

CHAPTER 12

ON-LINE MANAGEMENT OF CULTURAL HERITAGE CARTOGRAPHY. AN INTRODUCTION TO THE DANISH EXPERIENCE

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I. A HISTORIC VIEW

Ever since the earliest recordings of the cultural heritage mapping has been an essential part of the archaeological documentation in Denmark. This was also true when the first national survey of the country's archaeological past were initiated in the late 19th century. During the following decades every parish in the country was visited and short descriptions of the archaeological monuments and sites were recorded and their geographic location were marked on cadastral maps. The result, later known as the "Parish Record", is now archived at the National Museum in Copenhagen.

Also after the completion of the national survey the information about the country's archaeological past has systematically been supplemented and updated at a national scale. Even though Denmark only has a surface area of approximately 43,100 km² it is a major task to compile an overview of the country's archaeological heritage. This is true regardless of the work is being done by hand or by the help of computers. This was the case in the late 1970s, when the process was initiated to digitise information from the original parish survey maps and the matching original textual descriptions for the approx. 105,000 finds and monuments known at that time.

In 1984 a Museum Act was passed through the Danish parliament and one of the results was the institution of a national Sites and Monuments Record (DKC) based at the National Museum in Copenhagen. Since then DKC has had the task of establishing a national database based on the retrospective recording of the information from the Parish Record and related archival material (for instance excavation reports) held at the National Museum (Christoffersen, 1992; Hansen, 1992). In order to secure the national overview of the country's cultural heritage the museum act also prescribe the local state-funded culture-historical museums to report all new archaeological finds and excavations to the central body. The amount is about 2-3,000 reports per year.

Today the central database holds information at different levels of detail of about 150,000 archaeological sites and monuments in Denmark. This is a consequence of the retrospective recording of the Parish Record supplemented with all new finds reported to the central body. Just by mapping the location of the sites it is possible to draw a reasonably precise contour map of the country as seen on Figure 12.1.

2. MAPPING THE PAST

As a lowland area in the northern part of Europe there is a great potential for agriculture in Denmark and large parts of the country has been under cultivation since pre-history. This is why there will be traces of prehistoric activity recorded almost everywhere in the country as reflected on the illustration above.

Politicians and planners need reliable maps of the cultural heritage in order to be able to decide where to protect and where to develop and to destroy. The illustration in Figure 12.1 is an attempt to produce such a map based on the information in the central database. However, we must be aware that it is more than just showing the distribution of the prehistoric settlement. It is also the mapping of centuries of systematic recordings, the local scientific activity as well as a map of our present knowledge. Moreover it is reflecting the damage done to the cultural heritage as a result of farming, construction works, replanting of woodland and similar factors leading to the location and often, subsequent destruction of cultural heritage remains. Due to this it is obvious that most of the recorded sites are no longer visible in the landscape, but they are not necessarily totally destroyed. We still have to take their possible remains into consideration when planning future activities in the landscape. This is why it is so important to develop an efficient and reliable information system, which combines knowledge about the cultural heritage with a geographical information system (GIS). The present paper will focus on this process.

GIS was introduced into archaeology in the early 1990s giving new possibilities for the physical planning in combining cultural heritage databases and GIS (Harris & Lock, 1992; Roorda & Wiemer, 1992; Reilly & Rathz, 1992). As early as 1993 an in-house mapping system was introduced by DKC for the use of registration using digitised maps. The maps were produced as a result of a co-operation between the National Survey and Cadastre (*Kort & Matrikelstyrelsen*) and the National Museum. The result was a set of topographical maps as raster images covering the whole country at scales of 1:100,000 and 1:25,000. Moreover they were the first digitised maps in the country to be generally available. Together with maps in other scales they were subsequently published on a 5 CD set (*Danmarks Topografiske Kortværk*). A range of digitised maps in both raster and vector formats has since then followed this initiative from the mapping agency.

The early mapping system was able to handle both point data and simple areas (vector lines), as overlay to the raster maps, but it did not have the facilities of a professional GIS. Even though its successor has been planned for some time, the system is still in use for the digitisation and recording process at DKC.

An important step was taken when the national database was made accessible on the Internet in 1997 under the name DKC online¹. For this purpose a new in-house mapping system was developed in order to handle the geographical information from the database on the web. The background maps were the already mentioned set of modern topographical maps (still as raster images) in the range between 1:2,000,000 and 1:25,000. The system soon became very popular both by the professional users and by

¹ <http://www.dkconline.dk>

the public. This led inevitably to a wish for the further development of the system (Hansen, 1999).

During the same year (1997) DKC joined the interdisciplinary research centre "Changing Landscapes" (*Forandelige Landskaber*)² with the aim of developing an information system for the cultural landscapes using GIS as a tool. In 1998 DKC also became a partner in a related research project "Agrar 2000 – Danish agrarian landscapes from the birth of Christ to the year 2000"³. The Changing Landscapes project has now come to an end, while the AGRAR 2000 continues until 2003. Within the framework of both projects DKC are focussing on the strategic and scientific aspect of the development of the information system for the cultural landscape.

In 2001 a new museum act was passed through parliament to be implemented from January 2002. One of the immediate results is the institutionalisation of a new governmental body "the National Cultural Heritage Agency" (*Kulturarvsstyrelsen*)⁴ to which DKC will be moved along with a number of other offices working with the archaeological heritage and the historic buildings. To live up to the intentions in the new museum act an efficient planning tool is urgently needed for development purposes and for the protection of the cultural heritage. In the construction of such a tool DKC can draw on the experiences from the two earlier mentioned research projects.

An updated version of DKC on the Internet (DKC online) was published in 2001. Apart from some reprogramming and changes in design the major improvement was that a national coverage of detailed ortophotos hereby was included and made available as background maps along with a set of "historic" maps from the late 19th century in scale 1:20,000. The latter was digitised as a result of a co-operation between the National Survey and Cadastre, the Danish counties and DKC. More series of historic maps are expected to be scanned and implemented during the coming years within this co-operation framework. In early 2002 a variety of maritime maps will also be made accessible on DKC online. This is a consequence of a major update in 2001 of the national database with information about maritime finds.

DKC has made the arrangement with the National Survey and Cadastre that we can distribute series of the scanned maps to the museums at a low cost. A similar arrangement is made with a private company, "Kampsax", which means that we can both distribute the digital ortophotos and the mapping software "MapInfo" to the Danish museums at reasonable prices. As a supplement to this we are also distributing our own datasets in vector format like coastlines and administrative boundaries to be used with MapInfo and other GIS software.

3. ACCESS TO INFORMATION

At the moment the public can only access the cartographic information on DKC online at the level 1:2,000,000, 1:500,000 and 1:200,000 while the more detailed maps

² <http://www.sdu.dk/Hum/ForandLand/English/Index.htm>

³ <http://www.natmus.dk/Agrar2000/>

⁴ <http://www.kulturarvsstyrelsen.dk>

are reserved for the professional users. Using the same logic not everybody can access detailed information from the database. They can only read a summary, which among other data leaves out the exact geographical location. This is done in order to prevent the information from being misused by treasure-hunters and the like. However, there is a growing understanding that it might be better for the public to know about the existence of the cultural heritage in order to be able to protect it rather than locking the information away. It is necessary to take a discussion within the archaeological community concerning the policy of access and to balance the need for making information available on the one hand and the wish to protect sensitive data on the other. Each country has to implement its own strategy in order to solve the problems. In the book *Our Fragile Heritage* more of the papers are addressing the theme from different viewpoints (Hansen & Quine, 1999). One of the more extreme solutions is to supply researchers with the wrong co-ordinates in the firm belief that this will prevent archaeological sites from being looted as given by example by Ruiz Zapatero & Jimeno Martínez, 1999, 45.

The reality is that with nowadays large, regional or national databases combined with GIS interfaces we have powerful tools that can both be misused and in most cases hopefully used for the benefit of archaeology. Despite this many sites are still not taken into proper consideration in the development of our landscapes and cities. They may be recorded but the information about them is not available to planners or constructors and/or they simply do not consult the expertise. This can undoubtedly be demonstrated from every country all over the world. However, Deacon (1999) very well describes the sometimes rather hopeless situation in reconciling needs, dreams and the harsh reality based on the situation in South Africa, as does Chakrabarti (1999) for India.

Database technology and GIS systems are essential in order to present and to give access to the cultural heritage knowledge. However, we have to bear in mind that the scientific foundation still is a most important factor in creating an information system for the cultural heritage. We must also focus on quality in the underlying archaeological information. Bearing this in mind we have good possibilities for the process to be a success in Denmark. The country is rather small, and it is both possible and natural to handle the information at a national level. The collection of archaeological information goes back to the 17th century and it has in principle been supplemented since then. However, there is still some way to go before we declare the project for finished –if ever.

Despite years of efforts in the recording of the information from the parish record, it has not yet been completed. This is essential to give a more balanced view of the archaeological information from the country as a whole. The museums still report to the central body in analogue format, even though we have been working for years in establishing online recording. A first version was actually implemented in 1995 and is still in use at some museums. The major problem has been the lack of possibility to make online recording of the geographical information. This has now changed with the use of the Internet. These problems must be addressed at the same time as DKC is expanding from being an archaeological database to include the whole of the cultural heritage from prehistory to modern times.

4. TOWARDS A NEW GENERATION OF THE INFORMATION SYSTEM

As mentioned earlier the new museum act demands for an information system for the cultural heritage and based on our experiences from our participation in the interdisciplinary research projects Changing Landscapes and AGRAR 2000 we are now in the process of implementing such a system. The information must be available online for museum professionals, planners and constructors in order to secure the best possible development of the physical activities in the build up areas and in the open landscape. This is the challenge we are facing in the future development of the national record for culture history.

The first step is to substitute our in-house developed mapping system with a professional GIS system to be used both in the recording process and on the web for online access to information. Not least for the benefit of non-professionals it is also important to include the knowledge in the system that "white spots" on the archaeological distribution maps, as for instances seen on Figure 12.1, not necessarily means that there are no prehistoric remains to be found in the area. The "blank spots" could easily be reflecting lack of archaeological activity, like it is seen in some countries where the archaeological recording process has not yet been completed for instance due to a late start or similar factors (Palumbo, 1999).

To "fill out" some of the white spots a further step whenever possible must be to include information about the physical size (area) of the archaeological sites as a supplement to the mainly point related information we have recorded at present. Of course this will be difficult or in many cases quite impossible for instance where the sites have been recorded long time ago and are now gone. A supplement could therefore be to work on methods to transform point data into surfaces via analysis of the landscape characteristics in order to give a more adequate representation of a prehistoric or historic reality. Figure 12.4 gives an idea of the consequences seen at a national scale. The illustration is simply made by increasing the point size simulating a buffer zone around each site, and this is obviously not sufficient when it comes to the detailed levels in which the farmers, planners and archaeologists are working in the field.

Besides factual information the information system must also be able to handle hypothetical information about the possible location of the archaeological sites. It is not only a question of which sites exist in a given area but also an estimate of their extent and which types of sites are still likely to be found. It is much debated if such systems based on predictive modelling can be implemented without only having a high degree of self-fulfilment, leaving other not yet so well known site types to an uncertain fate.

Another of the initiatives which are planned according to the new Museum Act is a programme to chart the exact location and extent (as far as it is known) of classical archaeological sites and areas of "high cultural heritage value". The data is going to be available online within the framework of the cultural landscape information system, so that site owners, planners and others in the public administrative bodies have easy access to the information. The purpose of this is to focus on the sensitive areas and areas threatened by destruction and hereby hopefully give them extra protection. Typical examples of the site types in question could be medieval town centres or "Kitchen Middens". Recent investigations on the state of preservation of the latter classic Danish site type

demonstrate that about 90% of the middens are now almost gone and that the rest of them may disappear over the next decade if nothing is done to protect them from final destruction (Andersen, 2001).

5. A DIGITAL ARCHIVE FOR EXCAVATION REPORTS

During the last years some of the mainly larger Danish museums have been recording archaeological excavation data with digital equipment. This has led to a wish to be able to deliver the final excavation report and the related documentation in digital format to a central digital archive.

The long-term plan is to integrate the digital excavation plans with the other data in the central databases. This will make it possible to give online access to maps and orthophotos showing not only the location and extents of a site but also the exact position of every site-element. Furthermore references to descriptions and images of artefacts should be made available whenever possible.

At the time of writing, a special "digital archaeology advisory group" (*Referencegruppen for digital arkæologi*) is working on its concluding report with recommendations for the establishment of such a digital archive for excavation reports. The report concludes a year's work for the group members, who are representatives from the Danish museums, the archaeological institutes at the universities, the National Museum and DKC. The digital archive itself is expected to materialize within the next two or three years depending on funding.

6. BEYOND A NATIONAL CULTURAL HERITAGE DATABASE

With a central database for the cultural heritage and easy online access, the Danish public, researchers and administrative bodies are well served. A minor part of DKC-online is available in English, giving other nationalities the possibility to query the data as well. A logical next step is to implement the facility to search in not only the Danish heritage database, but in those of other nations as well –all in one operation.

A first step in this direction is just about to be taken. Within the Culture2000 programme the European Union have agreed to fund the ARENA⁵ (Archaeological Resources Europe – Networked Access) project. Among the objectives of the project is the establishment of a gateway to European heritage databases. This includes interoperable map-based searching, promoting elements of the heritage concerned and sharing and extending the project partners' expertise and experience within the field of digital archiving, and make this expertise and experience available to all European countries. The programme runs until December 2004, at which time the ARENA gateway should be implemented among the six partners with an open and extensible architecture, thus enabling other nations' national database to be connected.

⁵ The project partners are Archaeology Data Service, York, UK (lead partner); the Museum Project, Bergen, Norway; CIMEC, Institute for Cultural Memory, Bucharest, Romania; Poznan Archaeological Museum, Poznan, Poland; Fornleifastofnun Islands, Reykjavik, Iceland and DKC.

7. GIS EDUCATION FOR MUSEUM STAFF

It is all very well that the Danish National Cultural Heritage Agency is responsible for taking care of the archaeological and historical data in terms of preservation and availability issues, but we need to take a more holistic approach. With the museums delivering the data and the Agency having only limited possibilities to verify the correctness of the data, it is crucial that the researchers and curators at the museums know how to produce digital data of high quality. A common phrase among programmers is garbage in – garbage out, and this is what we risk: if the data received by the central database lack in quality (precision, extent, etc.), the data offered by the central database will be considered unreliable, and users will hesitate to use it.

The digital data in question are spatial in nature. It is the location of a site and the extents and contents of it. These concepts are in some ways new to the museum community. The normal practice is often just the marking of the location of a site on a map sheet, while the extents and contents of it are normally recorded in the field in a local coordinate system established for that particular excavation. The relation to a global spatial reference is hereby often difficult to co-ordinate afterwards.

In order to ensure that data of a certain standard are produced, DKC established a programme of courses in GIS in 1998. The programme is still running and has been well received by the museums. More than 80% of the archaeological museums in Denmark have sent staff to the introductory courses, and some 75% have purchased GIS software through DKC. Even with a frequency of 4-5 courses a year, more are still needed, as are courses for experienced and advanced users. It is hoped that the initiative can continue under the auspices of the National Cultural Heritage Agency.

Another of the points stipulated in the new Museum Act is an increase in the exchange of data between the Agency, museums and municipal, county and state authorities in a digital format. Although the GIS courses so far have focused on excavation data, the positive side effect is that knowledge of GIS makes it possible to communicate spatial information digitally between museums and planners in general.

8. CULTURAL ENVIRONMENTS

There has been a new emphasis lately on the context of sites rather than just on the individual sites and so considering preservation strategies for larger areas rather than for just the perimeter of single sites. In other words to focus on for example not just the settlement site, the grave yard and the coastal landing site as individual sites but seen together as forming an entity: Village, burial ground and working place for a fishing community. The term used for these entities is "cultural environments", and they are representing one of the new kinds of data the information system must be able to receive from the museums and counties within a very short span of time. This is yet another example of the necessity to be able to adjust to external demands.

9. CONCLUSION

It should be clear from the above, that the National Cultural Heritage Agency is facing many new demands in terms of new types of data and new ways to record and

map them. The existing online GIS component from 1997 is simply not able to live up to these demands. The year 2002 should see the introduction of a new online GIS with the ability to display vector data other than just points and with a high degree of user interaction in terms of choice of background map, and choice of relevant vector layers. With this in place the technical foundation for the projects mentioned above is established.

Demands to national heritage database changes over time, and both the database and the methods of accessing it must develop to reflect these demands. Furthermore, the database cannot be seen in isolation. It constitutes only one part of an information system: the data. Hardware, software, programmers and users need to develop in a parallel process. Even though we are building on centuries of work we have to act faster than ever and to focus on all aspects of the information system including funding and staffing. It is more than ever a fight against time.

As we are developing the information system and increasing the easy access to the cultural heritage information great damage is done to the archaeological remains as a result of the physical development of the society. We cannot change this process. We can help focussing on it by making the information available. Mapping is an essential part of this both for the recording, the presentation and for the final decision-making –where to protect and where to destroy.

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