NEWS IN THE NATIONAL MAPPING PROGRAMIN SWEDEN

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Introduction

Several changes have during the last years taken place within the Swedish national mapping program. The introduction of a new reference system in 2007 was the start for several other changes, ranging from transformation of coordinates in all databases to the design of the printed map. At the same time new routines for updating of the databases were introduced, as well as a new technical environment and education of the staff.

Background

Lantmäteriet, the Swedish mapping, cadastral and land registration authority, was founded in 1628. It is a Government agency and its mission is to contribute to an efficient and sustainable use of Sweden's real property, land and water. The organisation has four main activities, which also form the organisational structure: Cadastral services, Land and Geographic information services, Land registration and Metria (working on a competitive, commercial basis). Swedesurvey is the overseas agency of Lantmäteriet.

The total staff amounts to approximately 2 000 employees at around 100 offices located throughout Sweden. The head office is situated in Gävle. See figure 1.

Some facts about Sweden
- 9 mil. inhabitants
- 450 000 sqkm
- 1570 km long
- Capital Stockholm
- Highest point 2111 m
- Forest ~60%
- 100 000 lakes

Figure 1. Facts about Lantmäteriet and Sweden

75% of the annual turnover is generated through fees and invoiced costs for real property formation, the use of information from databases and for consultancy services. The remaining

25% are core grants from Government and is primarily used for producing basic data and managing and maintaining registers and databases. Our clients are in central and local government sectors, in the private sector and amongst the general public.

Among some of the tasks of the department of Land and geographic information services are

- Geodetic research
- Produce databases containing geographic information and printed maps
- Make the produced geographic information available through retailers.

The national mapping program of Lantmäteriet includes databases, printed maps as well as web services for geographic and real property information. About every 10 years long term plans are decided and these plans are then broken down in more detailed annual plans.

During the last years several changes have taken place within the national mapping program. The starting point was the introduction of a new reference system.

News in the National mapping program in Sweden

New Reference systems and new map projection

Concurrent with the increased use of satellite-based surveying techniques (GPS/GNSS), the importance of globally adapted three-dimensional reference systems has also grown. With positions in the new Swedish three-dimensional reference system SWEREF 99 the coordinates can now be unambiguously determined and the exchange of data worldwide is made easier. Plans for this new reference system started many years ago and the preparations for its introduction have mainly comprised geodetic development work and the creation of a map projection. The new two-dimensional map projection has the name SWEREF 99 TM.

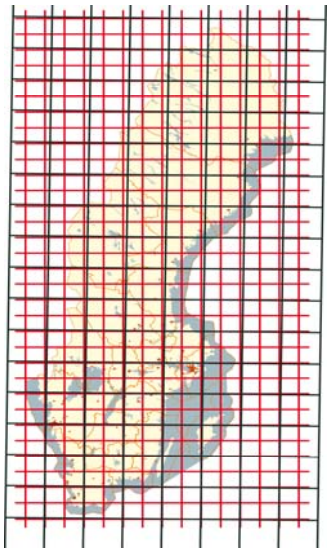

Figure 2. Comparison of the previous map projection (red) and the new map projection SWEREF 99 TM (black).

After a long period of planning, the successful transformation of most of the coordinates in the databases at Lantmäteriet took place in the beginning of 2007. Since the coordinates are many, and many people are involved in the daily updates of the databases, it was a challenge

of logistics to put all the pieces together and minimise interruption in the production. The last databases were successfully transformed in 2008.

The field work for the third national leveling program was completed in 2003 and the calculations were finished a few years later. The work resulted in a new height system, RH 2000, which was implemented in the geographical databases during 2008.

Changes in the map design

The products within the Swedish national mapping program are both analogue and digital. The production line is fully digital and we provide our costumers with the printed map on paper as well as digital files in vector and raster format. We also provide web services where the data is part of the service.

Unfortunately, the number of sold printed maps has decreased considerably during the last years. Due to this fact we had to try to find a more profitable way of publishing the official maps. When changing to the new reference system and map projection we consequently took the chance to introduce some changes in the map design. First of all we looked at the map format. Earlier the products and formats were according to table 1.

A digital plotter was purchased for Lantmäteriet almost 10 years ago. It has been used for printing the Property Map on demand. When the costumer places an order, data is retrieved from the databases, a printing file is automatically produced and the file is sent to the plotter for printing. The advantage is that the data is up-to-date and no storage of printed maps is needed. A possible disadvantage is that the costumer receives the map three to five days after the order has been placed and that the width of the printing paper is a maximum of 470 mm.

Since many of the maps in the different series are printed in a small number of copies and the demand of maps to be up-to-date is increasing, we decided to use the plotter instead of offset printing for three more map series. These series are now printed and stocked in small numbers. To enable printing in the plotter it was necessary to change to a new paper format. See table 2. We also chose to print on both sides of the paper. See figure 3.

Product	**Scale**	**Format of map image**	**Printing**
Property map	1:12 500	50x50 cm	Plotter
Topographic map	1:50 000	50x50 cm	Offset
Road map	1:100 000	50x50 cm 75x50 cm	Offset
Mountain map	1:50 000	4 various sizes	Offset
Mountain map	1:100 000	15 various sizes	Offset
General map	1:250 000	4 various sizes	Offset
Map of Sweden	1:1000 000	70x157 cm	Offset

Table 1. Products and previous formats.

Product	**Scale**	**Format of map image**	**Printing**
Property map	1:12 500	80 x 40 cm	Plotter
Topographic map	1:50 000	75 x 40 cm	Plotter
Road map	1:100 000	75 x 40 cm	Plotter

Mountain map	1:50 000	6 various sizes	Offset
Mountain map	1:100 000	4 various sizes	Offset
General map	1:250 000	75 x 40 cm	Plotter
Map of Sweden	1:1000 000	70 x 157 cm	Offset

Table 2. Products and formats for new map design.

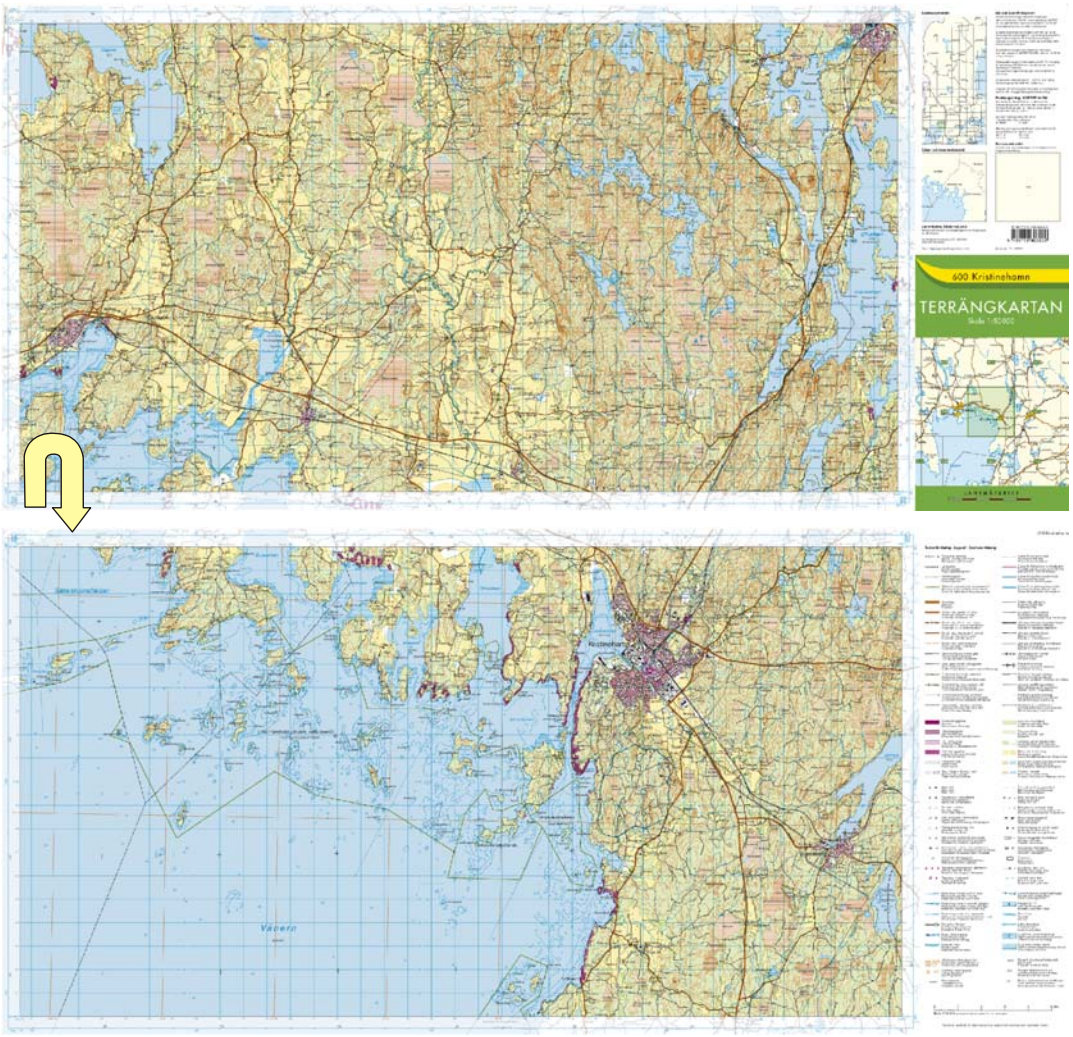

Figure 3. Design of the Topographic map.

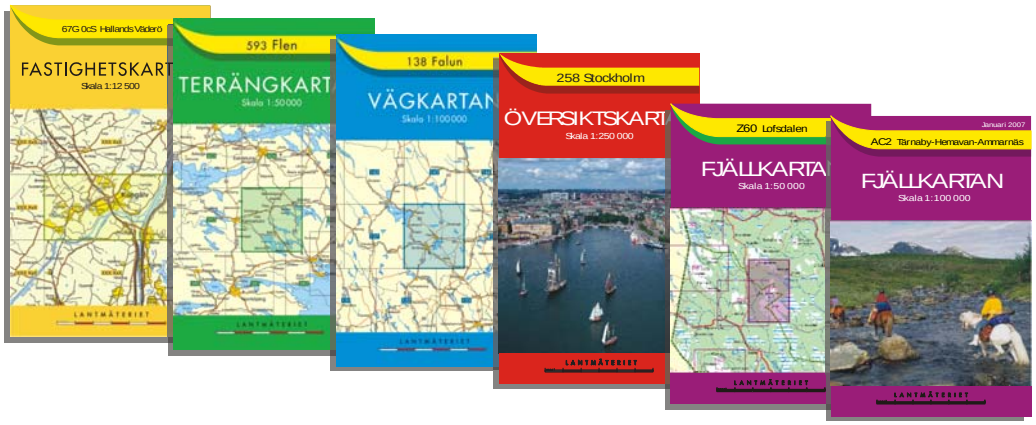

Figure 4. Design of the front pages.

The front pages of the map series were changed and now have the design shown in figure 4.

New routines for updating

The production and updating of the databases is based on aerial photographs. In 2006 Lantmäteriet introduced a new aerial photography program. It includes aerial photography and the production of air photos and orthophotos. One third of the country is covered every year. The average age of the photographs is three years, but the most urbanized areas are photographed more frequently and the sparsely populated mountain areas less frequently.

One use of the information from this program is to update the databases used for the national maps. With the possibility of having up-to-date photographs, the updating of the databases has increased considerably. Earlier the updating of a map sheet took place at several years intervals, usually 4-8 years.

Besides these periodic updates, a continuous thematic update of the databases now also takes place. The most popular themes are buildings, roads and administrative boundaries. Big efforts have also been made to initiate work in co-operation with other agencies for updating of the information. One example is that routines are now in use for co-operation with all municipalities in updating the buildings. Another example is the co-operation with the Swedish Road Administration for the exchange of road information. Co-operation with our neighbouring country Norway is also taking place for common digital national boundary at different scales.

New technical environment

Another change taking place is the change of technical environment. Software from ESRI has been used for the smaller scales for many years. We have now changed to ArcGIS and are also introducing it to the largest scale database. This change will take place in August 2009 and has been planned for several years. Many among the staff are involved in, or are affected by, this change. Having the same software for all the production lines will now enable us to get a more homogenous and effective production line.

ArcGIS is now allowing us improved topological checks. The software also enables data to be stored seamlessly, which in addition allows improved quality checks.

Conclusion

Technical changes and customer demands, together with new working methods, have brought many changes to our maps. Some can easily be seen in the design and the currency of the printed maps, while others are only known to us as producers.

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