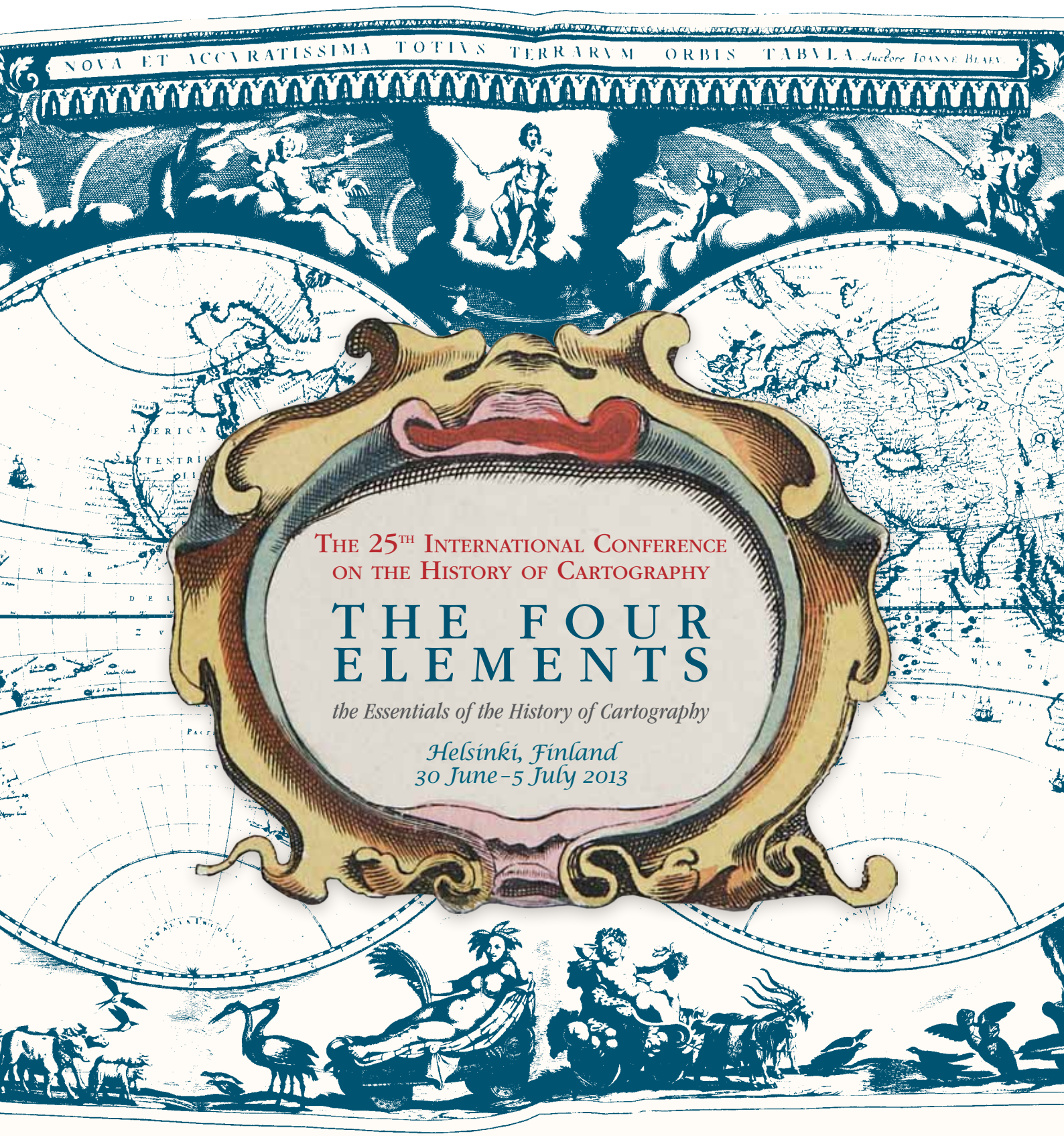

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