e-Perimetron, Vol.1, No. 2, Spring 2006 [155-163] www.e-perimetron.org | ISSN 1790-3769

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The cadastral cartographic heritage of Sweden

Keywords: Digital archiving; historical cadastral mapping.

Summary
Cadastral mapping has a long history in Sweden. Systematic mapping had already started by 1628 with the instruction by His Majesty to Anders Bure to educate land surveyors and undertake the mapping of the country. Some years later the first instructions for mapping and surveying were laid down. A distinction was made between geometric and geographic mapping with the geometric one more detailed and normally at the scale of 1:5,000. The maps were collected in atlases, the *geometriska jordeböcker* (Geometrical Land Books). In 1725 new survey and mapping instructions were issued, mainly as a compilation of what had been laid down before. Now the scale for detailed mapping has increased to 1:4,000. The maps from these times show that the arable land was very fragmented. To overcome the problems an order was given to the land surveyors to adjust and amalgamate the small pieces of land to as few holdings as possible when they were called to a mission in a village. The work was called Storskifte (Large Holding) and issued as an Act in 1749 followed by *Regulations for Land Surveying in the Kingdom of Sweden* in 1783. Also a more ambitious form of re-allotment of farmland called *Enskifte* (One Holding) was introduced. It became, however, more and more difficult to fulfil the goals and a modification called *Laga Skifte* (Legal Parcelling) was issued in 1827. Almost all villages in Sweden were surveyed and mapped in accordance with the Act and Regulations of Laga Skifte during the following century. The maps and detailed descriptions of all pieces of land are very accurate and are still used as a basis for decisions when a subdivision of land is going to take place. The paper will give a further description of these map series and how they have been scanned and made available for both professional and private use.

Early Maps of Sweden

The first well-known map of Sweden, the Carta Marina, was constructed by Olaus Magnus and printed in Venice in 1539 at an average scale of 1:1.7 million. Olaus Magnus travelled widely within Sweden on duties for King Gustav Vasa. Despite being was sent to Rome as a diplomat for negotiations with the papal court, he couldn't agree with the Reformation, which the King strongly supported. He never returned and devoted his life to historical research and writing. Together with his two year old brother Johannes Magnus, who was the last Catholic Archbishop in Uppsala, he lived for about ten years in Danzig before they moved to Italy. Most of the information for Carta Marina was compiled through interviews with Swedish students who had travelled in order to study at European universities. Together with their writings on Swedish History, the Carta Marina made the two brothers the best known Swedish scholars of the 16th century (Swedish National Encyclopaedia, 1994). During the next century, Andreas Bureus (1571-1646) became the cartography most worthy of note. He served King Gustav II Adolf as Secretary, Royal Architect and Mathematician General. Due to border disputes with Denmark and Russia he was commissioned to draw a map of Scandinavia in 1603, a "synopsis in which all His Majesty's provinces and towns and their positions could be made visible to the eye". After extensive travel and

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field work he published in 1626 the great map *Orbis Arctoi nova et accurate delineation.* Thanks to Dutch map publishers the maps of Bureus became widely known.

The Geometrical Cadastral Books

Already during the 15th century a more systematic work was started to register land holdings in *Land Books*. During the regime of Gustav Vasa (1523-1560) this work was given further attention in order to facilitate the assessment and collection taxes on farms for the Crown. From the 1530´s onwards the Land Books were updated yearly and thus became a standard feature for the accounts of the tax collectors. Later on the Land Books also included other types of properties and are nowadays the official Real Property Register. Andreas Bureus´ map of Sweden was at scale 1:2 million and couldn't match the detailed descriptions given in the Land Books. Hence, King Gustav II Adolf decided to set up a Land Survey and instructed Andreas Bureus to educate land surveyors and to carry out a systematic mapping of the whole kingdom. Translated from the original Swedish, the preamble to the *Instruction of the 4th of April, 1628* to Andreas Bureus reads: *"Since His Majesty's gracious desire and Intent is not only to defend his country and Kingdom from the enemy, but also that His Majesty, as the Opportunity arises and by all possible means, will improve its Capabilities And so that His Majesty may all the better be able to accomplish and execute this; His Majesty wishes to receive a synopsis, whereon His Majesty may study the position of all the Provinces and Towns, whereby His Majesty will then all the better be able to survey and consider by What Means and Where there is need for repairs and improvements. Therefore His Majesty has graciously commissioned and ordered Andrea Bureo to take upon himself to carry out this work."*

Andreas Bureus faced an enormous task. The instruction was very demanding. Not only maps of all towns but also maps of all villages showing fields, meadows and forests were to be drawn. All lakes and rivers that were or could be deemed navigable as well as harbours were to be measured and mapped. Bureus had to start from scratch by training surveyors. He found six young men with suitable qualifications who formed his first class in surveying and mapping. However, Bureus was soon assigned to other duties and the land survey was placed in the Crown Lands Judiciary Board (Kammarkollegiet). The Board issued a number of regulations, but it was not until 1636 that a memorandum with cartographic instructions was issued. Cultivated land was to be grey, meadows green and mires yellow. Lakes edges were to be light blue, while rivers and streams were to be drawn in a darker blue colour. Forest was to be green and Rocky land was to be left uncoloured. Boundaries were to be marked in red and fences in black.

A distinction was made between *geometric* and *geographic* surveying and mapping. The former was used for detailed surveying and the production of large scale maps, which were generalized and put together to make small scale maps of parishes and other geographic areas at the central land survey in Stockholm. Finally, a map of Sweden was completed in 1688. Since Carl Gripenhielm was the Director General of the National Land Survey at that time the map is known as Gripenhielm´s map. It was a classified military map possessed by the War Archive. Rather soon it disappeared. When it turned up in its right place again it had nail stick showing that it had been illegally copied. By whom and where is still a secret. Under Gripenhielm, geographic mapping flourished with the production of road maps and provincial maps. In 1687 he sent out an instruction for geographic maps and how to symbolise some 90 different features. Despite the wars and the increase in geographic mapping beyond the border of modern Sweden, the geometric mapping continued.

In 1688 a new Survey Instruction for both geometric and geographic surveying and mapping was issued. It was very detailed both in surveying and mapping, but also gave the cartographer freedom to find solutions to problems in a sensitive way and *"to allocate colours and include everything worthy of note in the most suitable and pleasing manner."(source for quotation?)* The instruction made it also possible for the surveyors to assist landowners to solve boundary disputes and in the division of land. The surveyors became increasingly involved in the legal aspects of ownership and taxation. The map became a document showing the extent of each holding, together with any subsequent sub-divisions. The maps could readily be related to the information in the Land Book. With the Survey Instruction of 1725 further steps were taken. Special instructions for land division were given and the map with its attached description became a document showing the legal position (*laga läge*) of a farmer's different holdings in accordance with the principles given in the Land Law of King Kristofer from 1442. This was valid until 1736, when the law of 1734 got legal status. The works of the land surveyors had now become instrumental in the Government's policy to amalgamate the fragmented farm land to larger holdings.

Amalgamation and Legal Parcelling

The principles for division of land in a village resulted in a very fragmented picture. When dividing land the surveyors were instructed to try to convince the landowners to agree on adjustment and amalgamation of the narrow strips and scattered pieces into as few holdings as possible. The instruction to amalgamate land was enforced by the *Storskifte Act* of 1757. A further step was taken by Rutger Macklean at the castle of Svaneholm in Skåne, the southernmost province of Sweden. When he became owner of the castle in 1782, he wanted to introduce new agricultural techniques and crop rotation in addition to many other changes in society. The farms on his land were also fragmented and difficult to use efficiently. He made a new plan in 1785 in which each farm became one holding. He was also very active in the Parliament and in 1803 the first act of *Enskifte* (One holding) to be applied in Skåne was adopted. Storskifte and Enskifte ran in parallel and in the 1820s most of the villages had been mapped or remapped in accordance with the Regulations for Land Surveying. How these laws and regulations were applied is shown in an appendix to this paper with an example from a small village in Southern Sweden.

As the amalgamation laws and regulations set such unacceptably high demands, a new land law called *Laga Skifte* (Legal Parcelling) with more moderate demands was adopted in 1827. It became valid from the year after and for the following one hundreds years. Laga Skifte meant *"to make as large a consolidation as their condition and position may allow, without any landowner suffering there from"*. During that period the surveying and mapping activities were very extensive. The surveyors used the summers for field work and the winters for drafting maps, one copy was produced for the county administration and one for the national land survey in Stockholm. The latter copy is usually more decorated and carefully drawn. Since 1976 all these maps have been archived at the National Land Survey in Gävle. The maps are available for research as well as to the public. Even though every effort is made to ensure that the maps are handled with great care, a more satisfactory method of protection has been under consideration for some time.

Digital Archives

A long term programme of microfilming was launched by the National Land Survey in the 1970s. The aim had been to make the deeds more available to users without recourse to consulting the

originals. This worked well for black and white documents in A4 format, which were recorded on roll film. One master film and one copy were stored in safe rooms with suitable environmental controls at the National Land Survey and one copy was sent to the county offices for operational use. Tests with micro cards in colour for large format were not found to be feasible. The programme was under-funded with the result that the production of new documents became larger than the number of filmed documents per year. With the advent of Electronic Document Management (EDM) new opportunities were tested. During 1994-95 new archiving methods were tested using a process that included microfilming, indexing and storage in digital format on writeable compact discs. One part of the project was to find a suitable technique for scanning of large format maps in colour. The successful compression of coloured documents and on-screen presentation remained problematic. However, the broadband technique for communication was coming and the large demand for storage could be met. An investment in a total digitalisation of the archives was found to have a rather short pay off time. Savings could be made in many different ways. One was the rent of space for the county analogue archives that was easy to calculate. Another was that the travel time and cost for getting access to the documents almost disappeared.

After some years of uncertainty how to proceed, the Director General of National Land Survey initiated a series of studies concerning the archiving strategy, perpetual storage of the analogue documents, technical solutions and a plan for the full implementation. With the findings from these studies the whole process could start in 2002 with the county of Stockholm. The reason for choosing Stockholm was that the county office had to move its office and found that office space for a digital archive was much less than the space for an analogue one. It is remarkable that this ICT project was finished on time and that the digital archive was accessible at the new office from the first day. In order to access documents in the digital archive an information service called *Arkivsök* (Archive Search) has been developed. The service is available from the home page of the National Land Survey and restricted to licensed users who log in with username and password. Searches are conducted per county, parish, village/township and type of deed. There are many tools for navigation in the documents. Map studies are now a pleasure.

It should also be said that several other historical map series have been digitised and available via Arkivsök. The public have also access to these via the service *Historical Maps for All*, also available from the home page.

Acknowledgement

Most of the information about the surveying and mapping activities in Sweden during the last centuries is taken from an article by Örback (1994) published in the first volume of the National Atlas of Sweden (Sporrong and Wennström, 1994), where a lot more of the cartographic heritage of Sweden can be found. I also want to thank National Land Survey (www.lantmateriet.se) for the charge-less use of *Arkivsök* and Alastair Pearson for his valuable comments.

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Appendix

Reallotment in accordance with the Land Reform Act of 1757 (Storskifte) as conducted in the village of Burlöv in the years of 1777-78, in accordance with the survey regulations of 1766

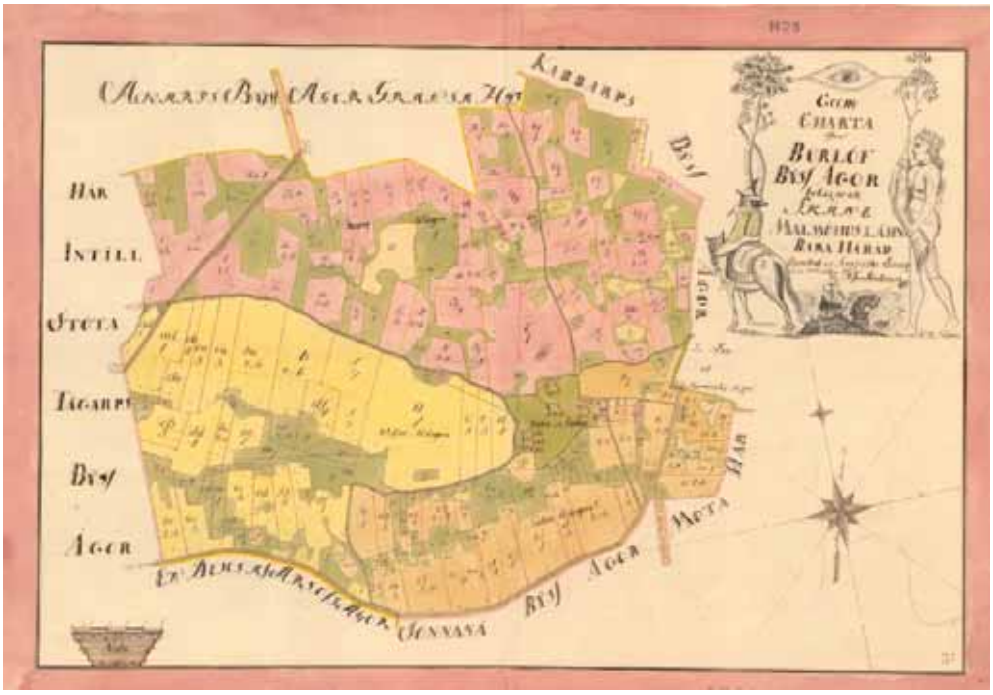
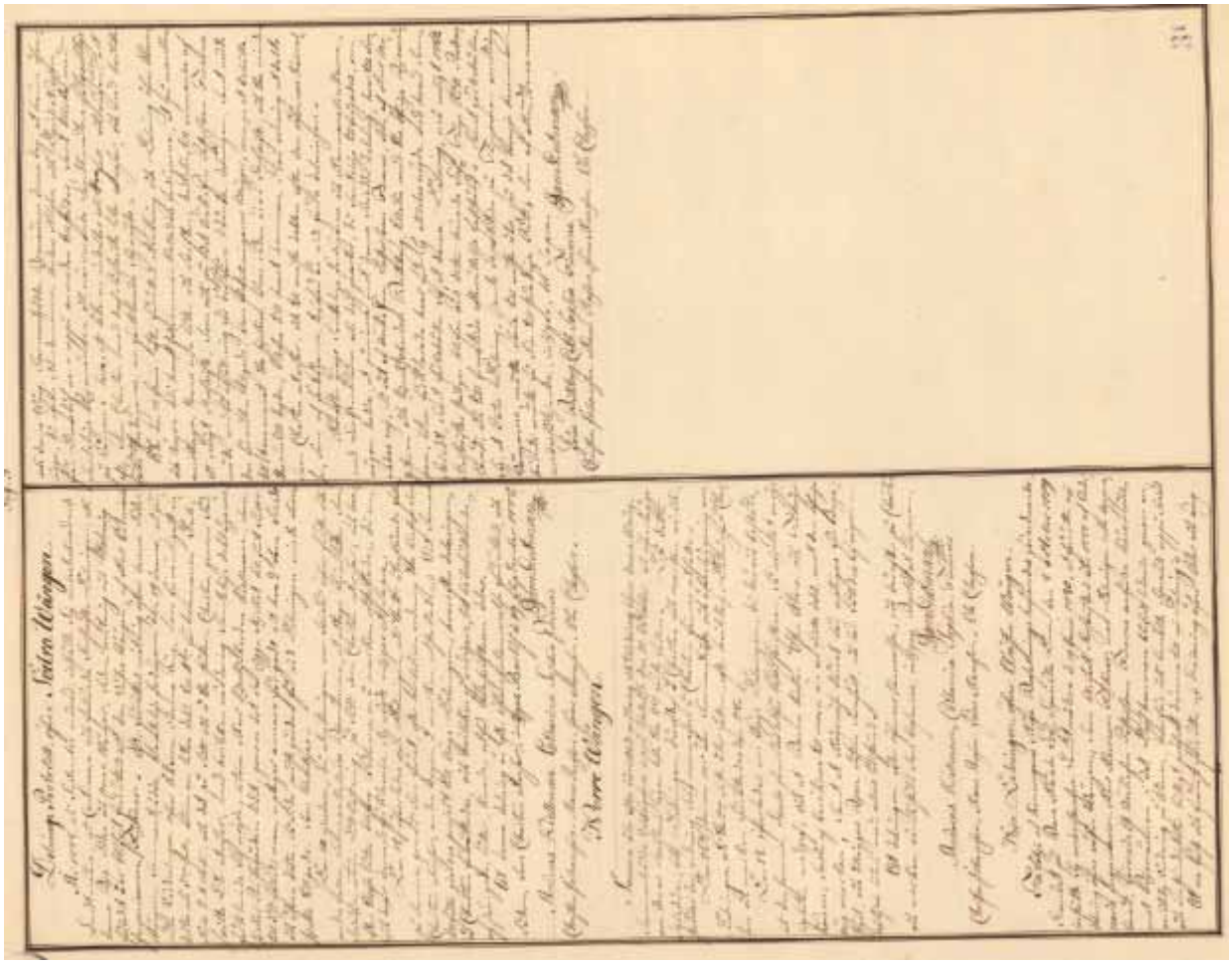


Figure 1. A Geometric Map of the village of Burlöv in Skåne, the southernmost province of Sweden. The arable land of the village is divided in three parts. Each part (wång) is fenced and commonly owned by the farmers in the village, and cultivated in accordance with the medieval system for crop rotation. Land depicted in green is meadows. The map shows the result of how the land was divided and allocated to each of the six farms in the village. All measurements are shown in attached tables. The cartouche is just a decoration.

Figure 2. Enlargement showing the centre of the village with the location of the farm buildings and a true picture of the church. The windmill of the village is also depicted with a true picture east of the centre. Farm N 7 close to the church is the farm of the vicar and the parcels numbered with "7" were allocated to that farm.

The following two pages show the tables with measurements and final agreements. From the enlargement of the table we can see that field “b1”, northeast of the church is a tilled field of mould clay with an area of 11 tunnland and 6+3/4 kappland. One tunnland is about one acre. Tunna is the Swedish word for barrel and also a volume unit of 150 litres. Kappe is a volume of 4.58 l. Hence, the old Swedish area measurement units are a transcription of how much rye that should be sawn on the area.



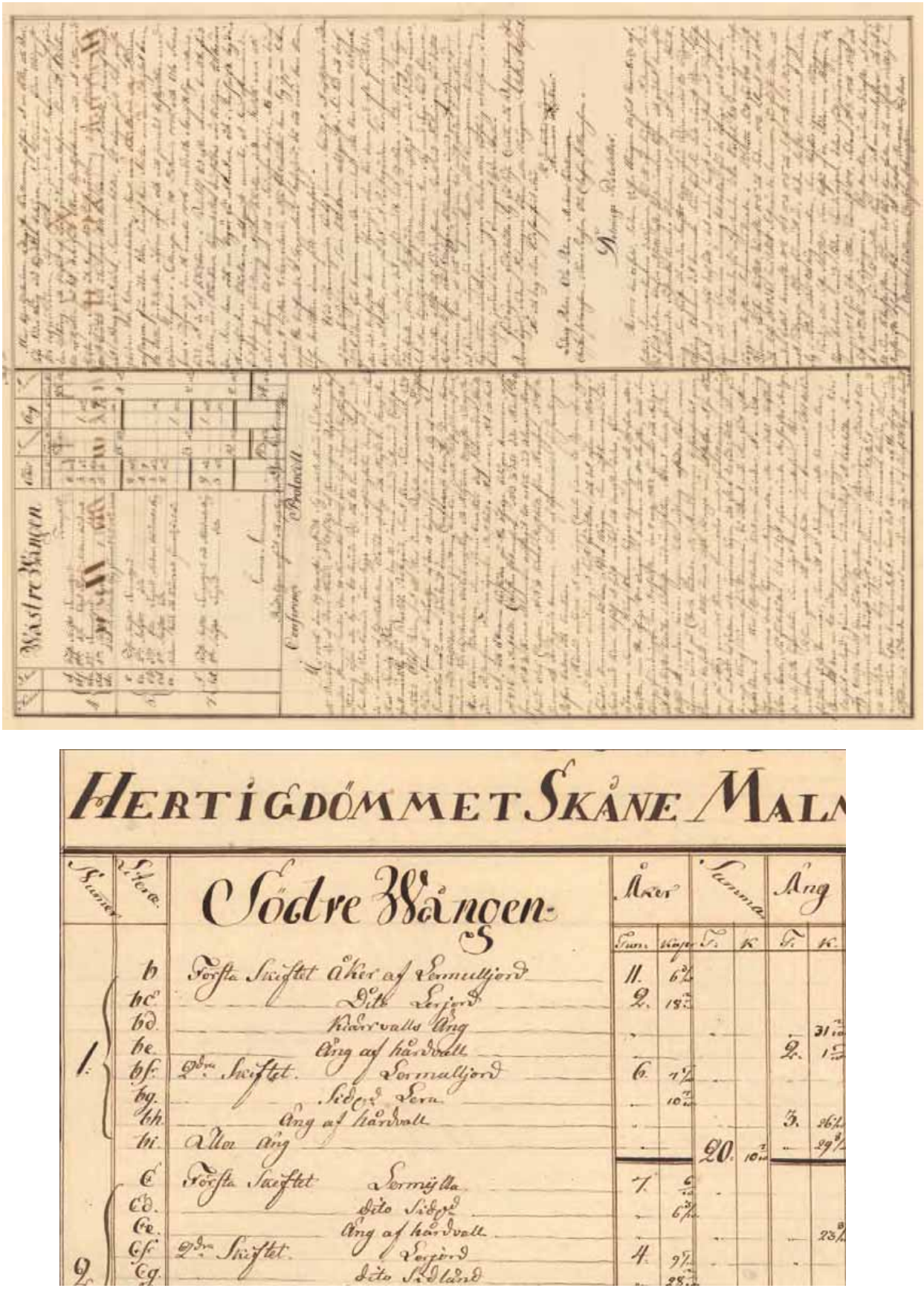


Figure 3-5. Enlargement of the first part of the descriptions of the different fields. Each field is numbered and described with type and soil. Åker means ploughed land and äng meadow. Area is given in tunnland and kappland, where one tunnland is equal to one acre.

Reallotment in accordance with the Enskifte Act of 1803 as conducted in the village of Burlöv in the year of 1817 in accordance with the Regulations for Land Surveying of 1783

Figure 6. With the regulations called Enskifte it was possible to create a structure, where each farm became one holding. The owner of lot D was instructed to move his buildings to the lot with assistance from the others. The text part of the transaction is signed by the land owners and gives a detailed description.

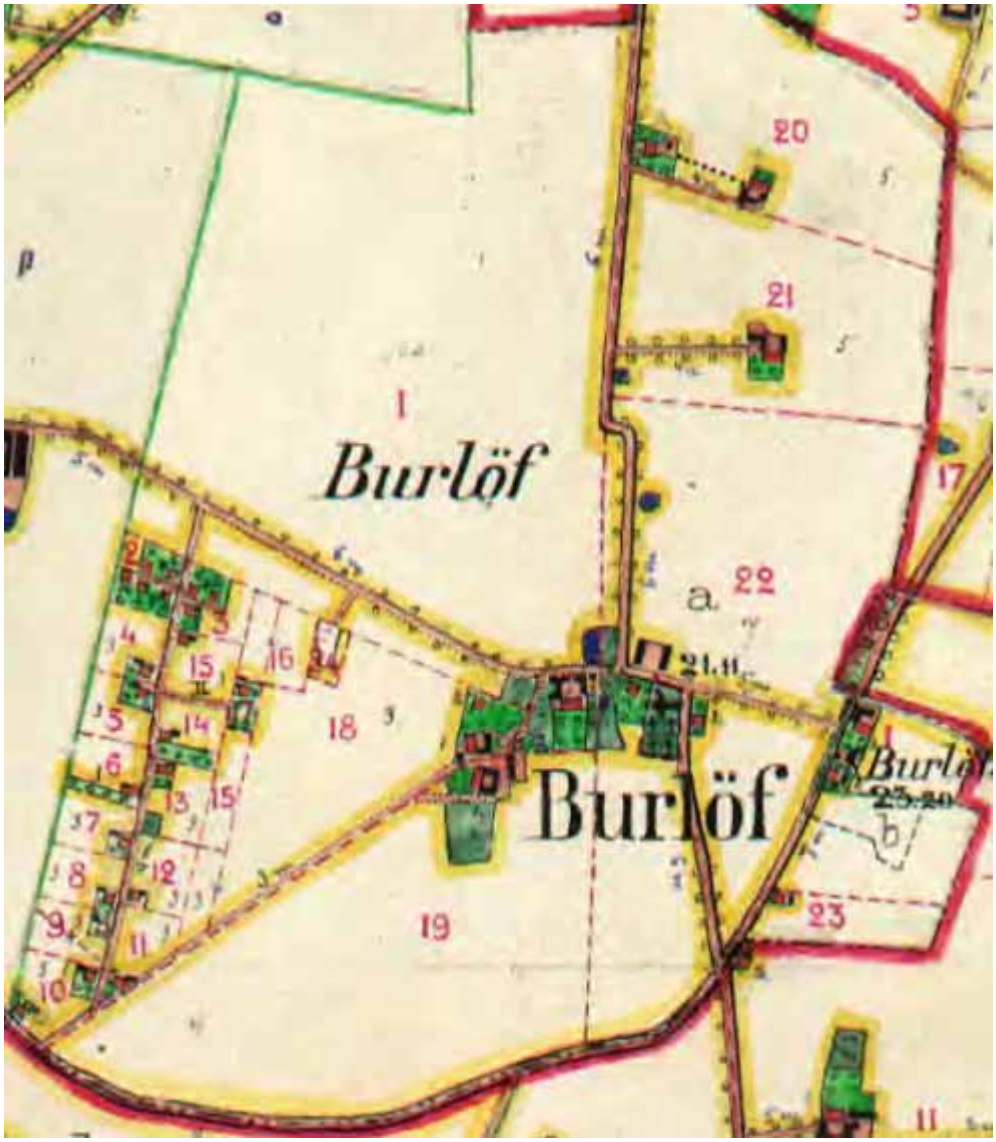


Figure 7. The map shows that the lot D (Burlöv 5) has been divided into two farms with buildings and gardens. The triangular lot west of the church has been divided into small lots, suitable for industry workers, where the family could grow their own vegetables.