

DIGITAL HISTORICAL MAPS IN PHYSICAL PLANNING

Klas Cederin and Mats Carlson
Kristianstad University
School of Engineering
S-291 88 Kristianstad
Sweden

Klas.Cederin@tec.hkr.se, Mats.Carlsson@tec.hkr.se

Background

The historical maps have become a more common and important source of information in administrative work within the cultural heritage sector in Sweden. The usage of historical maps has also increased in untraditional sectors, such as infrastructural planning, as the interest in environmental issues has increased in past years. The character of the historical map is that of;

- knowledge based background facts
- historical source
- indicator to environmental phenomena; biotic or manmade influences
- input to landscape analysis

As an artefact the map is easier to understand than commonly agreed values of culture heritage or environment.

Authorities that are engaged in physical planning has introduced geographical information systems (GIS) in order to process geocoded data. The historical map must be in digital form to fit in with the other data sources.

This paper describes how the historical maps are turned into digital form with scanning techniques. It discusses when the digital process is necessary and why digital historical map should be used in physical planning.

Historical Maps

Sweden has an extraordinary treasure of handmade large-scale historical maps. Since the systematic mapping of Sweden started in 1628, when a National Land Survey (NLS) [<http://www.lantmateriet.se>] was founded, a great number of maps have been produced. This gives us the possibility to visualise the development of the landscape and the settlements in rural areas. In a large number of villages mapping has been accomplished approximately every fiftieth year [Helmfrid, 1968].

The maps can be divided into two groups; the first group is small-scale maps (geographical maps) which gives valuable overview of parishes or counties. The second group, which is the major part of the archives, is the large-scale maps (geometrical maps) ranging from the scale of 1:4000 to 1:6000. These maps survey hamlets and farms in a very detailed way.

When the NLS was founded its aim was to increase knowledge about the assets of the country and to facilitate taxation. These early geometrical maps were archived in books, "Geometrisk jordeböcker". Normally only the infields was covered i.e. fields and meadows. A short text describes the size of the farmstead, sowing, productivity of meadows, pastureland, forests and other assets.

The major part of the handmade large-scale maps is redistribution maps produced between approximately 1750 – 1900. The aim of realotments was to increase production by replacing the scattered land-owning structure with larger units for every farmer. The design and the content of the maps vary over the years, but normally landuse, buildings and other physical features of importance are shown in great detail.

Ownership, areas and quality of the soil is listed in associated textpages.

Naturally the maps contain errors, both systematic and unsystematic. The fieldwork relied on simple instruments for measuring distance and angle. Much depended on the skill of the surveyor. Consequently, every map has an unique set of errors. But the maps have each one separately, often a very high standard of geometrical accuracy especially in the parts of the map that covers the infields.

Since 1628 Sweden has had recourse for a systematically production of detailed large-scale maps over hamlets and farms [figure 1]. It is in these aspects that Sweden is unique. Probably no country in the world can show such a well-preserved and systematic series of handmade maps. The maps are kept in different archives administrated by different authorities and libraries. Most of the maps are kept in an archive administrated by the NLS. The archive contains approximately 215 000 handmade maps from 1628 to 1973. There are also around 60 000 printed maps. The regional archives, situated at county administrations, contain more than two million maps. A large number of these maps have historical interest.

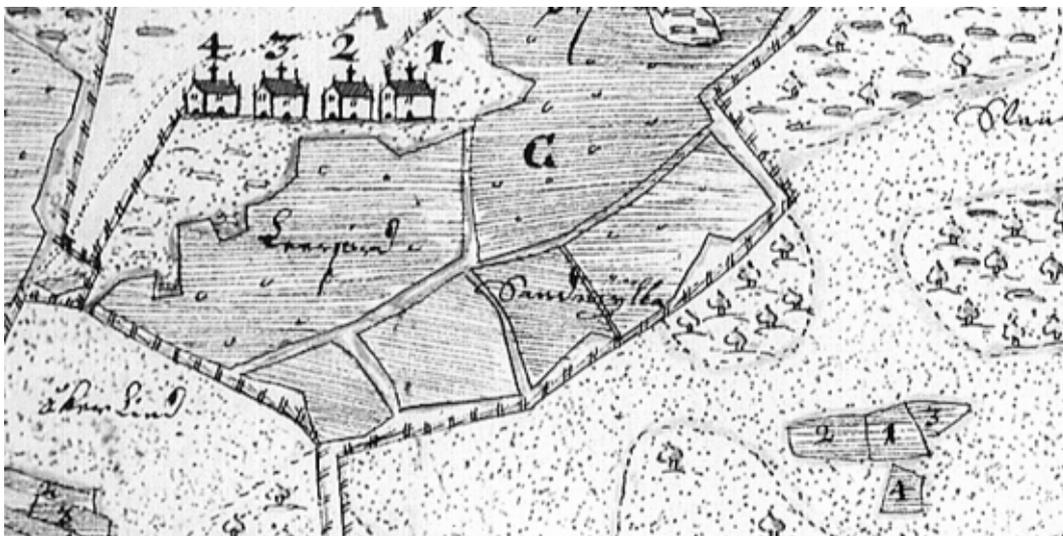


Figure 1 Large-scale map ("jordebokskarta") from around 1660, showing the village of Hamre. The fields are hatched with horizontal ink strokes resembling stylised furrows. The original scale is 1:5000

Historical Map Overlay

Historical maps and associated textpages have earlier, mainly in historical-geographical research, been used to reconstruct landuse, settlements and spatial structures in the landscape. In order to make the large amount of information in these maps more available; geographers have used the method with historical map overlays. In practice this was, in the beginning, a material of limited value. But the production of historical maps overlays increased. To make it possible to use the overlays for different purposes and by different users, the need for standardisation [Tollin, 1991] of these overlays became obvious and necessary. Methods and standards were developed at Stockholm University, Institution for human geography.

There were particularly three aspects on historical map overlays that were essential:

- The need of standardisation of content and design is necessary.

- The scientific accuracy must be of a high and equal standard. It is important that the quality of the content does not vary. It must be possible to form an opinion about the overlay as a scientific source
- The overlays must be registered (metadatabases) in a way that makes them accessible for scientists and physical planners

It is important to work with the original maps and not with copies. Copies are generally distributed in a reduced scale or in black and white. Normally, when the overlays are finished, they are reduced to the scale 1:10 000. These maps are geometrically corrected regarding different errors; for example error in angles (rectification). The historical map overlay, are also, which is very important, adjusted into the national grid (geocoded). The National Heritage Board (NHB) [<http://www.raa.se/index.asp>] together with the county administration has been involved in projects regarding farmland and its cultural heritage in order to receive funds from the European Union (EU). In this process the historical knowledge is transmitted via a historical map overlay made for each farmstead.

Historical Maps in Physical Planning

Recent years have brought a steadily growing need for understanding of and research regarding the historical content of the landscape. The landscape is a subject for intensive planning and legislation. Demand on land and natural resources is increasing. At the same time our knowledge and understanding of connections between economy, ecology, environment and human activities is also increasing.

Local and regional planning has earlier been directed towards facilitating settlements. Today the approach and possibilities are somewhat different. In Sweden, as well as in other countries, environmental laws emphasise the preventing of environmental problems together with ambitions to preserve and develop our build environment, rural areas, communications and social life.

Historical maps can (and are) used in many fields and in many disciplines. There are many examples of this. It has, however, often been a question of occasional or clearly defined efforts of human geographers and archaeologists. Good examples can be found in localisation planning of road sections, archaeological excavations, inventory of pasture and meadowland related to environmental protection and when forming nature reserve (cultural and natural heritage management). As a support for physical landuse planning in Sweden the historical maps, unfortunately, so far have been of marginal importance.

Present projects in processing historical maps digitally

The public nature of Sweden's official archives for maps and surveying records together with the manual methods of producing map overlays has numbers of disadvantages, for example, the wearing and tearing on the sensitive original documents from the seventeenth, eighteenth and nineteenth century.

These circumstances have developed an anxiety among the official archive holders, such as NLS along with its regional organisation, to fear abuse and deterioration of the original material.

Projects during the 80:ies were focused on saving and restoring parts of the historical maps and records in the central and regional archives. Attempts were made to photograph and distribute the material on microfiches. This is the similar technique used to preserve the Swedish churchrecords. The difference is that the surveying materials consist of maps together with written records. Maps are often in colour and notations are often made on the backside of the originals.

Other projects during these years used scanning techniques along with geometrical rectification and geocoding into the national grid. These efforts were made jointly by NLS and NHB.

Eventually in the late 90:ies NLS decided upon a great national project to scan the historical documents along with the total content of contemporary archives (comprising of plans, redistributions schemes, etc.). The idea is to scan, publish and distribute the historical documents on the web. The result of this action will probably be locked archives to the great disappointment of the collective of historical researchers that need to investigate and examine the original documents. The plans for this huge project predicts that by the year 2005 there will 2 million maps together with 50 million written sheets digitised.

Sweden, together with partners from various European countries, has been involved in a "INFO 2000-project" concerning historical maps [<http://www.dhm.lm.se>]. This kind of projects aims on promoting public awareness and usage of official databases and archives. The financial support comes from the EU in order to achieve progress for the European Multimedia industry. This "INFO 2000-project" has been very important to the Swedish efforts in dealing with historical maps digitally, especially from the point of "developing and implementing" web technology for publishing and distributing digital historical maps.

Developing efforts to handle the processed maps

Up until today the projects hosted at NHB have resulted in a row of development work (since 1995) within datamodelling, image processing, webpublishing and distributing as well as GIS-analysing. The more recent project is called "Digital Historical Maps for Cultural Heritage Management" and runs until Dec 2001. There is however further need for;

- scanning
- rectifying
- geocoding
- tools for converting the content into vectors files
- webpublishing and distribution of maps
- promoting the usage of digital historical maps in the cultural heritage sector

The image processing methods has emerged according to developments in software and graphical peripherals. Today desktop-mapping software is dominating the workingchain for processing historical maps digitally.

In order to interpret (identify and structurize) the historical maps and to convert their content into vectors there has been a development of conceptual datamodels for elements of the landscape. In extension to the datamodel there is a need to construct a database. The tool for digitising the content should be manual. Studies have shown that no automatic method can, so far, replace the human mind in detecting pattern and variations in colour.

After a row of different developing projects (conceptual modelling, software developments and so forth) the NHB is forced to look upon digital historical maps, as the economist would have done. Is there any business in digital historical maps? In order to finance the research and development at NHB, they plan to increase the usage of the digital historical maps. Today's means include publishing and distributing by web together with other remote services. The authority tries to promote the data source in all sorts of applications. One of the more important issues would be to incorporate the digital maps in physical planning activities; to use historical maps should be as common as contemporary maps or demographics. At the point when the historical map has become a natural ingredient in the physical planning the time will come to develop methods for analysing the content of the maps; spatially and temporal.

Digital historical maps in physical planning

The examples of the use of digital historical maps in physical planning are concentrated into the

cultural heritage sector regarding inventories, archaeological excavations, infrastructural planning and knowledge communication (museums and public organisations within the cultural heritage sector).

The first application at NHB that included digital historical maps was made in effort to develop a field collecting system for inventories of the landscape. The idea of data-capture system was to bring series of digital historical maps from different times into the field at the inventory.

At that time the positioning techniques based on satellites were not available therefore the positioning ability was not included in the data-capture system. Since then the numbers of satellites for civilian use have increased (more accurate measuring) and GIS/GPS integrated software is common on the market. This technical solution is very important within the concept of inventory and maintenance of databases. The authors have used the same technique at Kristianstad University.

An inventory of different application-areas was made by the NHB as a prestudy to the recent works on developing methods for processing digital historical maps. NHB has it's own department dealing with archaeological excavations. Spatial collecting, storing, documenting, analysing and presentation of archaeological information is made within a digital process. To fit in, the historical maps as input, must be in digital form.

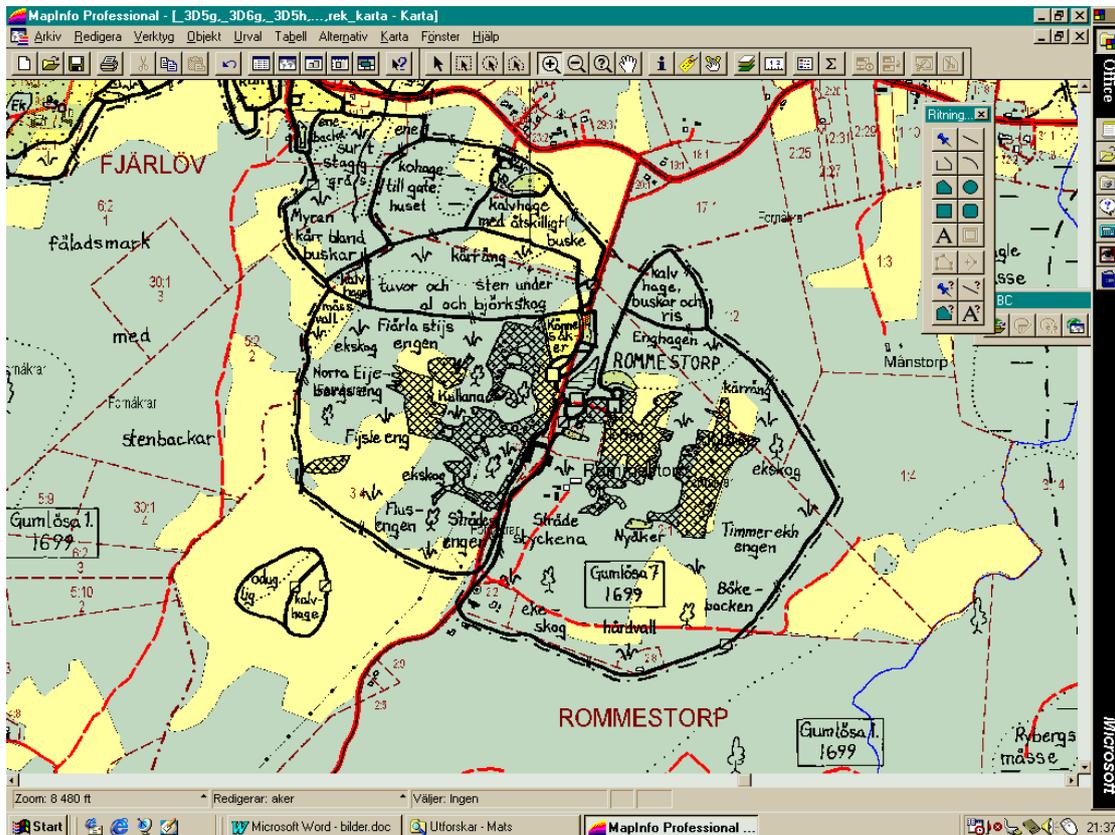


Figure 2 A digital historical map overlay combined with an NLS-map in the scale of 1:10 000. The map overlay is an extraction of a map dated 1699. The pattern shows fields. The light colour on the modern map represents today's fields.

The most common method among the users of historical maps is the semi-digital way of processing the content. An overlay is made in a traditional way with rectification and geocoding. The result is thereafter digitised and combined with other data sources regarding physical planning. This semi-digital processing method is still a very time consuming way of using historical maps in physical planning.

The digital processing includes rectification and geocoding in a raster GIS environment before the content is converted into vectors in the planning database.

The way to analyse the extracted and digitally processed information from a "digital map overlay" is very traditional. Studies of the statistical distribution of landuse are made in the GIS. Temporal analysis can also be made if the area permits a study of several maps in chronological order. These introductory analyses must be followed by structural analysis that gives indicators of the landscape's diversity. The temporal dimension can be combined with the structural analysis in order to detect the changes in the landscape during a long period of time.

It is the authors firm conviction that historical maps are used today in several inventories and pre-studies that has to do with physical planning whether it shows or not. One can suspect that when cultural heritage or environmental issues are considered, there has been at least one study of historical map involved. With an increasing use of GIS and GPS in different organisation, there will be a common use of historical maps.

Conclusion

Historical maps are used in physical planning in Sweden. They have become increasingly important source materials both for cultural heritage management and for authorities responsible for conservation of the natural environment and the expansion of the infrastructure. Most of the maps are processed with traditional methods, which requires specific skills and are cost- and time-consuming.

There is a need for new and cost/time effective methods for processing historical mapdata. Physical planners have demands on both large-scale sources; with details on dwellings, road networks etc; as well as small-scale information in order to conduct landscape-analysis.

References

- Helmfrid, S., 1968. Storskifte und Lagaskifte in Väversunda. *Geographische Zeitschrift* 1968:3
- Sporrong, U., 1989. De äldre lantmäterikartorna i forskning och planering. *Kartbladet* 1992:2, pp 10-15 Gävle.
- Sporrong, U., 1992. Kartläggningen i Sverige, det storskaliga materialets omfattning och potential. *LMV-rapport* 1992:13, pp10-16. Gävle
- Tollin, C., 1991. Ättebackar och ödegården. De äldre lantmäterikartorna i kulturmiljövården. Riksantikvarieämbetet. Uppsala.