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GIS USAGE IN SCANDINAVIA

1. Introduction

In the autumn of 1995 I made a survey of the use of GIS in Scandinavian Archaeology (Madsen 1996 and 1997). It showed that although GIS and GIS-like applications were spreading in Scandinavia, as elsewhere, it appeared to be a very slow process. If compared to the relatively high profile of Scandinavian archaeology it had to be considered a very marginal topic.

Up to the point of survey only 6 regular GIS projects with a research aim could be cited. To these came a use of GIS for cultural management purposes focused on the administration of sites and monuments (6 projects). A further 6 projects were engaged in developing the use of GIS like techniques (mostly CAD based) for field investigations.

The current survey carried out in the autumn of 1997 has presented us with 12 projects, which can be classified as having a proper research aim. Four projects are concerned with cultural resource management, and two with the development of field methods. One may note that the number of projects of the two investigations is the same (18). This is coincidental, and it is certainly not the same projects that are reported by the two surveys. The 1995 survey was based on available literature and personal communication, and it included all projects that existed or had existed up to that point. The current survey is based on a questionnaire and only includes current projects, where project members have reacted to the questionnaire. This makes it difficult to compare the two investigations. In the following I will however comment on the development over the last two years as well as the current status of GIS applications in Scandinavian archaeology based on the questionnaire.

2. Field recording applications

The urge to improve the efficiency of excavation recording and analysis has resulted in a number of attempts to handle excavation drawings digitally. This is true for Scandinavia as everywhere else. A GIS type of application is ideally suited to handle excavation data. The direct reference between objects of the graphical user interface (excavation drawings) and the textual recordings of the underlying spatially referenced database is a dream revelation to any field archaeologist.

Yet, when you take a look at the applications developed you soon realise that almost all of them are not GIS applications at all. They are CAD like

applications (mostly based on AutoCAD) with no real integration between graphical objects and textual information. Mostly, the graphics consist of dumb digital drawings that have hardly any more functionality than ordinary paper drawings.

Sadly, most archaeologists confronted with this type of digital graphical representations are not aware that there is a problem, and that CAD is a kind of *cul de sac* in relation to a proper intelligent linking of excavation plans with other types of recordings from excavations. It is a further problem that in many cases the CAD applications are run by land surveyors. They are specialists in using these types of programs, but they have none or very little insight into archaeology to acknowledge the need to use the more advanced functionality of a GIS. The archaeologists on the other hand often have insufficient knowledge about the characteristics of CAD and GIS respectively to understand the difference and to become instrumental in a common shift from CAD to GIS.

Handling digital excavation plans in a CAD system like AutoCAD and in a GIS system like MapInfo or ArcView is not very different. Both have good drawing facilities, both support layers, and both are capable of producing fancy output, freely scalable. There is a world of difference in their functionality, however, where the geographically referenced database and the analytical capabilities of the GIS systems are totally missing in the CAD systems. The amount of work used to input an excavation plan from scratch into a CAD or a GIS system is about the same, but the amount of information they potentially hold is far from being the same.

3. Cultural Resource Management applications

The '95 survey came up with six Cultural Resource Management (CRM) projects, while the current has produced four. One of the projects mentioned in the '95 survey was a very early pilot project, while two others probably still exist, but is not mentioned in the current survey, as no response to the questionnaire has been received. One of the projects in the current survey is stated to have a narrow purpose of handling information from a specific rescue excavation project, and it will not be continued. Three of the projects from each survey are identical. They are "flagships" for each their Nation – Norway, Sweden and Denmark – and it is indeed worthwhile to pay closer attention to them.

The documentation project in Norway is a huge and costly project aimed at compiling cultural heritage information from the university collections and files, convert them into digital format, and make them available to the public on the Internet using among other things GIS interfaces. The project is aimed at the general public, and its goal is to present the National cultural

heritage to the Norwegian population. You have to know the force and importance of the National heritage in Norway to understand why it is possible to mount a project of this nature costing millions and millions of Norwegian Kr.

Despite the importance of Nationality in Denmark, often played out as a trump to keep Denmark in opposition to all unionist movements in Europe, it is absolutely inconceivable that a project of similar scale could occur in Denmark. In fact a pilot project with similar intentions as the Norwegian documentation project has been carried out. The purpose of that project was to present the best of the Danish older Bronze Age finds to the public via the Internet. You may look it up at www.dkc.natmus.dk. Despite what may be termed a very, very successful pilot project, it has proven difficult and perhaps even impossible to raise money to put other material from Danish Prehistory on the Internet.

The GIS developed within the Swedish Central Board of National Antiquities is for administrative uses only. The stated aim is very clearly administrative: "the main purpose is to make GIS an operative tool in CRM and administrative functions, as well as a tool for field archaeology and analysis". The decision behind is clearly reflecting "company policy" at the highest level: "We are now introducing GIS on a large scale throughout our organisation". Further "To make GIS a tool for the increasing number of users within UV (shorthand for field investigation units – ed.), we have adapted the following procedure: each of the five local offices has chosen a project appropriate for a pilot GIS-study. The project should be well formulated and motivated, and subsequently documented. All the experiences are gathered to build a foundation from which to base the subsequent projects" (citations here are taken from the descriptions of the project by Pernilla Flyg in this volume).

Again you have to know the special National background to understand the implication of these statements. Sweden, by all probability, has the most beneficial antiquity law in the world. Basically this law state that everything that comes in the way of development projects, public or private, has to be investigated thoroughly. This means that enormous amounts of money are funnelled through the Central Board of National Antiquities and into rescue archaeology. When the statement is made that GIS are to be introduced on a large scale throughout the organisation, it is not petty money that is being allocated for the purpose. Of equal interest is in fact that it is all done for administrative reasons. The foundation of the activities of the Central Board of National Antiquities is a law that has to be administrated, no more no less. All decisions taken are for this purpose and this purpose alone, and the mounting of a major GIS system is for the internal administrative use of the organisation, and not for the benefit of archaeological research units, nor the general public.

It is interesting to note that so far next to nothing has been published concerning the development of GIS usage within the Central Board of National Antiquities. It is very thought provoking that a development in the archaeology of a country, that must be considered to be of major interest to the archaeological research community at large, can pass if not unnoticed then unpublished. It is indicative of the nature, function and purpose of a huge administrative organisation like the Central Board of National Antiquities. They are completely self-contained and not dependent on a product they have to "sell" to others. Their purpose is to make certain that the legislation concerning endangered relicts of past cultures is kept. This means that as much as possible should be preserved, and what cannot be preserved should be destroyed in the controlled manner known as an archaeological excavation. The outcome of the excavations in terms of knowledge of the past is irrelevant. It is not part of the legislation that specified amounts and quality of knowledge has to be delivered in return for the resources invested. The administrative body produces for its own good, and the good is that the legislation is kept.

I apologise. What I said here is in fact unfair to the Swedish Central Board of National Antiquities. In fact very much is done to make the Board productive, not only in filed paper, but also in published knowledge. But it does not alter the warrant of their existence, nor does it prohibit that their actions in general are governed by their purpose. A GIS is set up not for the benefit of gain and dissemination of knowledge, but for the administration of cultural resources, and that is an internal matter for the organisation.

DKC – The National Danish Record of Sites and Monuments – was established in the early eighties with the explicit aim to transfer the extensive, and complex (not to say messy) paper records to computer files within an approximately ten year period. Fifteen years later only half of the records have been transferred. A rapidly growing yearly accession combined with a low budget has made it become a never-ending story. Despite its historical position as a pioneer country in archaeology, and the carrier of one of the densest distributions of prehistoric sites and monuments in Europe, Denmark is probably the one of the "richer" European countries using least money on archaeology. Further, in line with Danish tradition (contrary to what we see in Sweden), resources are decentralised, making it almost impossible to carry through in style a major project like DKC.

The GIS application associated with DKC was initiated in the late eighties, but only now has it become the powerful tool that it so obviously can be. Its development has progressed through many stages, some of which were *cul de sacs*. The slowness in development, however, is mostly due to a lack of resources. Only one person at a time has been allocated to the project, and only occasionally when other jobs were not in the way. In its current version

it appears as a raster layer combined with a vector layer. The raster layer displays scanned map coverages of Denmark in 1:500.000, 1:250.000, 1:100.000, 1:50.000 and 1:25.000 resolutions, while the vector layer displays information about sites and monuments as well as other vectorised information like administrative boundaries. The scanned maps are placed on a number of CD-ROMs, which can be handled manually, be placed in a CD-ROM tower, or transferred to a hard disk drive. In the GIS application the maps appears as seamless coverages with correlation between resolutions. The vector layer is directly linked to the DKC database (or a local copy of this), and always reflects the result of queries posed by the user. Further the vector layer is interactive. Thus you can query the content of the database by activating sites in the vector layer, or you may change the database information of the geographical position of a site, by simply moving the site marker in the vector layer.

The DKC database with its GIS user interface is a PC-based system, running on any standard PC with Windows 95 or Windows NT. It is free for all archaeological institutions in Denmark, and there are no extra software costs to run it, so it is ideal for the decentralised organisation of Danish archaeology.

The DKC database is currently being hooked up to the Internet. This development makes it possible for the public as well as the professional archaeologist, wherever he may be, to query the database. To the public, only selected information will be available. To gain access to all information it is necessary to gain permission (and a password) from DKC. At the moment of writing only the textual information is available over the Internet, but the use of the GIS across the Internet is currently being developed, and will be available at the time of publication. A visit at www.dkc.natmus.dk is worthwhile all the same.

4. Research applications

Of the 12 projects of the current survey classified as research projects, only two were also recorded in 1995. The reason is that most of the projects recorded then had already stopped or were about to stop. They were early ventures into the use of GIS and they were also small-scale projects run on an experimental basis by individuals. Looking at the projects reported in the current survey, it is worth noting how many projects are marked as starting in 1997. Is this a major breakthrough for GIS in archaeological research in Scandinavia, or is it just a bandwagon effect resulting in more projects being announced than carried out?

Among the projects reported it seems possible to separate three different types of projects. One consists of projects run on a more or less personal

basis along with other work. It is among these projects that we might expect to find those that are not going to develop very far.

Another category is Ph.D. projects. There are currently two of these at the University of Aarhus, and one that is targeted to become a Ph.D. project next year at the same university. In addition I am in contact with a person who is also aiming at establishing a GIS based Ph.D. project, if money can be raised. Further a Ph.D. project based on GIS will be launched in connection with the landscape project to be mentioned below. So within a year we may see up to five Ph.D. projects involving GIS at the University of Aarhus. I am not aware if similar developments are shaping up at other Scandinavian universities, but it is not unlikely.

The sudden popularity of GIS in Ph.D. projects is very pleasing. More than anything it will create the foundation for a future use of GIS in archaeological research. The projects will not only result in a formal presentation through a thesis, but they will also form a base of experience from which these young researchers will carry out their work in archaeology in the future.

As a third type of project we may see the project "Changing Landscapes" to be launched by the end of this year in Denmark. It is a major interdisciplinary project, in which the National Museum and the Institute of Anthropology and Archaeology at the University of Aarhus participate with a subproject called "Land-use and Regionality in the Prehistoric and Early Historical Landscapes". Within this subproject GIS will be fully integrated with among other things employees working exclusively on the production of map layers, and with a Ph.D. project dealing with principles and methodology in the reconstruction of past cultural landscapes. It will be the first major archaeological research project in Denmark, and possibly in Scandinavia as well, where GIS is fully integrated, and where resources are allocated to GIS as a primary area of focus.

In my '95 survey I commented upon the vast difference between the considerable advance of GIS within administrative archaeology on the one hand compared to its almost non-existence in research archaeology on the other. I was indeed worried by this situation, and I still am, because basically nothing has really changed even if GIS now seems to become part of research archaeology. The real worry of course is that archaeology not governed by the rules of research can be considered a valid endeavour at all; that it is allowed to exist as an administratively based technical routine just because legislation says so. Surely, we can save the records of our past by making certain that nobody touches them, archaeologists inclusive, and for this we need administration. We cannot save the record, however, by routinely excavating it. Consequently, if we are concerned with gaining knowledge of our past, there cannot be any other legitimate reason for archaeological excava-

tions than goal oriented research, and every aspect of these excavations must be focused accordingly.

5. Demands for GIS

GIS is a very strong tool in archaeological research, but it is also a very resource-demanding tool. There is not very much an individual can achieve alone, if the results are to be on a certain scale and significance. This is more or less the same as saying that most of the research projects reported in the survey are not likely to be very productive. It does not mean that the researchers are not capable of doing a good job (being one of them I would never imply anything like that). It means that it will be very difficult to carry through a project if you have got other work to do as well – and most people who are in research positions have. Only large-scale projects with a direct research funding can be expected to achieve major results. In addition of course administrative archaeology could produce results, if its organisation and the code by which it exist could be turned in the right direction.

So I am still sceptical. GIS is increasingly in the focus of Scandinavian archaeology, but to make it matter in archaeological research takes more than an interest. It calls for a pooling of research money, and more than that it calls for a redefinition of the purpose of administrative archaeology. If administrative archaeology cannot be turned into planned goal oriented research, the future of archaeology (and the use of GIS in archaeology) will be very bleak indeed. Administrative archaeology has the resources, but does it also have the gut and the will to change its own conditions? Only if this happens can we expect archaeology to take full advantage of the methodological and technical complexity of GIS.

Leaving these political considerations aside, what are then the demands and problems that make GIS so difficult to integrate as a standard tool in archaeological research? First of all, there is a need for high quality background data (topographical, geological, hydrological, etc.). The acquirement of these data has proven very difficult. Partly because the data are not yet fully available in digital format, and partly because the "owners" of the data – mostly various public authorities – claim outrageously high prices to provide them. The prices are aimed at the private market, where for instance land measuring companies and other firms using geographically referenced data can afford to buy them because the expense is added to the bills of their customers.

Archaeological research projects, being non-profit, low-budget undertakings cannot afford to buy the data for anything more than a very small local area. The problem is very much debated in Denmark right now. Not only archaeology but also a number of other areas within research and higher

education using these types of data are seriously affected. Even those departments (geographical and geophysical departments) who train the people whom the data-providers will employ in the future cannot afford to acquire the data they need to train their students. This has led to negotiations with the data-providers, and it is now reported that these disciplines can have the data for free, if they will offer free in-service training for the staff of the data-providers – if you scratch my back I will scratch yours. For archaeology the generous offer is that we only need to pay half price, since our projects are non-profit. Even if we had been offered the data for a tenth of the market price the average archaeological research project could not afford it. We can only hope for a change in the future, probably politically dictated. Cracks have begun to show and we have already unofficially acquired some types of data for free, but cannot base publications on them before official agreements are reached.

Many types of data needed for archaeological projects are not available in digital format, and will not be so from outside data-providers. As a consequence the projects themselves have to digitise many types of historical map data important for the reconstruction of past cultural landscapes. A very tedious, time consuming and hence costly task. A number of historical disciplines apart from archaeology have shown an interest in the transfer of historical map data to digital format. Obviously these different disciplines will collaborate in the future on the creation of these types of data. It is only to hope, then, that the many individual "data providers" can administrate a sound balanced sharing of data. A common sharing is certainly needed if GIS based research in these disciplines shall prosper in general.

A very important requirement for the success of current or future research projects in archaeology aiming at using GIS is an in depth knowledge of GIS methodology. Computer literacy is spreading in Scandinavian archaeology as everywhere else, but to be a computer power-user does not provide sufficient background to carry through a GIS research project. If a detailed knowledge of what the analytical capabilities of GIS are, and how the analyses are to be carried out the projects are likely to be reduced to an exercise in basic map production. "Pretty pictures" will be the result and little more.

We are up against a serious problem here. Archaeologists are not educated to understand and utilise GIS, nor are they educated to understand and utilise databases, nor indeed any other aspect of computers. The problem is that handling of electronic data is a completely new experience. All through our life we have been trained to organise and handle data on paper. The computer is a new media featuring a completely different way of organising data. We need a completely different approach to data, but do not have the knowledge and training to accomplish it. Instead we treat the computer media as if it is a piece of paper. The word processor, where people use the tab

key and the space bar to create an agreeable page formatting, is a very good but trivial example of this. It is not so trivial, however, if you try to organise a database as if you were dealing with card files, or if you work a GIS system as if it is a set of drawing foils that can be placed on top of each other. The problem then is that you are not at all using the potentials of the media. You are not using the computer as a tool of improvement, but just as a tool of replication.

One way out, if you have got the money, is to hire people, who know of computers and let them handle all the computing. At first it may seem the right thing to do, but then on second thought it may not be a good idea at all. The problem obviously is that computer people do not know archaeology, so they will first of all ask the archaeologists, what they normally do and how they do it, and then they will set up and operate the systems accordingly. What you get is more or less what you would have had if you had done it yourself, but now you will be removed one step away from your research tools. You will be doing your research by way of a deputy, and probably you will not understand what is going on at all.

Archaeologists must be able to handle their tools themselves. Help from technical staff to routine work, like producing maps is fine, if you can afford it, but when it comes to analytical work the archaeologist must be capable of handling everything himself. If he doesn't he will never be able to understand what is going on. The problem is that archaeologists in general know very little, and although they may be interested in learning they soon find it very complicated and tiresome, so in the end they rely on the technicians – often all the way through. So when the technician say: "let's do it this way" the archaeologist says "ok", and soon the technician is the invulnerable guru.

What we need is education, education and education: systematic training of current archaeologists if we can catch them, and above all training of young new archaeologists. That is why at the Department of Archaeology, University of Aarhus we are currently planning a one-year degree in informaticts for disciplines involved with culture history (archaeology, arts history, ethnography, history) on behalf of the Faculty of Arts. All students within these disciplines can, if the plans go through, choose this one year as a supplementary discipline on the bachelor level or at the masters' level, depending on the individual students' planning. It will among other things contain database theory and a thorough introduction to GIS. Education modules like this will be an absolute necessity if future archaeologists are to be able to live up to the responsibility of using modern information technology in their research.

6. Conclusion

Research projects involving GIS will become more and more numerous. Due to the points made above, and the fact that research projects in archaeology in general are small, involving only one or a few persons, it is obvious that most GIS uses will attain the nature of pilot projects. Further, they will often be reduced to computer based mapping projects, rather than true GIS projects.

The situation with GIS projects aimed at cultural resource management is very different. These projects are created within large-scale organisations (state/county antiquary services), where resources are much more plentiful than in research, and where human resources can be allocated to form the foundation of large-scale projects. These projects do not, however, have a research objective. Rather, they are aimed at the administration of sites and monuments in the landscape. Thus background data is often limited to modern topography, and the focus is on (nation-wide) retrieval of archaeological data from the archives rather than their analysis in a landscape setting.

Seen from a research point of view the current use of GIS in cultural resource management is not very interesting, apart from the help it may provide to retrieve data from the archives. Nevertheless, it is probably from the GIS usage of the antiquary services that we can expect the most awarding research results in the future. When the administrative facilities of these systems are up and running, the next, obvious step to take is to start making predictive models of where different types of sites can be expected to appear in the landscape to provide support to the planning authorities for land development. Apart from the administrative value of this type of predictions, they will also have an immense research potential as hypothesis-testing mechanisms, if only the research bodies will be allowed access.

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Madsen T. 1997, *GIS and Scandinavian archaeology. A tale from the real world* (revised and extended version of Madsen 1996), in M. North, I. Johnson (eds.), *Archaeological Applications of GIS, Proceedings of Colloquium II, XIII International Congress of Prehistoric and Protohistoric Sciences (Forlì, 8-14 September 1996)*, Sydney University Archaeological Methods Series, n. 5 (CD-ROM).

RESULTS OF THE QUESTIONNAIRE GIS AND ARCHAEOLOGY

Title of the project: The Bardu project.
Promoting institution: University of Tromsø.
Year of beginning: 1996.
Foreseen term: Ongoing research and educational project.
Geographic area: Generally within Troms County, Norway.
Excavation area:
Short description of the project: Landscapes and cultural change in a multi-ethnic setting. The investigated area has for long been the meeting place of four different groups of people: the Saami, the Norse/Norwegians, the Kvens (immigrants from Finland), and Dølene (immigrant forresters from Østlandet in southern Norway). Basically the project aims at investigating how the various groups have related to one another and manifested themselves in the landscape. However, aside from analyses of the various economies and settlement patterns in a topographically and ecologically richly diversified area, particular emphasis is put on the study of symbolic and sacred aspects of the landscape.
Hardware: PC.
Software: V/G-kart, Idrisi, ArcInfo.
Application of descriptive standards: SOSI.
Application of Spatial Analysis: CA, MCA (multiple CA), VS (viewsheds) MVS (multiple viewsheds).
Other important information:
Address: Institute of Archaeology, Faculty of Social Sciences, University of Tromsø, 9037 Tromsø, Norway.
E-mail: hanspb@isv.uit.no
www address: http://www.isv.uit.no/seksjon/ark/index.htm

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Title of the project: The cultural landscape of Steigen. Perspective and cognition.
Promoting institution: University of Tromsø.
Year of beginning: 1996.
Foreseen term:
Geographic area: Nordland County, Norway.
Excavation area:
Short description of the project: An investigation of perception and cognition in one of the best preserved Iron Age cultural landscapes in Norway. Contextual analysis and multiple viewsheds of settlements and graves/cemeteries are used to analyse how the two worlds of the living and the dead are signified in the landscape.
Hardware: PC.
Software: V/G kart, ArcInfo.
Application of descriptive standards: SOSI.

Application of Spatial Analysis: MVS (multiple viewsheds).
Other important information:
Address: Institute of Archaeology, Faculty of Social Sciences, University of Tromsø, 9037 Tromsø, Norway.
E-mail: hanspb@isv.uit.no
www address: http://www.isv.uit.no/seksjon/ark/index.htm

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Title of the project: Large-scale introduction of GIS into Swedish archaeology.
Promoting institution: Swedish Central Board of National Antiquities, Department of Archaeological Excavations (RÄÄ/UV-KK).
Year of beginning: 1996.
Foreseen term: 1999.
Geographic area: Sweden.
Excavation area:
Short description of the project: Our main concern is rescue archaeology, and we operate on behalf of the Swedish state according to the National Laws of Cultural Environment. We are now introducing GIS on a larger scale throughout our organisation; the main purpose is to make GIS an operative tool in CRM and administrative functions, as well as a tool for field-archaeology and analysis. Since the introduction of our field system 1991, we have gathered a considerable amount of archaeological data in a standardised GIS-adapted manner. We also have a great treasure of historic maps which are becoming digitised and rectified, and a national SMR. To make GIS a tool for the increasing number of users within UV, we have adapted the following procedure: each of the five local offices have chosen a project appropriate for a pilot GIS-study. The project should be well formulated and motivated, and subsequently documented. All the experiences are gathered to build a foundation from which to base the subsequent projects.
Hardware: PC (Pentium Pro 200 Mhz; Pentium 133-166 Mhz for desktop GIS).
Software: ArcCAD and ArcView on a Windows NT platform. ArcInfo will perhaps become our central data base manager.
Application of descriptive standards: One of the main structuring principles for the field system is that data concerning the historical heritage are stored in public, national registers. This renders certain demands on standards to provide easy access, and it does also require an open structure which is not dependent on specific hardware or software. Another important requisite is that the system should be easy to operate and relatively inexpensive, so that it might be used on any kind of excavation, even the smallest ones with restricted budgets. The original field system was constructed on the basis of a FoxPro-application, which handles GIS-adapted geographic and attribute data in related database-tables on a field located portable PC. This field system is now undergoing change, and it will become more integrated with the information system and adapted to other software we are using (e.g. ArcView). The heart of the system is the co-ordinate-table. It has an open structure

with a basic coding, and it might be applied to any kind of excavation irrespective of contract character or whether the objects are settlement sites, graves or urban medieval layers. Every object shall have a short description (attribute data) before the post-processing procedures begin. During the post-processing, further attributes might be added. The system has so far been used at more than 300 excavations, varying in size and character, since the start of the early nineties. Except for digital maps, the geographical data mainly derive from total stations, but we also use other digital information (e.g. photogrammetry, digitising, DGPS). Still, some of the archaeological field methods are traditional, and we strive to include also that kind of information into the system.

Application of Spatial Analysis:

Other important information:

Address: Pernilla Flyg, Central Board of National Antiquities, Department of Archaeological Excavations (RÄÄ/UV-HK), Box 5405, S-114 84 Stockholm.

E-mail: pernilla.flyg@rashm.se

www address:

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Title of the project: The VEDA project.

Promoting institution: County Museum of Västernorrland & Department of Archaeology University of Umeå.

Year of beginning: 1994.

Foreseen term:

Geographic area: Ångermanland, Sweden.

Excavation area:

Short description of the project: Salvage excavation of two Iron Age farms (400-800 AD) with long-houses, grave cairns and farm-fields. The project was a joint venture between University of Umeå and The County Museum of Västernorrland.

Hardware: PC, Macintosh, Sokkia total station, Calcomp, Psion.

Software: MapInfo 3.0, Filemaker 3.0, Geodos.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Lars Göran Spång, Västerbottens Museum, Box 2034, S-87102 Hermosand.
Per Ramqvist, Department of Archaeology, University of Umeå, 90187 Umeå.

E-mail:

www address: ylm.se/oghn/ola.html; ylm.se/oghn/larsg.html; umu.se/arke

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Title of the the project: Passage graves of Falbygden.

Promoting institution: Institute of archaeology, University of Göteborg.

Year of beginning:

Foreseen term:

Geographic area: Skaraborg Län (Central South Sweden).

Excavation area:

Short description of the project: Compilation of Archaeological data and GIS data for Skaraborg Län. Data comprise topography (DTM), county divisions, soil maps, SMR data, specific information on passage graves. Analyses are carried out with specific reference to the positioning of the passage graves in the landscape.

Hardware: PC (Pentium 120 Mhz, 32 Mb RAM).

Software: AutoCAD 13, ArcCAD 11.4, ArcView, Idrisi 2.

Application of descriptive standards:

Application of Spatial Analysis: View-shed analyses.

Other important information:

Address: Karl-Göran Sjögren, Institute of Archaeology, University of Göteborg, S-412 98 Göteborg.

E-mail: kg.sjogren@archaeology.gu.se

www address: http://www.hum.gu.se/~arkpp

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Title of the project: A settlement archaeological analysis of Danish sites with iron production in Younger Roman and Older Germanic Iron Age (app. 200-600 AD).

Promoting institution: Institute of Anthropology and Archaeology, University of Aarhus.

Year of beginning: 1995.

Foreseen term: 1998.

Geographic area: Denmark with special focus on Central and South Jutland.

Excavation area:

Short description of the project: The purpose of the project is to treat the Iron production process in a settlement archaeological context. The position of the settlements in the landscape and the logistic organisation of the Iron production in the settlements is analysed.

Hardware: Standard PC.

Software: Access 2.0, Excel 5.0, AutoCAD LT, R2V, MapInfo 4.1.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Lars Nørbach, Institute of Anthropology and Archaeology, University of Aarhus, Moesgård, DK-8270 Højbjerg.

E-mail: farkln@moes.hum.aau.dk

www address: http://www.aau.dk/dk/hum/forhisto/index.html

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Title of the project: Rescue excavations in the Stockholm area.
Promoting institution: Arkeologikonsult.
Year of beginning: 1991.
Foreseen term:
Geographic area: Stockholm area, Sweden.
Excavation area:
Short description of the project: Development of procedures for digital field recording of excavations, followed by digital presentation of results in terms of CAD-drawings, elevation models, scatter and isaritm plots of finds and topological analyses. The aim is to develop more sophisticated models describing environmental resources and land-use strategies (for example slash-and-burn cultivation or areas suitable for Iron Age).
Hardware: 486 and Pentium PC's (Win95 and Windows NT 4.0), digitisers, plotters. Total stations (Nikon), dGPS (Trimble, PathFinder Pro XL, digital cameras Nikon and Kodak).
Software: Database in Paradox, now Client Server Solution based on Informix. MicroStation, Surfer.
Application of descriptive standards:
Applications of Spatial Analysis:
Other important information:
Address: Oscar Törnquist, Arkeologikonsult AB, Optimusvägen 14, Box 466, 194 04 Upplands, Väsby.
E-mail: Oscar@norn.se
www address: http://www.norn.se

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Title of the project: Spatial Data in Archaeology (SDA). Part of the research consortium "From Data to Knowledge".
Promoting institution: University of Helsinki, Department of Archaeology.
Year of beginning: October 1996.
Foreseen term: 2000.
Geographic area: Eastern Finland.
Excavation area:
Short description of the project: Settlement by using simulations and multi-criteria or multi-objective decision making procedures. The problem is how to create more realistic and advanced models with GIS without crude classifications and simplifications, for example continuous variables instead of classifications and how to handle uncertain information for example with using fuzzy data.
Hardware: a) Pentium/Pentium Pro PC, Windows 95/NT; b) Sun Sparcserver, Solaris.
Software: a) Idrisi, MapInfo; b) Markow Chain Monte Carlo simulation program build at the Department of Computer Science, University of Helsinki.
Application of descriptive standards:

Application of Spatial Analysis: Visibility, pathway, Bayesian probability, simulation.
Other important information:
Address: Tuija Kirkinen, University of Helsinki, Department of Archaeology.
E-mail: Tuija.Kirkinen@Helsinki.fi
www address: http://www.helsinki.fi/~tuikirki/

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Title of the project: Double track project.
Promoting institution: Institute of Archaeology, Art History and Numismatics, University of Oslo.
Year of beginning: 1993.
Foreseen term: 1997.
Geographic area: Follo in Akershus and Østfold counties, Norway.
Excavation area:
Short description of the project: The purpose of the project was to survey, project and carry out excavations for a new motorway and dual track railway. 19 Stone Age and 2 Iron Age localities were excavated following the survey. GIS was used for planning and evaluation purposes in relation to the survey data and to handle excavation plans from the two (major) Iron Age excavations.
Hardware: PC and Unix workstation.
Software: Windows 3.1 and 95: PC ArcInfo, Penmap; Unix: ArcInfo.
Application of descriptive standards: Finds database: Stone Age artefacts were recorded following an approved published classification system.
Application of Spatial Analysis: Analyses of distributions of flint waste and artefacts to delimit sites.
Other important information:
Address: Evy Berg, IAKN, University of Oslo, Frederiksgt. 3, N-0164 Oslo.
E-mail: evy.berg@iakn.uio.no
www address:

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Title of the project: Documentation project.
Promoting institution: Dokumentasjonsprosjektet, Universitetet i Oslo.
Year of beginning: 1992.
Foreseen term: 1997.
Geographic area: Norway.
Excavation area:
Short description of the project: The purpose of the project is to convert information from paper based archives belonging to the historical-philosophical faculties of Norwegian universities to electronic data. All information becomes as far as possible geographically pinpointed.
Hardware: PC, Mac, Unix.

Software: Oracle and ArcInfo.
Application of descriptive standards: All free text is SGML coded. Otherwise all text information is kept as far as possible in its original form.
Application of Spatial Analysis:
Other important information:
Address: Jon Holmen, Dokumentasjonsprojektet, Boks 1123 Blindern, N-01 Oslo.
E-mail:
www address: http://www.dokpro.uio.no

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Title of the project: An investigation of the Iron Age settlement in Follo, Akershus county.
Promoting institution: Institute of Archaeology, Art History and Numismatics, University of Oslo.
Year of beginning: 1991.
Foreseen term:
Geographic area: Follo, Akershus County, Norway.
Excavation area:
Short description of the project: An investigation of changes in exploitation patterns between older and younger Iron Age based on the positioning of sites in the cultural landscape. A main method of the investigation is the use of view shed analyses to isolate aspects of the cultural landscape that are due to human rather than resource based choices.
Hardware: PC, Mac, Unix.
Software: ArcInfo.
Application of descriptive standards:
Application of Spatial Analysis:
Other important information:
Address: Joel Boaz and Espen Uleberg, IAKN, University of Oslo, Frederiksgt. 3, N-0164 Oslo.
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www address:

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Title of the project: Cultural meeting in Østlandet 5000 years ago.
Promoting institution: Institute of Archaeology, Art History and Numismatics, University of Oslo.
Year of beginning: 1997.
Foreseen term:
Geographic area: Østerdalen, Hedmark, Norway.
Excavation area:
Short description of the project: BP at a time when inland hunter-gatherer had active

contact with early farmers in the Oslo fjord region. Part of the project will be to create 3D TIN models of cooking stone heaps associated with pit houses. The purpose of the project is to analyse changes in artefact and bone material around 5000-4500.

Hardware: Macintosh.

Software: ArcInfo.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Joel Boaz, IAKN, University of Oslo, Frederiksgt. 3, N-0164 Oslo.

E-mail: Joel.Boaz@iakn.uio.no

www address:

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Title of the project: Reconstructing a Neolithic cultural landscape.

Promoting institution: Institute of Anthropology and Archaeology, University of Aarhus.

Year of beginning: 1997.

Foreseen term: Long term educational project.

Geographic area: Eastern Jutland, Denmark.

Excavation area:

Short description of the project: Known Neolithic monuments, sites and stray finds are mapped against a reconstructed ancient physical landscape. Interrelations between the Neolithic material and landscape elements will be isolated and used in an attempt to predict "new" sites to fill in the pattern. Field surveys will be used to test the validity of the predictions. It is expected that it will be possible to reconstruct not only the basic patterns of Neolithic man-land relationships, but also the social landscape i.e. the territorial divisions between basic social groupings.

Hardware: Standard PC's.

Software: Windows NT, Microsoft Access, MapInfo 4.1 professional, ArcView 3.0 with spatial analyst extension.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Torsten Madsen, Institute of Anthropology and Archaeology, University of Aarhus, Moesgård, DK-8270 Højbjerg.

E-mail: farktm@moes.hum.aau.dk

www address: http://www.aau.dk/dk/hum/forhisto/index.html

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Title of the project: "DKC - The Danish National Archaeological Record on-line".

Promoting institution: National Museum, Copenhagen.

Year of beginning: 1982.

Foreseen term:

Geographic area: Denmark.

Excavation area:

Short description of project: The Danish National Archaeological Record (DKC) is a database of archaeological sites and monuments covering all cultural-historical remains from the past to the present from the land and on the sea-bed. For practical reasons efforts have until now been concentrated on prehistoric finds and monuments. The central registration of the cultural history of more recent times will be started in the course of 1998. The record is primarily a tool intended for use by museums, universities and related institutions. As the database contains sensitive information it is not freely accessible. However, there is public access to selected information in the register, while the professionals have full access to texts, maps etc. regulated by the use of passwords. The database currently contains information about 140.000 locations that can be accessed through digital maps using the Records interactive GIS system. The GIS system integrates raster based maps of Denmark in 1:500.000, 1:250.000, 1:100.000, 1:50.000 and 1:25.000 as well as a variety of information in vector format such as administrative boundaries, elevation curves etc. A further development of the Record will be the integration of digitised excavation plans (CAD). Access to the database via the Internet is available and interactive use of the GIS system on the Internet is currently being developed.

Hardware: Standard PC's.

Software: MS Access is used for data entry/retrieval and a SQL-server for data storage. DKC is combining an in-house developed mapping system with the MapInfo GIS system for data entry and the presentation of information.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Henrik Jarl Hansen, DKC, Nationalmuseet, Ny Vestergade 11, Baghuset, DK-1471 København K.

E-mail: DKC-HJH@dkc.natmus.min.dk

www address: http://www.dkc.natmus.dk

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Title of the project: Changing landscapes. Subproject: Land-use and regionality in the Prehistoric and Early Historic cultural landscapes.

Promoting institution: Danish Environmental Research Programme. Participating partners of Land-use and regionality in the Prehistoric and Early Historic cultural landscapes: National Museum, Copenhagen Institute of Anthropology and Archaeology, University of Aarhus.

Year of beginning: 1997.

Foreseen term: 2000.

Geographic area: Denmark.

Excavation area:

Short description of the project: The purpose of the project Changing landscapes is to generate knowledge and tools for modern landscape management, including the cultural landscape. The subproject: Land-use and regionality in the Prehistoric and Early Historic cultural landscapes has as one of its aims to develop an Information System for the cultural landscape using GIS. For that purpose a variety of older maps will be digitised and integrated with the archaeological data in the National Record as well as with geological and botanical information.

Hardware: Standard PC´s.

Software: Windows NT, MapInfo 4.1 professional, ArcView 3.0a with spatial analyst extension.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Henrik Jarl Hansen, DKC, Nationalmuseet, Ny Vestergade 11, Baghuset, DK-1471 København K; Jens Andresen, Institute of Anthropology and Archaeology, University of Aarhus, Moesgård, DK-8270 Højbjerg.

E-mail: Henrik Jarl Hansen: DKC-HJH@dkc.natmus.min.dk Jens Andresen: farkja@moes.hum.aau.dk

www address: http://www.dkc.natmus.dk

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Title of the project: An analysis of the relationship between settlement and landscape 0-550 AD in Southern Jutland and Funen.

Promoting institution: Institute of Anthropology and Archaeology, University of Aarhus.

Year of beginning: 1996.

Foreseen term: 1999.

Geographic area: Southern part of Denmark.

Excavation area:

Short description of the project: The study of the relationship between landscape and settlement will focus on topografical preferences of individual sites in order to document landuse and agricultural strategies in different parts of Denmark. It will be attempted to statistically correlate the Iron Age material with the smallest Danish administrative unit: The township.

Hardware: Standard PC.

Software: Windows NT, MapInfo 4.1 professional, ArcView 3.0a with spatial analyst extension.

Application of descriptive standards:

Application of Spatial Analysis:

Other important information:

Address: Peter Steen Nielsen, Institute of Anthropology and Archaeology, University of Aarhus, Moesgård, DK-8270 Højbjerg.

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www address: http://www.aau.dk/dk/hum/forhisto/index.html

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Title of the project: Digital recording and analysis of the Nørre Snede excavation.
Promoting institution: Institute of Anthropology and Archaeology, University of Aarhus.
Year of beginning: 1997.
Foreseen term: 2001.
Geographic area:
Excavation area:
Short description of the project:
Hardware:
Software: Windows NT, MapInfo 4.1 professional.
Application of descriptive standards:
Application of Spatial Analysis:
Other important information:
Address: Mats Riddersporre, Jens Andresen, Institute of Anthropology and Archaeology, University of Aarhus, Moesgård, DK-8270 Højbjerg.
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ABSTRACT

The use of GIS in Scandinavian archaeology is still limited. The current survey has revealed 18 projects, of which 12 are proper research projects, four are cultural resource management (CRM) projects and two are aimed at developing field methods. Minor projects based on the work of individuals prevail among the research projects, although at least one large-scale project is reported. Three of the four CRM projects are "flagships" for each their country (Denmark, Norway and Sweden).

The paper takes a critical attitude towards the current development in Scandinavian Archaeology, where an obvious disparity between administrative- and research archaeology prevails. The way GIS is applied may be seen as a good example of what this disparity means. Major scale uses of GIS occur in CRM context, but primarily not with a research aim. Ambitious research projects, on the other hand, are promoted by research institutions, but generally they appear impotent due to a lack of resources.

Further the paper focus on demands for making GIS a success in archaeological research. Issues discussed here are: active research contributions from CRM units in the future; better access to digital map information for non-profit research projects; education, education and once more education of archaeologists.