CHAPTER 2

HISTORICAL DOCUMENTS AND RECORDS

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This chapter introduces the use of historical documents as sources in Historical Ecology research. There is a large range of purposes and contents of historical documents, and many of them hold important information about the use, qualities, agreements, and beliefs related to past ecosystems. Written words from the hands of people in the past, illustrations, and photographs are a direct link to these people's lives and conditions. Historical documents therefore play a vital role in Historical Ecology research. In this chapter we present several categories of historical documents and issues relating to their use. We provide an outline of the process of historical criticism that includes both external and internal analysis. The chapter will also describe a sampling of the kinds of historical documents that contain information relevant to Historical Ecology questions, including tax records, parish records, ethnological data, Atlases, photographs, and family records. Finally, the chapter describes several brief case studies from Sweden and France on how historical documents have contributed to historical ecological research questions.

Introduction

In pre-industrial societies, the majority of people were directly dependent on local natural resources for their daily needs. Before industrialization, the economy of western states rested mainly on food and fiber grown and harvested from local and regional ecosystems and used locally. There were also many reasons for writing down, drawing maps, or in other ways documenting conditions and agreements regarding people's use of ecosystems. Documents from such circumstances are therefore rich sources of knowledge for all kinds of Historical Ecology questions. Writing has a relatively short history in relation to the history of humanity and was preceded by oral communication and agreements. Even though oral communication has continued being of great importance, the written word made it possible to consolidate laws, agreements, assets, ownership and other important information in documents that could be communicated unchanged into other contexts in time and place. Written documents have preserved details of past societies' relationships with their environments in public archives and private holdings from past times that otherwise would have become lost and forgotten. With the right tools and knowledge, these documents are a gold mine for historical ecologists and others.

Historical Ecology brings together researchers from the natural sciences, social sciences, and the humanities. Researchers in the natural sciences are sometimes skeptical of the validity of information from historical documentary sources. They see that type of information as subjective and unreliable, especially when compared with the scientific method applied to the "hard sciences." Those not trained in the field of history often do not realize that trained historians apply a rigorous process of criticism to historical documentary data that includes both external and internal analysis. The uncritical and inexpert use of historical documents by researchers in

fields outside of history who seek to use historical information to provide context to their own data, has led to the misuse and mistrust of historical information.

The oldest written documents were made by and for the educated elite, such as the royalty, nobility and clergy, and they were almost exclusively written and used by men. Laws, court records, tax registers, land purchases, cadastral maps, probate inventories and church records are examples of sources written by the elite that can be found in national, regional and local archives. With time, common people got access to basic education and could start writing and producing, for example, diaries, letters, private agreements, biographies, and farm records. These "ego-documents", written by someone with inside knowledge, may have been collected by archives at a later stage, but are more likely kept privately by descendants of the authors, if they still exist. It is important to keep in mind that the survival of historical documents of any kind is haphazard. Even for government documents, fires, wars, and changing ideas about the value of documents affects what survives and what does not. In the early 20th century, as ethnologists noticed that folk culture had changed radically with the extensive effects of industrialization, ethnological archives started to collect knowledge and folklore of common people. It was at this time that a great deal of previously oral culture and knowledge was recorded for the first time.

Disciplinary underpinnings and perspectives

In their wider sense, historical documents include carvings on stone and wood, hammered coins and engraved medals. Interpretation of these belong mainly to the disciplines of archaeology, linguistics, and numismatics. The focus of this chapter, documentary sources replicated on paper or similar media, have traditionally been used in various historical disciplines such as political history, economic history, mentality history, social history, agrarian history and local history. Historical documents are a rich source to many historical ecological questions, especially in combination with other types of sources presented in this volume. Historical scholars have a long tradition of working alone in the archives, digging deep into their questions and publishing alone. The lone researcher has been the standard model in history research and monographs have been rewarded with greater scientific credit than co-authored publications. Authors in co-published books usually have individually written chapters and the different researchers rarely discuss each other's work even when the book has a joint theme. When integrating historical documents in Historical Ecological projects, it is preferable, often even necessary, to cooperate with other scholars throughout the project, starting with formulating questions, continuing with discussing interpretations, exploring each other's data and methods and writing chapters or papers together. This is a significant change in the way that many history researchers are used to working, however we acknowledge that cooperation is an increasing trend in historical research.

The use of historical data and analysis

Historical documents are often readily available from local, national, and international archives. Many such documents are now also available digitally and many archives can be searched online. Sometimes personal documents like diaries are found in the possession of family members or local historical associations.

Source criticism

Historical documents must be critically evaluated through a process called source criticism. This basic aspect of historical research is necessary because no documentation contains a complete and unbiased presentation of the subject matter. Today, people are becoming more and more aware of the need to be critically aware before using information from the flood of information we face every day, in order to differentiate between facts, fake-news and twisted interpretations by vested political and economic interests. This includes evaluating

information in the media based on what we know about the current societal context, which groups in society that stand for impartial information, and which groups have a particular interest in the message coming through to the audience. Similarly, historical documents must be critically evaluated before they are used as sources.

Source criticism includes a critical examination of the used sources and an assessment of the credibility of statements made in any source of information. Historical documents were not created to answer the questions we want to address in our research. They originate from a specific historical context, created with methods and aims relevant to their time, which often poorly match what we find as relevant and interesting today. In using historical documents it is therefore important to understand what they can inform us about, and which questions that are difficult or even impossible to answer from these sources. In short, the source critical evaluation determines if, and how, a particular source can be used.

The process of historical criticism includes both external and internal analysis (Barber and Berdan 1998, Kyvig and Marty 2000).

- External analysis is designed to determine the authenticity and the context of the document. In other words, it examines if the source is what it claims to be. External analysis includes questions as:
- Can the historical continuity for the document be traced (i.e. chain of evidence)?
- Are the physical aspects of the document appropriate (i.e. the date of paper, pen, ink, pencil)?
- Is the handwriting appropriate in terms of date, style and characteristics fitting for the purported author?
- Are there anachronisms in words, phrases, spellings, polite usages, structures, or concepts? (anticipatory and retrospective).
- Is the document adequately consistent with the corpus of well-established sources?
- Internal analysis is designed to determine the credibility of the information contained within the document and includes such questions as:
- Was the author in a physical position (i.e. place and time) to report events or conditions?
- How much time elapsed between the events and the writing of the account?
- Did the author have the cultural background, including language proficiency, to understand what was observed?
- What were the author's biases, and how might they have affected their reporting?
- What were the author's vested interests, and how might it have affected their reporting?
- What elements are formulaic or expected within this genre, and which are unique and potentially meaningful?
- Was the report inherently plausible?
- How well does the report fit in with other evidence on the same issue?
- External analysis is of particular importance when working with private documents and local archives (or any source which so far has not been viewed with critical eyes). Internal analysis should always be applied. If you are working with a commonly used source, others may have evaluated its usefulness, but not always in ways that are relevant for your specific questions.

Source pluralism

In many Historical Ecological questions it is necessary to combine several different sources. These may give complementary information about the research question, complementing each other on types of information, temporal and spatial cover, and level of detail. For example, cadastral maps will show the location and size of

pastures and may even provide information about productivity and vegetation. More detailed sources such as diaries may show how grazing was organized in time and space, and why they were organized in this way. If the map and the diary both refer to the same village, the grazing organization can be reconstructed (example 1.). Under beneficial conditions, field surveys of the pastures may add knowledge about productivity and tree cover. Together, these three sources give more information about the pasture than any of them could do alone, thus filling each other's information gaps.

If several sources provide similar information about something, they give support for a clearer interpretation. But it is also valuable when sources diverge because that highlights the need to reconsider the interpretations. Questions may need to be rephrased, sources may need to be re-evaluated, and involvement of further sources may be necessary, which develops new knowledge. Many Historical Ecological questions benefit from combining different documentary sources with non-documentary sources, such as ecology, oral information and archaeology. In addition, some data such as tax and land use information can be integrated into GIS for spatial and temporal analysis (see Chapter 11).

Spatial, institutional, and temporal scales

Historical documents may cover different scales, from individual statements in diaries, letters, court registers (micro scale), descriptions and statistics covering local-regional conditions (meso scale), up to national sources (macro scale). The micro scale often contains details that are missing from the other levels of information, for example, how people decided how to work their land depending on social relations, economy, technique and individual knowledge. On the one hand, information from individual persons cannot be seen as representative for a larger group of individuals. On the other hand, societies consist of individuals and such details shed light on what circumstances and motivations may be hidden behind official records at meso and macro-levels. They may illustrate how known societal or land use changes, known from the macro-level, were taking place in individual farms or households. The possibility to zoom in and zoom out in scale is always rewarding as it sheds light on both the overall picture and the details.

Example 1. Grazing according to an ethnological questionnaire and cadastral map

In 1941, Edith Östergran answered a questionnaire from the museum of Nordic cultural history (Nordiska museet) about livestock management (NM60 Boskapsskötsel). Edith was born in 1895 and retold information she received from her father about her childhood farm around 1870. At this time her father worked ⅛ of the village Österskog situated in the county of Jönköping, Sweden. Edith informs us that in 1879 there were two large oxen, four cows, two heifers, one calf, eight sheep, two sows, and five hens at the farm. She described six different pastures of varying productivity. Lassabohagen was the most productive. Kärrahagen, Nyröslet and Långelyckan were other productive pastures. Västbohagen was situated further from the others and Storåkersmaden was the least productive of the pastures because the soil consisted of peat. Also hay meadows and arable land served as pasture in late summer when vegetation had grown back after harvest. Every described pasture, and a few more, can be identified in the cadastral map over the village from 1882, made because of the land reform "laga skifte" (Figure 2.1). In laga skifte land was redistributed and common land (in particular pastures) became private.

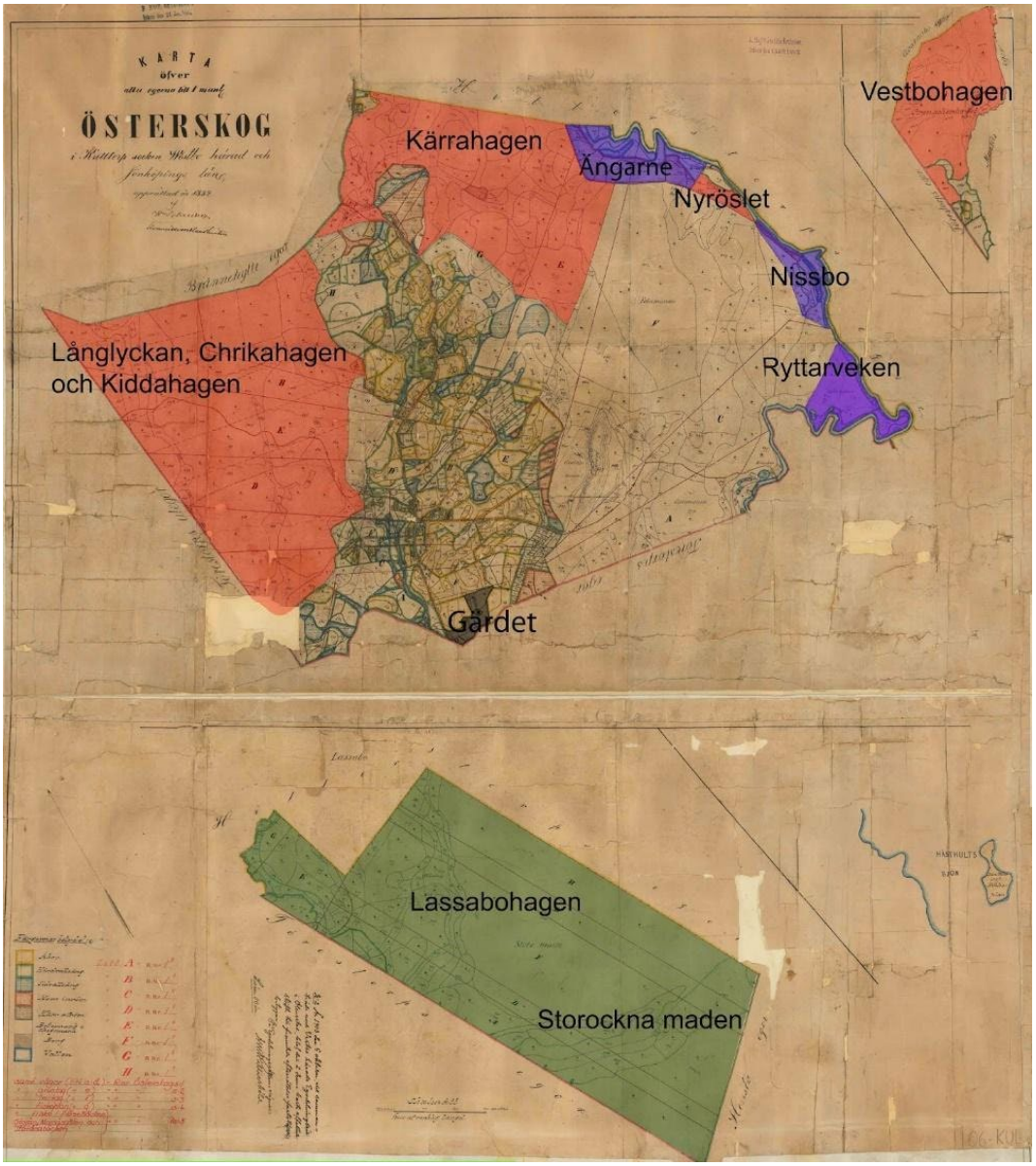


Figure 2.1. Cadastral map of Österskog from 1882, where the names and locations of pastures described by Edith Östergran have been highlighted. Source Lantmäterimyndigheternas arkiv 06-KUL-54.

Before 1882, pastures were commonly held and grazing was strictly regulated for all villagers, which was also described by Edith. The dates when livestock were moved was very exact in Österskog and she used entries from the calendar of 1870 as an example.

The combination of Edith's statement and the information in the cadastral map enabled a reconstruction of the grazing organization in this village before the land use reform (Figure 2.2). Furthermore, Ediths written statement explains how grazing organization reflected land productivity and cattle productivity. The best pasture, Lassabohagen, was reserved for high lactating cows, who had their calves late in winter. They were kept indoors, eating hay until early or mid-June when the vegetation in pasture had become lush. They also

grazed hay meadows in late summer. Low-lactating cows were moved seven times between four intermediately productive pastures during the summer. Non-lactating cows and heifers were let out to graze in mid-May, and they had to settle for the least productive pasture, Storåkersmaden.

In addition to how grazing organization was influenced by productivity, we also expect different ecological responses in the vegetation from periodic and continuous grazing, for example in response to grazing pressure. Although we cannot measure grazing pressure in hindsight, we find it likely that grazing pressure was higher in the four pastures grazed by the migrating cows than in the continuously grazed pastures. In pastures with high grazing pressure, where nearly all vegetation, including flowers is being consumed, species that depend on yearly flowering and maturing seeds are disfavoured. Thus, we expect different grazing organizations to have shaped the vegetation composition differently.

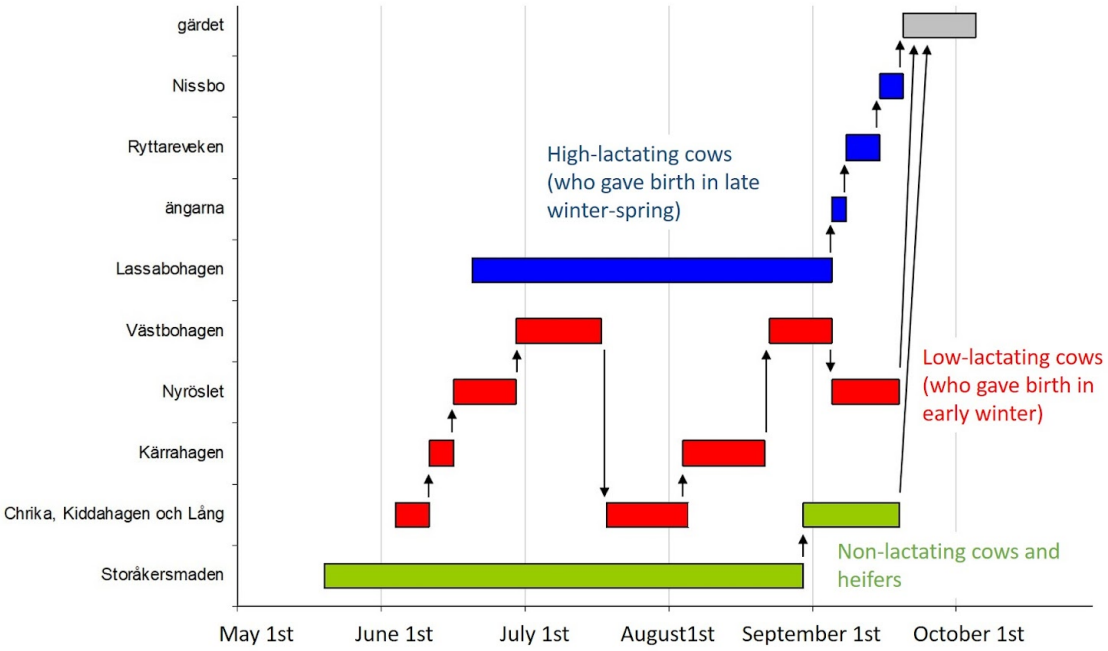


Figure 2.2. Grazing organization at Österskog village in the 1870'ies as described by Edith Östergran (see text). The information presented in example 1 shows how grazing was organized in one village in Sweden and it may be unique or representative for the region. It illustrates how grazing could be organized and how it related to cattle production and land productivity, without saying that other villages used the same organization. Despite being local, it holds invaluable information of a kind that is rare in historical sources.

Sources also differ in their temporal extent, from momentary (one day) to long time-series. Sources can be retrospective (reflecting on the past) or only inform us about the time they deal with. It is important to be aware of any particular circumstances (war, crop failure, livestock disease, economic crisis, exceptional prices etc.) before using momentary information as representative for a longer time period. Again, example 1 only shows data from one single year, but it most likely represents a somewhat longer time period, since the informant chose this year to illustrate grazing organization at her family farm. Retrospective sources may also be influenced by whether or not the source wants to highlight the past as being better or worse than the present.

Methods of collection and data analysis

The methods of data collection vary depending on sources and what kind of data that is used. There are two main lines of analysis of historical documents: quantitative and qualitative.

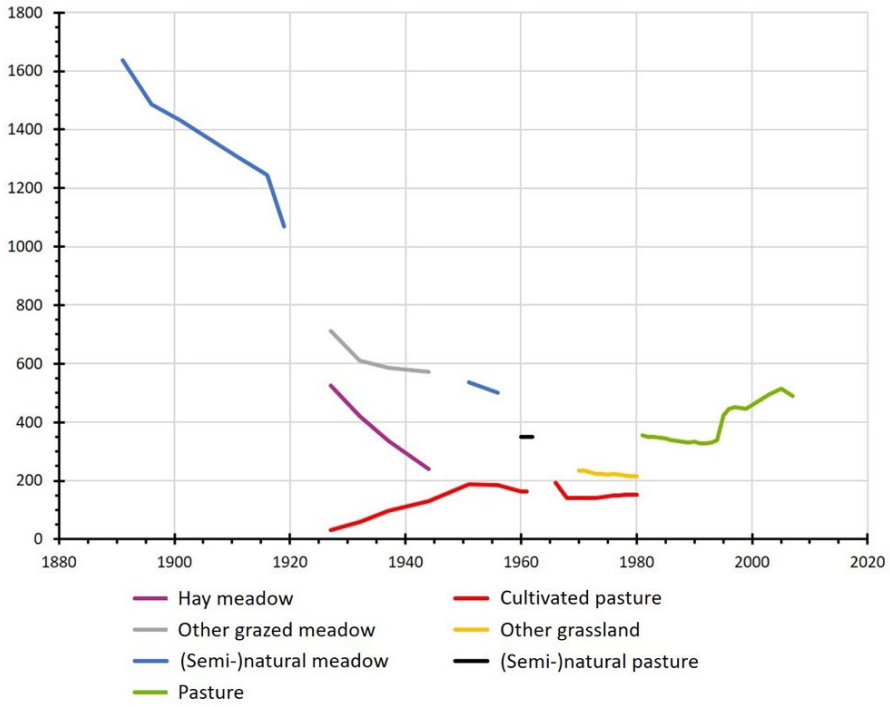


Figure 2.3. The area of different grassland categories in Sweden. The Y-axis shows thousands of hectares. Source: Jordbruksverket och Statistiska centralbyrån 2011, Figur 1L.

Quantitative analyses

Quantitative analysis aims to present numerical information, statistical surveys or present results in ways that can be generalized or compared. Some documents provide direct numerical data such as the number of inhabitants, cereal harvest, livestock numbers etc. These can be combined at some geographical level into time series, or used to compare conditions in different regions. Question could be, for example: Did the population increase as hay meadows were transformed into arable land during the 19th century? Does the number of cows per household correlate with the area of pasture during the early 19th century in Sweden?

Diagrams based on quantitative data have great benefits in being visually illustrative. It is easy for the plain eye to see how curves on diagrams vary over a timeline and it gives an immediate understanding on how things have changed. However, not everything that can be counted should be quantified, and it is important to ask oneself when quantifying is the best way to interpret pieces of information. Statistical results and diagrams will never be better than the input data and should always be combined with a source critical perspective. Before temporal comparisons can be made, research must be done into the methods of historical data collection. It is common that data from different times have different origins, which blurs the results. In Sweden for example, the first agricultural statistical data was collected around 1800 by the parish priests (Gadd & Jorner 1999). Since priests also collected tax from farmers, there was an incentive by farmers to keep harvest figures and other information low. During the rest of the 19th century, the data collection went from the church to the county

administration, and later to regional farming associations, all using different methods. By 1913, Statistics Sweden started collecting more reliable statistical information, but the categorisations of land use types shifted with time. This makes it difficult to compare information over time. In diagrams, representing data of differing qualities, can be represented with different colors (Figure 2.3).

Data may sometimes be limited, but even with scarce or less stable data, quantitative analyses are valuable for finding patterns in the data, e.g. through plotting diagrams and tables, from which the results can be discussed. Large data sets are useful for making statistical analysis and finding large scale patterns that cannot be secured in small data sets. The data can be worked in Excel, minitab, R, or other statistical software commonly available. For large collections of qualitative data, analyses can be facilitated by the use of software such as nVivo and Atlas.ti. These programs can be used to sort, organize and perform quantitative analyses of qualitative information.

Figure 2.4. Cadastral map from 1642, the farm Bränntorp in the county of Östergötland in Sweden. The map shows the farmhouse, arable land (rectangles) surrounded by infield pasture, and to the left, a dry meadow with trees. The area outside the infield also belonged to the Bränntorp and was described as "forest and pasture sufficient". Source: Lantmäteristyrelsens arkiv D51-12:D8:64.

Qualitative analysis

Qualitative analysis is a group of scientific methods used to collect and interpret text or other non-numerical data. The methods of hermeneutics is all about how to understand text, including from historical documents. Interpretation is a part of all historical data and is especially important using qualitative data. Interpretation differentiates between the data and how the author understands the data in relation to the posed questions. It usually includes posing a larger question or research domain which is divided into smaller questions. These are answered, going through information from one or several sources and presented in text. The reader is thereby guided through the question, choice of source, the data, and its interpretation. The researcher must be clear on

the data input, interpretation process, and its results. In this way, others can read the text and agree on the interpretation or come to different conclusions. The questions may be more explorative such as: "how did the agrarian revolution affect landless people in the mining district of Sweden, with regard to wealth?", or more normative, such as "did landless people get poorer during the during the agrarian revolution in the mining district of Sweden?". The answer to normative questions is rarely a simple yes or no, but rather what information supports "yes", and what supports "no". Perhaps some landless people in the mining district became poorer but not all. In this case, a deeper discussion around the definition of "poverty" may be required. The discussion itself will reveal much new information about the situation for the landless groups, and leads to new insights about what changed in the society regarding this group of people. Of course, qualitative analyses may also give clear patterns, such as the ecotypes of families in Burgundy in the 1690s (see example 3).

Qualitative sources can sometimes also be quantified, for example, comparing the written statements of forest quality in cadastral maps such as in figure 2.4 . In one study we compared how the forest was described in 150 cadastral maps from the 17th century, situated in four different Swedish regions. The result (Figure 2.5), shows regional differences between maps, which must be interpreted before concluding if they also reflect differences in forest quality. For example, slash and burn cultivation were mentioned only in the maps of Alseda. Perhaps slash and burn cultivation was particular for Alseda and did not occur in the other regions. But an alternative explanation is that only the surveyor working in Alseda took notice of this forest use, while other surveyors did not. The forest was not of primary interest in these maps, and different surveyors could have put different efforts into the forest descriptions. Also GIS is useful to analyse and illustrate qualitative information (Figure 2.7, 2.21, 2.22, see also Chapter 11).

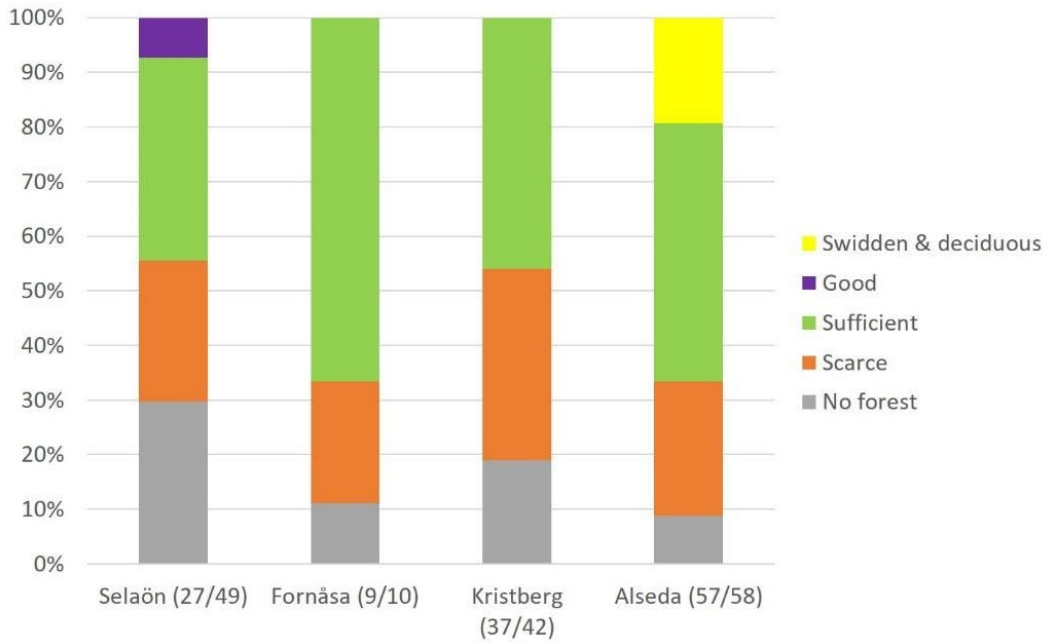


Figure 2.5. The forest quality described in cadastral maps from different regions in south-central Sweden: Selaön and Fornåsa are situated in the plains, Kristberg and Alseda in hilly forested areas. The graph shows the proportion of villages where the forest was described as good, sufficient, scarce or no forest in cadastral maps from the early 17th century. Swidden and deciduous forest was only described from one parish. Within brackets are the number of analyzed villages where there was a description vs, the total number of analyzed cadastral maps. Data from Dahlström 2006.

A selection of documentary sources

Societies have created documents throughout history, resulting from different institutional and private affairs such as royal, political, ecclesiastical, legal and statistical activities, documenting agreements, private correspondence and diaries, among many others. The kinds of available documents differ between countries, regions and time periods. Here, we present the primary sources most commonly used in our own projects, along with examples. We also address source critical aspects, access and copyright issues.

Parish records

In Sweden and other countries, the church kept track of the members in the parish. The priest kept registers for people moving to and from his parish, deaths, births, christenings, God parents and marriages. Parish records in Sweden are available from late 17th century to early 19th century. They are generally very accurate sources and give detailed information about households and people. In Sweden, the priest performed yearly hearings to investigate people's biblical knowledge. At the hearings, all people living in each household (including maids and farm hands) give an overview of which persons were associated with different households. Swedish parish records have been scanned and are free to use via the National archive: https://sok.riksarkivet.se

These registers provide an important background image of the study area, who lived there, people's positions in the society, socio-economic patterns, social relations and migratory patterns. In the reading of diaries, letters and other documents, it is essential to have an idea of the social context. For example, in one of our Swedish study areas of southern Dalarna, several farmers kept diaries in the same time period. By comparing the information in the diaries, we could easily see that several of the authors of the diaries were close relatives and the relationship to different people mentioned in the diaries was clearer to us. This gives us a better understanding of how ideas could spread, who bought grains and cows from who and the place of origin of farm hands and maids, etc.

In France, Elizabeth Anne Jones has reconstructed family relationships and the land use patterns in Burgundy by using information from the parish record (see example 4).

Cadastral maps and other cadastral records

A cadastre is a recording of properties, land use and land ownership, usually defining the dimension and location of land described in legal documents. Cadastres are often maps documenting borders, ownership, land use and other information necessary to ensure land valuation and taxation. In Sweden, cadastral maps were first produced from the early 17th century, which is early in international comparison, and continues up to the present. The different generations of maps contain different kinds of information, depending on the methods used and the aims of the map. Cadastral maps are very useful in Historical Ecology research. Primarily, we use the size and location of different land use types such as garden, arable land, hay meadows, pasture and forest in order to reconstruct land use history. Secondly, it is interesting to read how different parcels have been described in terms of vegetation and productivity, since they give important information about ecosystems. Thirdly, the location of fences is used to understand past grazing organization, i.e. timing of grazing in different kinds of pastures (Figure 2.6), which also may have shaped vegetation in ways that can be traced for centuries (see chapter 2 biological cultural heritage and Example 1).

These cadastral maps are impressively correct, given the cartographic methods used in these early times (see chapter 6 Historical Cartography). Information about ecosystems must be interpreted before it is used. For example, the maps usually only note some tree species in the forest, and the forest quality was expressed in

terms relevant for people's use of forest, i.e. sufficiency of timber, fencing and firewood, or economic value. Fences are not depicted in all maps, especially not small-scale maps.

Cadastral maps largely have been scanned in Sweden and are free to use at: https://www.lantmateriet.se/historiskakartor. Romanian cadastral maps made by the Austro-Hungarian empire in the late 19th century are published at https://maps.arcanum.com/en/map/cadastral/. Also, see chapter 6 Historical Cartography for French maps.

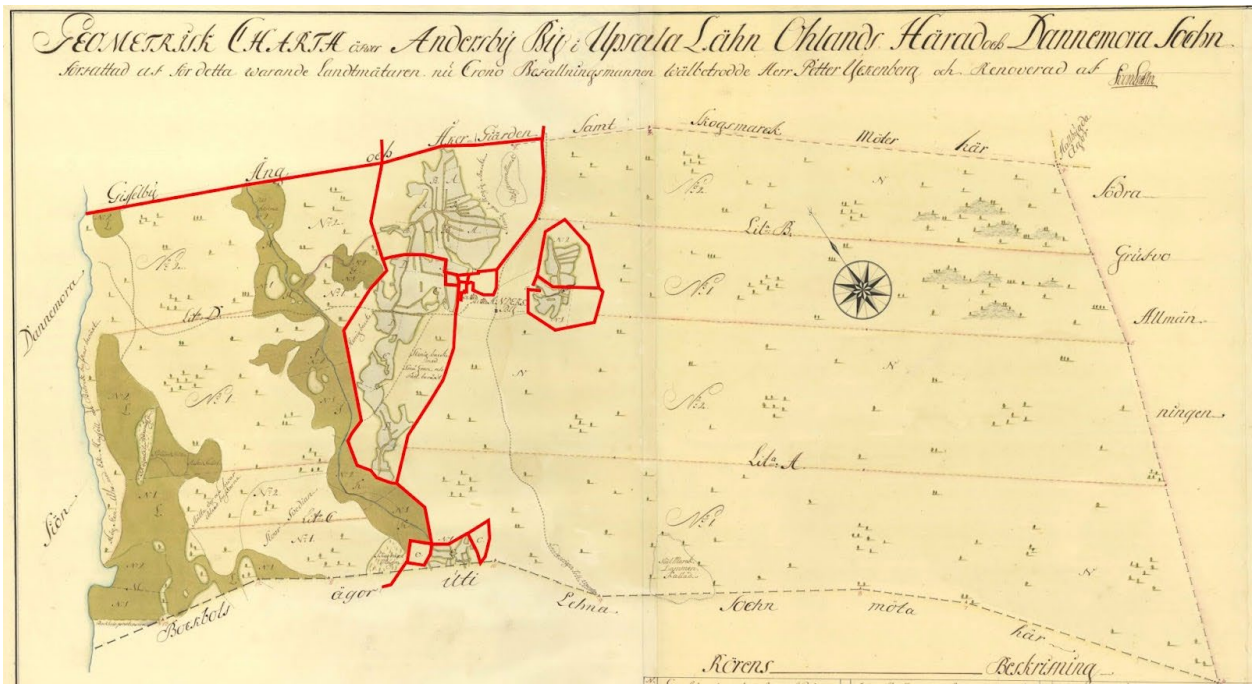


Figure 2.6. Cadastral map of the village Andersby, from 1739. Infields are situated to the left with arable land and hay meadows. The fencing system (red lines) reveals how grazing was organized in the village. Outland pastures to the east could be grazed all summer, and pastures situated in the west could be grazed only after the harvest on arable land and hay meadows, i.e. late August or September.

Tax records

Property and personal belongings subject to taxation have been recorded by the state for a very long time. Land, harvest, livestock, charcoal, and other items can therefore be found in registers at household, farm, or village level. These are all keys to understand subsistence, land use, and other information relevant to Historical Ecology. The subjects of taxation and the position of the tax collector differ between areas and time periods. There is reason to suspect that people were hesitant to give correct information to tax collectors, and that tax records therefore may underestimate what people owned and harvested.

In Sweden there was an extra tax on livestock and arable land during 1620-1641 as a means to finance participation in the 30-year war. Each household paid tax per livestock over one year of age with different rates for different species and ages. Each winter, royal representatives counted livestock and made registers, bringing us a unique opportunity to know how much livestock individual farms had, how livestock composition differed between farmers in different regions (Figure 2.7), and how livestock varied between years. From 1642 the direct

tax was replaced by a fixed sum and no more registers were made. The next time in history when livestock were regularly registered in Sweden is in the mid 1800´s when probate inventories became common.

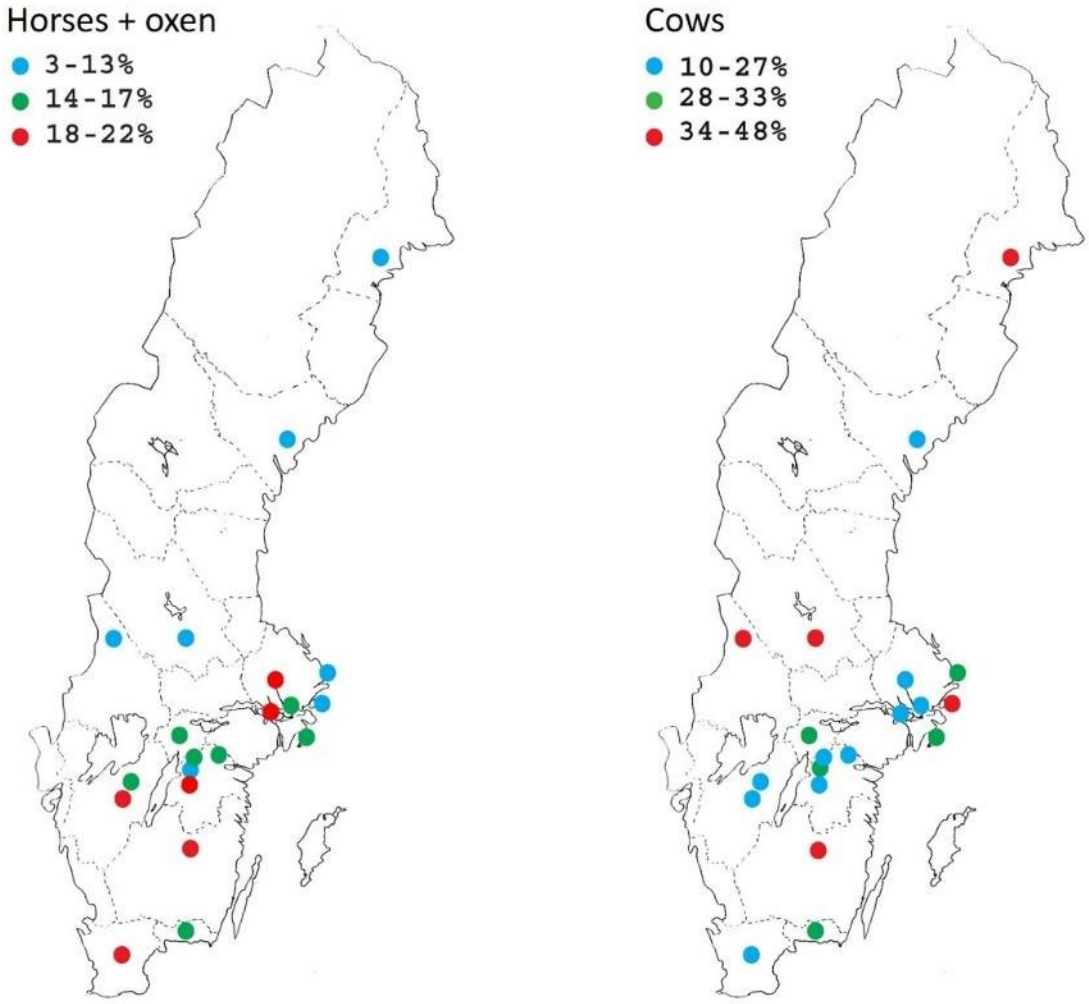


Figure 2.7. Livestock composition in the early 17th century based on studies using livestock tax registers. Not surprisingly, there was a larger proportion of working animals in regions in the plains where work in the fields was important or oxen were brought up (left map). Forested regions, where the economy was more based on milk production instead had more cows (right map). Illustration and references from Dahlström 2006.

Probate inventories

Probate inventories are important sources showing all property belonging to a deceased person at the time of death. Reading these inventories is almost like walking into the house of the deceased, as basically everything of economic value was listed: land, livestock, farm tools, wagons, kitchen equipment, looms, clothes and much more. These lists give invaluable insights into the farmers' lives and how they worked the land. Livestock is of particular interest (Figure 2.8), since information about animal husbandry and grazing is sparse in most historical sources.

Giving correct information was in the interest of everyone involved. However, assets of little economic value, and livestock reserved for the funeral may be missing, as well as food which usually was taken care of by relatives before the inventory was made. If people died old, it is likely that most belongings were already given to children. Therefore, the tragic cases, such as when people died in active ages, leaving young children and spouses behind, are most informative about the active farming. The inventories also declare the heirs of the deceased and therefore complement parish records with information about relatives.

Table 2.1. The Othemars farm in the county of Gotland in Sweden, was divided into smaller farming units during the course of the 18th and 19th centuries. Useful probate inventories (i.e. from active farmers/wives) have been color-marked. From Westin & Lennartsson 2017.

Decade	Othemars parts of 1 farming unit (Sw. hemman)							
1654	Gudmund Jönsson							
1700	Lars				Jöns			
1710	Lars				Jöns			
1720	Lars				Jöns			
1730	Lars				Jöns			
1740	¼	¼			½			
1750	¼	¼			¼		¼	
1760	¼	¼			¼		¼	
1770	¼	¼			¼		¼	
1780	¼	¼			¼		¼	
1790	¼	¼			¼		¼	
1800	¼	¼			¼		¼	
1810	¼	1/8	1/8		¼		¼	
1820	¼	1/8	1/16	1/16	1/8	1/8	1/8	1/8
1830	¼	1/8	1/16	1/16	1/8	1/8	1/16	3/16
1840	¼	1/8	1/16	1/16	¼		1/16	3/16
1850	¼	1/8	1/16	1/16	¼		1/16	3/16
1860	¼	1/8	1/16	1/16	¼		1/16	3/16

In Sweden, probate inventories became mandatory for all deceased persons from 1750. They are kept at National and regional Archives and many of them are digitally available. The strength of probate inventories is that they are very detailed about each separate case. On the other side is that the cases are irregular in time and space, i.e. the deaths of people were usually random. It may therefore be challenging if the study unit is the village and not the individual. We have used probate inventories to reconstruct livestock numbers at the village level. It is important to keep in mind that the property of the deceased only represents one part of all the potential livestock owners in the village. Therefore, it is important to know which part each probate inventory

constitutes. Here, other sources, such as parish records, tax records and cadastres are useful. In Table 2.1, we have mapped one village, Othemars, in the county of Gotland, Sweden. The village was originally one single farm, but during the 18th and 19th century it was divided into smaller farming units. The reconstruction of livestock numbers must take use of this information to be as correct as possible. In addition to the farming households, old parents, unmarried adult children, and landless in the village could own some livestock.

In Table 2.2 the information from probate inventories indicated in Table 2.1 have been combined and the total number of horses, cattle, sheep and goats calculated. Combined with the area of pasture from cadastral maps from different times, we calculate the stocking density. During these two centuries stocking density varied between 0.07 and 0.11 Grazing equivalents per hectare (equals 0.07-0.11 adult cattle per hectare). There was no trend of increasing grazing pressure, despite increased population and farming units, indicating that the pastures were fully utilized already in the early 18th century. The stocking density was low in comparison with that calculated in other regions, which is in concordance with the low productivity of this dry area.

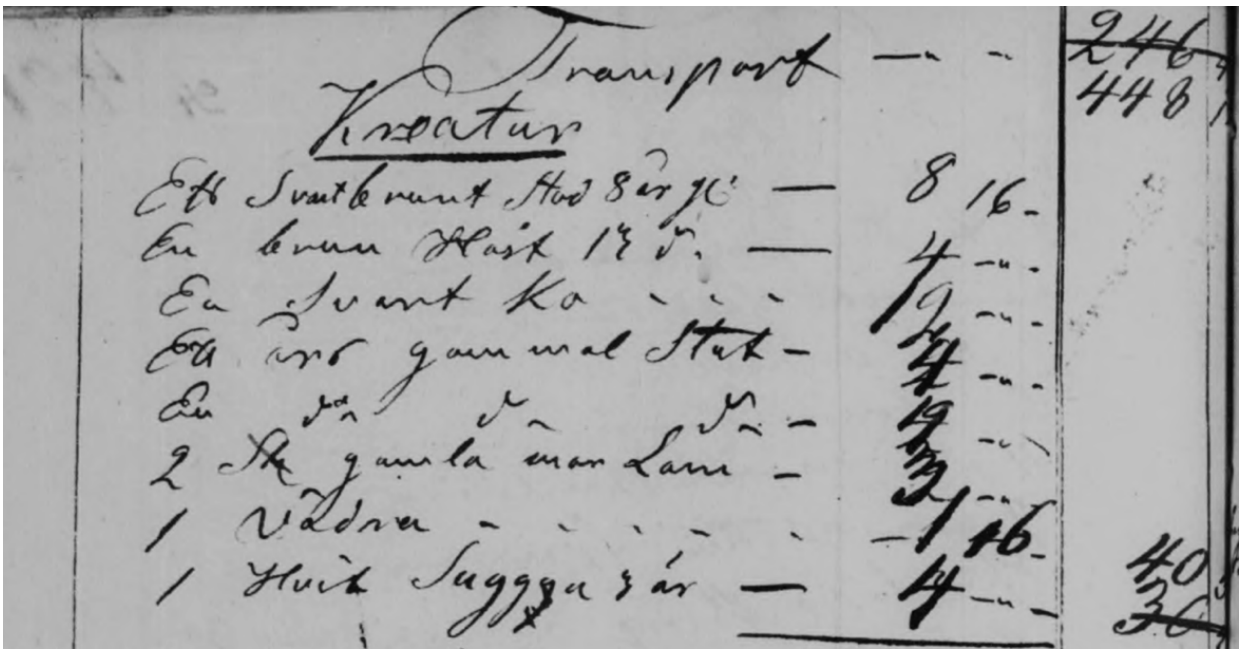


Figure 2.8. Livestock belonging to the farmer Lars Hansson, in the parish Othem on the island of Gotland at the time of his death in 1833: "One black-brown mare 8 years, one brown male horse 13 years, one black cow, one year old steer, one ditto, 2 old female sheep, 1 ram, 1 white sow". The total value was 40 Riksdaler.

Letters and diaries

Through letters and diaries, we have the possibility to come closer to the historical people than from any other historical sources (Lorenzen-Schmidt & Poulsen). Through them we can take part of people's daily lives, including work and struggles, joys and parties, relations, and private thoughts. Working with peasant diaries has enabled us to reconstruct land use in great detail, day by day, parcel by parcel, crops and workers, and how conditions changed over seasons and years. In some cases, the authors have also shared personal thoughts, troubles, aspirations and hopes, giving us direct insights into the inner lives of people (see example 2).

Table 2.2. Calculated livestock numbers in Othemars from probate inventories, excluding livestock belonging to landless people. Horses, cattle, sheep and goats have been combined into Grazing equivalents using their relative energy demand. From Westin & Lennartsson 2017.

Time period	Horses	Cattle	Sheep	Goats	G.equiv	Representation *
1: 1706-1726	24	40	34	9	86	100 %
2: 1773-1777	16	28	23	9	61	75 %
3: 1790-1804	13	20	31	0	49	75 %
4: 1813-1816	18	24	22	0	57	62,5 %
5: 1821-1833	16	36	52	0	75	50 %
6: 1856-1872	12	37	39	0	65	100 %

* The column shows the large proportion of the village that is represented by probate inventories from each time period. The higher the number, the better the accuracy.

None of these sources were invoked by authorities, which makes them different in terms of credibility and availability. Letters were written with the receiver in mind, and of course, this affected not only what was written, but also how. Diaries were usually kept for private use and probably reflect what was of personal interest and importance. There is no obvious bias in diaries, but they have a tendency to leave out information that was common knowledge for the author and the receiver, but which may be difficult to understand today. Most diaries were written by men and they always under-represent the daily tasks performed by women, such as tending livestock, milking, cooking, gardening and taking care of children and the elderly. The farmers of Hyttbäcken in south Dalarna, kept diaries over an 80-year period. Information about their economy and employment of several maids points to the importance of cows, milk and butter. Milking was a part of women's daily work but the only time it was mentioned in the diary was the day when the farmer himself had to do the milking because a maid was absent.

Letters and diaries are usually taken care of by descendants unless they were given to an archive. A collection of peasant diaries from different parts of Sweden have been collected and transcribed by the Nordic museum of cultural history (Nordiska museet), where anyone can read them. People who wrote diaries sometimes also kept their own farm records of harvests, the weather, and the economy.

Permission from descendants may be required before using private archives, unless they are owned by an archive. If the descendants and holders of the archive are interested in research on their family farm, they can also be of great help in learning to know the study area, local place names, people who used to live there and other things of interest (such as old farm tools, saved tools, etc. that add valuable information) See also chapters 5, 6, 8, and 9.

Ethnological data and local history literature

Ethnological institutions of many countries have long worked with collecting and presenting traditions, customs, other practices and language connected to folklore and traditional lifestyles (Poirier 1968). One common method was to distribute questionnaires to informants in the countryside regarding specific themes, among which some includes agriculture, livestock husbandry and forest use. The replies offer detailed and interesting descriptions useful to various Historical Ecological issues. Important source critical aspects regard aspects of memory, how people frame the traditional and the past, and how the questions of questionnaires have directed the informants to focus on what was considered of interest for the research department (Östling 2010).

For some regions, ethnological information has already been collected and published by researchers or interested amateur historians. Local history literature can be based on historical sources, ethnological data, oral history and personal memory and can give invaluable insights if they were made by persons with good local knowledge and source critical eyes. Example 1 Shows one use of an ethnological questionnaire from our work.

Historical Atlases

An Atlas is a particular type of document that contains a bound collection of maps as well as additional text, tables, graphs, and illustrations. Atlases have been popular since the great age of discovery in the 1500-1600's, and they can be global, national, or regional in coverage. The first modern Atlas was called Theatrum Orbis Terrarium (Theatre of the orb of the world), which was produced by the Dutch cartographer Abraham Ortelius in 1570. It was very popular and was produced for years in some 25 editions and in seven different languages. The name Atlas derives from the use by Gerhardus Mercator of an image of the titan Atlas from Greek mythology, supporting the globe in his first edition, and the use and name became generally accepted (Figure 2.9).

Figure 2.9. The use of Atlas supporting the globe in the title page for Mercator's Atlas Minor of Hondus (https://en.wikipedia.org/wiki/Gerardus_Mercator#/media/File:Mercator_Hondius_Atlas_Minor_of_1607_frontispiece.png)

Since then, global, national and regional atlases have been produced throughout Europe and North America, but less so in other regions around the world. While often the maps themselves are relatively general and less

detailed, these Atlases can provide useful historical information about population demographics, agricultural production, economic and political factors and more, all of which can be useful information for Historical Ecology researchers. Many national and regional libraries contain copies of local atlases, and many of these are now being made available in digital format online. They are also available from private map stores and commercially online.

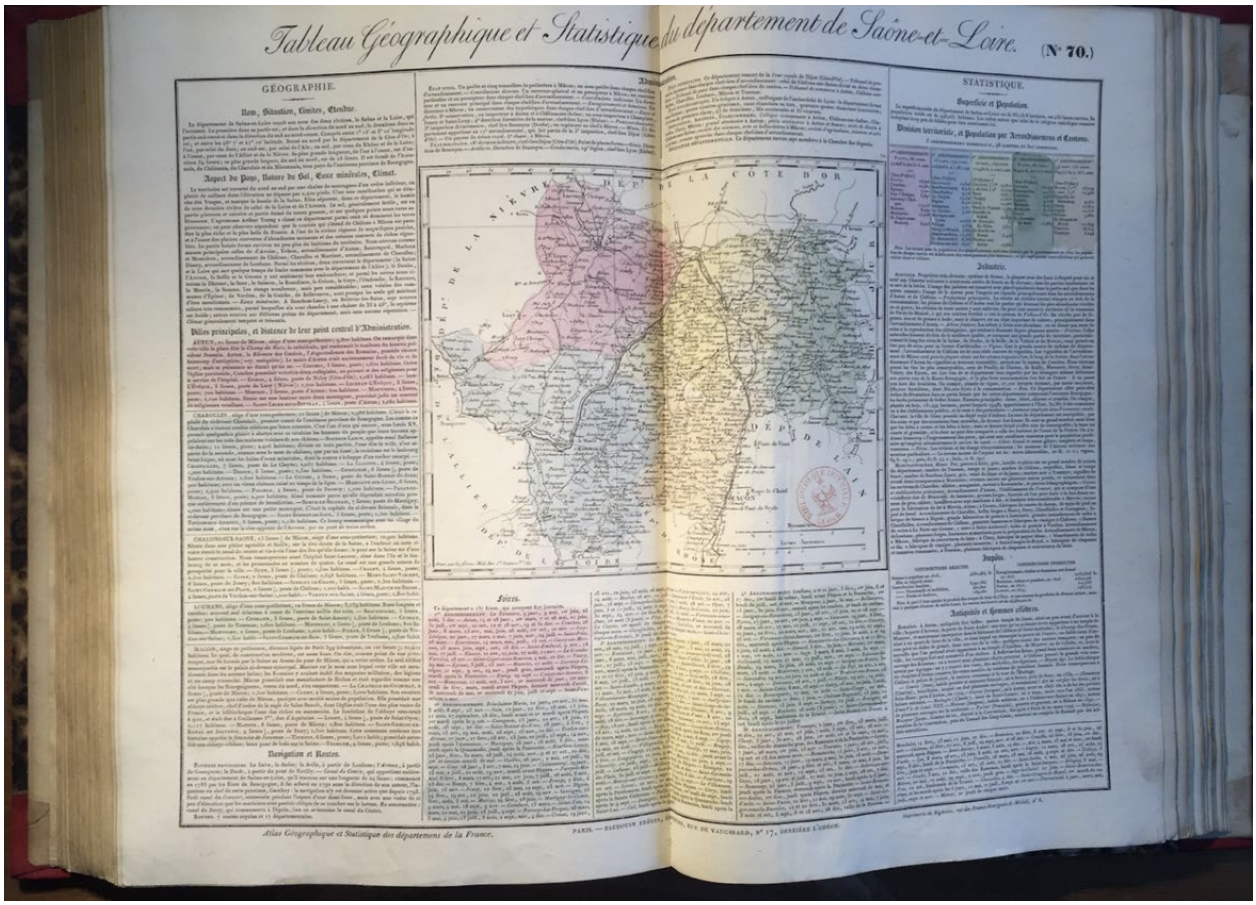


Figure 2.10. The Saone-et-Loire page of the 1832 Atlas, which includes our study area of Burgundy, France in the southwestern corner of the map. The map is surrounded by text data specific to this region. Image by S. Madry, document from the BNF, Paris.

The maps are useful, but it is the associated textual description of the department that is most interesting. The text from this Atlas includes information in the following categories:

Geography: name, location, boundaries, scope, aspect of the country, nature of the soil, mineral waters, climate, main cities, and distance from their central point of administration, administration, fairs.

Statistical: area and population, territorial division, and population by arrondissement and canton, industry, taxes, antiquities and famous people.

A few specific examples from our study area in Burgundy from 1832 (Figure 2.10) include the following. Vines were of great importance and "is the department's great source of wealth, the arrondissement of Chalons is covered on all sides with vineyards." and "The wines from this department are regarded by foreigners as inferior to other wines from La Haute Bourgogne, and the highest consumption is within France. It travels

little outside the borders. There are, planted in vines, 27,700 hectares forming, per average year, 762,000 hectoliters, of which 562,000 pounds are for consumption." Also, fruit trees in the region were of importance and abundant, however "not enough care is given to the reproduction of chestnut trees, which have tended to decline for several years." Concerning forest, the Atlas described "beautiful high forest. Main species: oak, beech, hornbeam and aspen." A great deal of other anecdotal information is included, providing a rich context for our understanding of the people and their environment at that time.

Historical Atlases provide a variety of useful data for Historical Ecology researchers. The data contained vary widely, but their popularity provided a frequent regional accounting of geographic, social, economic, and demographic information that included interesting and unusual data not found in other sources. These regional data are very useful for placing into context the more detailed information provided by local population and tax records and cadastral maps for individual study project regions.

Figure 2.11. A picture postcard from around 1910 of Uxeau, France. A vineyard is at right. From the collection of the authors.

Picture postcards and private photographs

Picture postcards have been very popular in many countries from the 1880's through today and they can sometimes be used to create time series, as discussed in chapter 8. Pictures were taken from the ground or from air (Figure 2.11 and 2.12). There are thousands of old postcards available in archives, online, and for sale in local markets and through other sources. The study of historical postcards is called deltiology in English, and there are several publications regarding their use in historical and environmental time series (Debussche et al.1999, Paxion and Cohen 2002, Sawyer and Butler 2006). In French, those who collect these are referred to

as 'cartofiles', and the collection of these is the third most popular collecting hobby in France, after the collection of coins and stamps. This popularity makes for a rich source of data for researchers.

Figure 2.12. An aerial view of Uxeau with Mont Dardon in the background. Taken around 1950. This oblique aerial photo shows the tiny village of Uxeau, in the heart of our study area. The church with its cemetery is central to the view, with the Iron Age hillfort of Mont Dardon in the background. Many details of field divisions, vegetation, land use, forest cover, and settlement can be extracted from this single image. (Image from Scott Madry's private collection).

In 1889, one picture postcard with the newly built Eiffel Tower in Paris sold over 300,000 copies and was instrumental in increasing the popularity of the idea. The golden age of this was between ~1900 and the end of the Great war when the popularity of these began to decline. Production continued, and color postcards were introduced in the late 1950's and early 1960's, and oblique aerial photos also became popular. In our study area in France there was a husband-and-wife team who owned a small airplane. They took aerial photos of local farms and villages and sold the aerial picture postcards throughout the region (Figure 2.12). There is even a French museum of the postcard, located in Baud in Brittany (Le Carton Voyageur - Musée de la carte postale, 3 Av. Jean Moulin, 56150 Baud, France).

From the early ages of photography, it was also common that ethnologists and enthusiasts started documenting the countryside in their profession or out of their own interest. Also, it became popular among wealthier private persons to have their pictures taken, often in front of their houses, business, or in their gardens. Other photos were taken in the rural landscapes around the houses or further out in the landscape. A Sweden example is the landscape researcher Mårten Sjöbeck who left a valuable treasure of publications and photos,

documenting traditional landscapes, habitats, land uses methods, houses, roads, technique and people (Figure 2.13).

Figure 2.13. This picture from 1932 illustrates methods of leaf harvest and the tools used in the village Ödenäs in the county of Västra Götaland. Photo: Mårten Sjöbeck. RAÄ kulturmiljöbild, PDM.

Picture postcards and private photos can be excellent sources of information for example indicating vegetation cover, land use, buildings, bridges, tools, livestock and more. Photos have an authentic aspect in showing everything that is included in the picture in great detail. In this respect old photos don't lie. On the other hand, the motive was chosen, usually for a reason. Before using photos as sources, potential biases must be considered. Many private pictures were taken in front of houses, of people in their best clothes, possibly together with their best horse. At a special occasion like this, people probably put care in choosing what the picture should show the viewer. Early countryside photographers perhaps had a tendency to document the particularly beautiful spots, the novel, the traditional clothes, only wooden houses, or other special interests. Other areas were left unphotographed.

Dating images is a key aspect of their use. Photos with people can be dated using information about the identification and age of the individuals. Picture postcards can also be dated by:

- The general style of the postcard, full or half sized image, etc.
- The postage paid, stamp type, and canceling postmark
- The size of the postcard and if it is color or black and white
- How the card is addressed, address codes, etc.

- The quality and type of paper and printing used
- The printed legend and producer name and address
- Other identifying marks or codes from the publisher

If a card's exact date cannot be specifically identified, it can still be generally dated by the styles of clothes, vehicles, furniture, and other features. But it must be pointed out that there can be a significant and unknown delay between when a photograph was taken and when the postcard was produced, or when it was sent and postmarked, so there is always some ambiguity in the dating. The general history and means of dating French postcards is well described in the literature (https://www.abelard.org/france/dating_postcards.php) and for the U.S. see: https://www.fortlewis.edu/finding_aids/images/M194/PostcardDating.htm

The identification and dating of picture postcards is specific to each individual nation. Many regional archives collect and make available these historical items, and many are available for commercial sale on the internet and at markets. Historic picture postcards are readily available throughout much of the world. In Sweden, using digitized photos may be completely free of charge and free to use, but photos from some other archives are expensive to get access to, and you may not be able to publish them or require explicit permission to do so. Current photos from the same vantage point can be taken to measure changes (Figure 2.15 and 2.16).

Figure 2.14. A French owner of the former grist mill Moulin de Bauzot, with his poster of the historical postcard of his home. Photo taken by the authors in 2009 while conducting field surveys of mills and millponds in the area (Madry et al. 2015). We see these frequently in the region and this photo of the current landowner and his enlargement of his house illustrates the continuing interest of local people in their history and historical postcards.

Figure 2.15. Uxeau ground view in the 1940's. This view shows the area that is in the extreme bottom right corner of the aerial image (Figure 2.11). The new monument to the residents of the commune who died in the Great War is at left, confirming that the picture was taken after 1918.

Figure 2.16. A similar view from Google Street View showing Uxeau today. Image courtesy Google.

We have used the analysis of historical picture postcards in our French study area for many years and have amassed a sizable collection. We have used these to identify land use and vegetation cover and other features of the landscape.

Case Studies from our research projects and study areas

Example 2. The social-ecological safety net of a Swedish 19th century vicar

In September 1813, on his 50th birthday, the Swedish vicar and farmer Johan Fredrik Munchtell started writing a diary. In almost 1,500 pages Muncktell described, among other things, how an agrarian subsistence system worked, how it changed, and how it was perceived by a single household between 1814 and 1829. Through the information it contains, we can come close to understanding the decisions and actions taken by an actual land-user 200 years ago.

In this study, we focused on the management of hay and pastures through the analytical lens of a social-ecological system (SES) to analyze the qualitative data of the diary. SES is a framework that helps focus on how ecosystems and socio-economic factors interact in detail in historical or current societies (Lennartsson et al 2015).

From the diary, we identified four main domains in the SES of Muncktell: ecosystems (hay meadows and pastures), market (buying and selling), labor and technique, and social relations. Muncktell's detailed diary provides several examples of how different domains of the household's social-ecological arena interacted. The SES of Muncktell can be described as follows. The farm cultivated large amounts of the cash crop rye, which was motivated by the household's high costs for labor and consumption, the latter in turn largely necessary for the household's social status. The rye cultivation required many oxen and horses for traction power. Muncktell had as many as 12 oxen and 4 or 5 horses, with which he cultivated ~50 ha. of arable land per year. The animals required large quantities of hay and large areas of pasture, but the rye cultivation decreased the supply of hay since rye was favored on arable land at the expense of hay production. In all, the system had become vulnerable to years with low grass production.

We illustrate the SES further using an example starting from the harsh weather's effects on the supply of hay. Muncktell seems to have regularly suffered from a shortage of hay in the late winter, a problem that was particularly pronounced in years of drought (poor growth) or rain (difficult harvest). He combined different measures to solve the problem. One was to use arable land for hay production (1 in Figure 2.17), either by sowing clover or timothy or by allowing natural grass growth. This is a transformation of ecosystem resources, as illustrated by an arrow within the ecosystem domain. This measure reduced the area available for production of rye and thus the production of rye for sale (1a). Thus, the arrow indicates that the ecosystem measure had an effect on the market domain. Another possibility was to sell a horse in the autumn, and buy one back in the spring, however usually at a higher price (2). The most important measure was to borrow or buy hay from friends and neighbors within his social network (3). This created social debts (3a) and Muncktell was expected to give favors in return, for example by providing cheap (below market price) rye when requested (3b). When the hay prices were high and prices on cereals low, Muncktell chose to feed the animals with cereals (4), which reduced the amount he could sell (4b). Finally, Muncktell used the boys he was catechising as labor for collecting leaf fodder to supplement the hay (5).

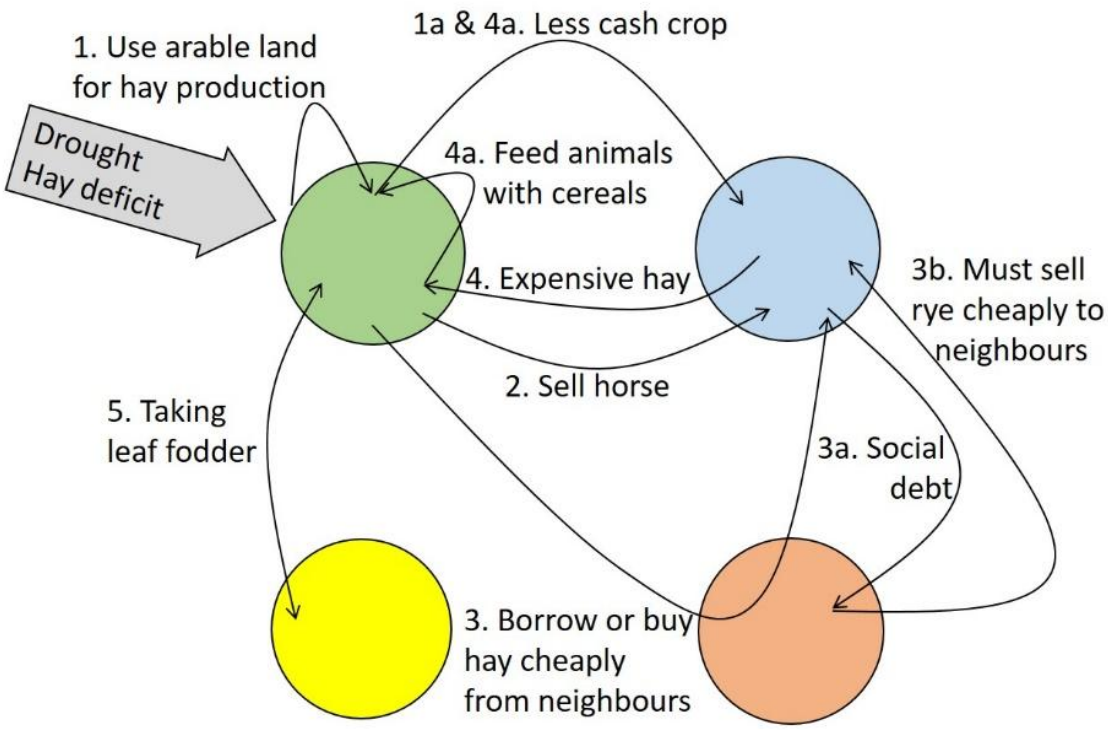


Figure 2.17. Some activities, and their effects, performed by Muncktell's household related to hay deficit during the period 1814–1821. Activities are related to the four main domains (see Figure 2.28). See the text for further explanation. From Lennartsson et al. 2015)

Figure 2.18 summarizes all the activities following hay deficit. By relating activities to domains, SES makes it clear that the deficit of hay was handled mainly through Muncktell's relations to the higher social groups, from whom he could borrow or cheaply buy hay. Muncktell's actions were thus mainly aimed at accommodating shortfalls of the hay supply, rather than to increasing his own supply. Some measures were taken for improving the drying of hay, i.e. for reducing the fluctuations, but hardly any significant actions were taken to increase the total hay resource.

In contrast, the shortage of pasture (see Lennartsson et al 2015), initiated labor-intense actions that were possible because of the availability of cheap labor. Most of the actions were aimed at extending and improving the farm's own pasture, e.g. clearing new pastures, both to overcome the immediate problem and for reducing the risk of future pasture deficit.

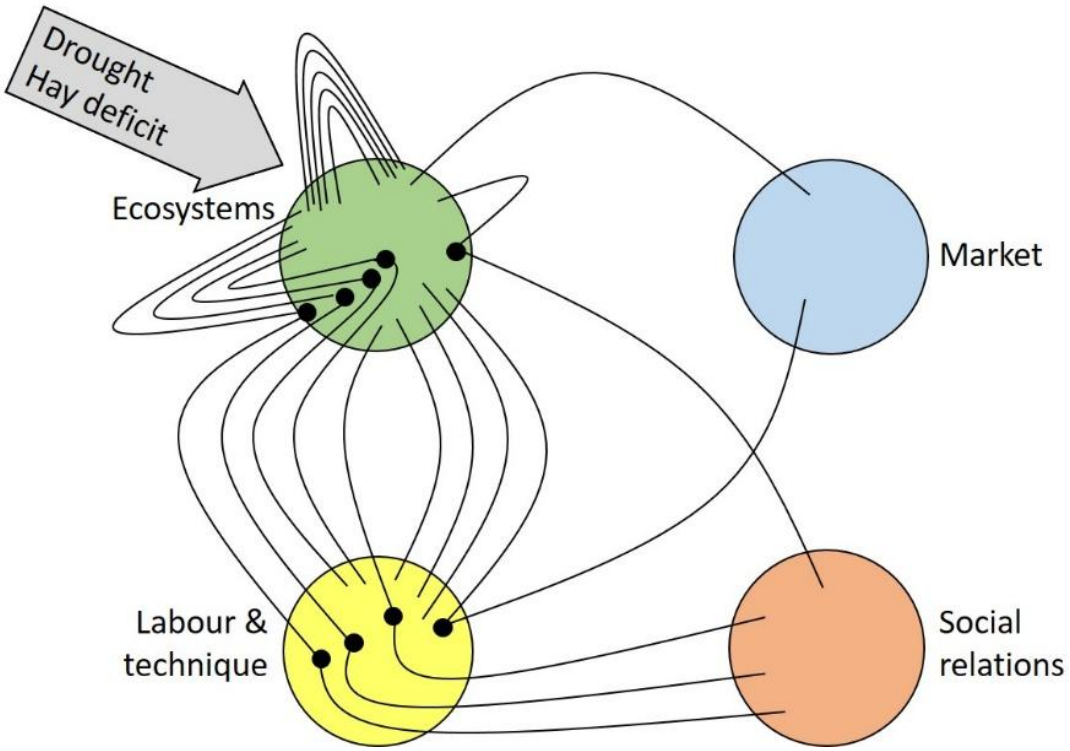
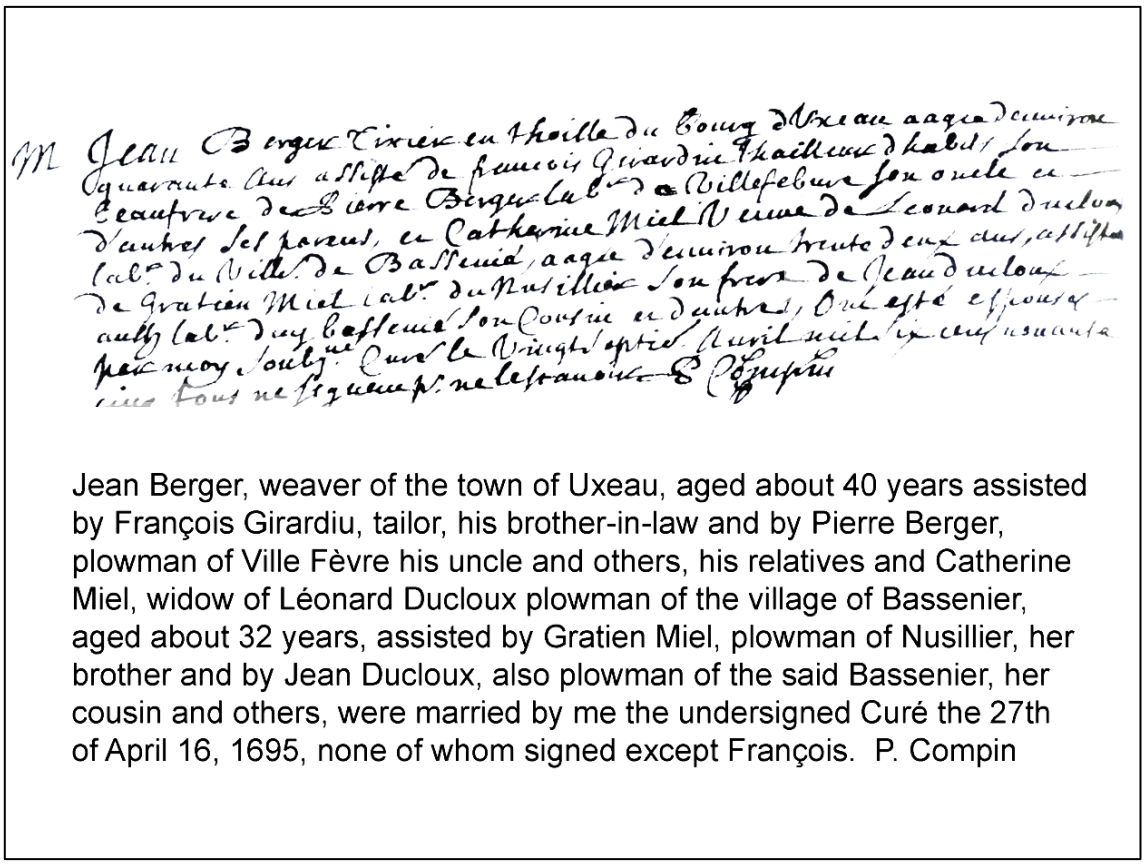


Figure 2.18. Graphic representation of all activities, and their effects, performed by Muncktell's household for handling the deficit of pasture hay, 1814–21. For simplicity, the lines show only the interactions between domains, not the direction of the interactions.

Example 3. Parish records reveal ecotypes in late 17th century France.

In our long-term research project in Burgundy, France, we have made use of large amounts of documentary data about land use, economy and more. Among many other tasks, we have integrated the detailed cadastral (land ownership) maps with the associated tax data in our project GIS (Madry et al. 2015). It is difficult to find historical data directly related to land use parcels for time periods before the mid 17th century. Although there is tax information about individual parcels from the 1791 onwards, it is difficult to use this to reconstruct all land worked by individual households. This is due to the fact that much of the land was farmed by large, communal sharecropping households (*communautés*), whose land was mixed with land owned by individual members of the communauté, and also land owned by the elites in the surrounding towns who leased their land on a sharecropping basis. For earlier periods, it is difficult to find any historical data relating directly to local land use. Parish records offer indirect possibilities to address questions about land use, subsistence and social relationships.

In order to take our land-use study as far back in time as possible, we used parish records with the oldest complete records available, from the 1690s (Jones 2009). Parish records contain information about baptisms, marriages, and burials together with the age, residence and occupation of the family members (Figure 2.19). In addition, information was given about the marriage witnesses, mourners at burials, and godparents, and also for these peripheral persons often the residence, occupation and relationship to the family member were accounted for.



Jean Berger, weaver of the town of Uxeau, aged about 40 years assisted by François Girardiu, tailor, his brother-in-law and by Pierre Berger, plowman of Ville Fèvre his uncle and others, his relatives and Catherine Miel, widow of Léonard Ducloux plowman of the village of Bassenier, aged about 32 years, assisted by Gratien Miel, plowman of Nusillier, her brother and by Jean Ducloux, also plowman of the said Bassenier, her cousin and others, were married by me the undersigned Curé the 27th of April 16, 1695, none of whom signed except François. P. Compin

Figure 2.19. Example of wedding entry from 1695 Uxeau parish records with translation.

The commercial genealogy software Family Tree Maker was used to create 'family reconstitutions', basically doing genealogical research (i.e. making family trees) for the entire parish. Reports were generated that were customized and exported to Excel spreadsheets and relational databases for further statistical analysis and integration with our project GIS database (Jones 2009).

The study area (Figure 2.20) consisted of a lowland area (parish of Bessy) and an upland hill country around Mont Dardon (parish Uxeau). The 1690s was a very cold decade with large variation in weather patterns resulting in the last great famine in France. Since people in Uxeau survived these crises better than most in the surrounding areas, it is also interesting to search for possible successful farming strategies indicating models of resilience and sustainability.

In the 1690s the parish consisted of 17 communautés and 10 non-communautés including 4 small family farms, 2 villages, 3 mill sites, and one industrial hamlet. The main farming activity was growing grains, mostly consumed locally. Mills had to be plentiful because the wagons were few (groups of neighbors often shared a single wagon), and roads were bad, preventing long distance transport. The mills (four altogether, with one mill being part of a communauté) were all situated along a certain elevation line or fall line, in Uxeau (Figure 2.21). Vineyards were also located at a similar elevation along the well-drained slopes in Uxeau below Dardon, and the lowlands of Bessy had no wine growers.

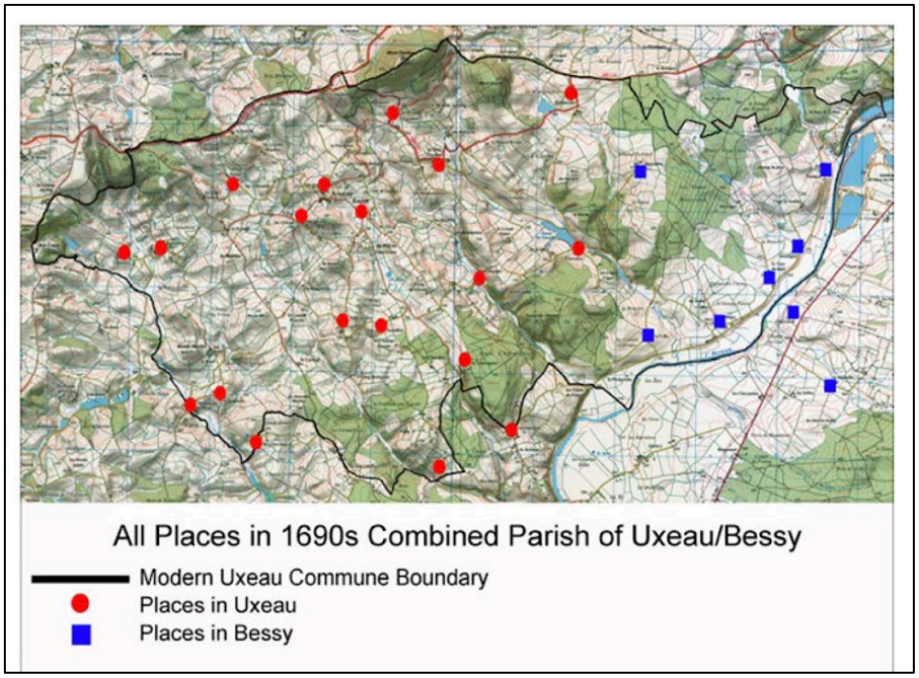


Figure 2.20. Modern topographic map showing all occupied places present in the 1690s parish records, indicating uphill Uxeau (red) and lowland Bessy (blue) and the modern commune border. Background map courtesy IGN.

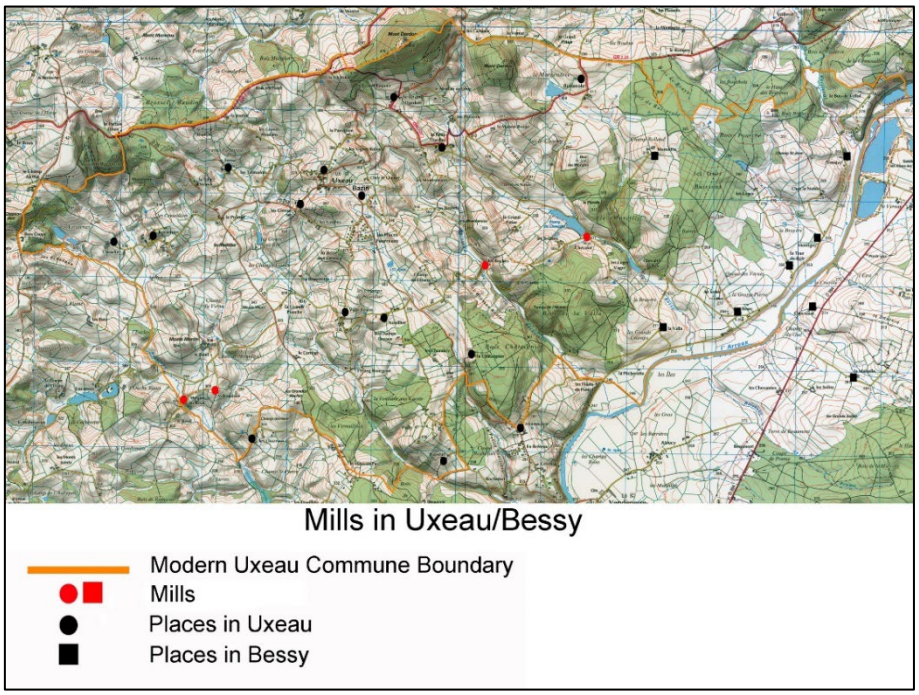


Figure 2.21. Map showing mill sites present in the 1690s parish records, with mill sites is red. Background map courtesy IGN.

Animals were absolutely essential in order to provide manure for the fields. The households also needed to raise some kind of homegrown fiber for clothing. In the uplands of Uxeau, sheep could graze on the rocky and steep land unsuitable for farming and they gave both manure and fiber (Figure 2.22). In lowland Bessy, those purposes were served by growing hemp and the fattening of retired plow oxen which eventually were sold to the towns for meat.

The maps derived from analyzing the 1690s parish records show two distinct ecotypes. An ecotype (Mitterauer 1992:142-143) encompasses:

- the local environment and its range of available resources
- the particular resources that are extracted and the type of technology for doing so
- the sociocultural institutions for instituting and organizing the family as an integrated workforce
- the local relations between peasant farmers and non-peasant groups (e.g. the nobility, village tradesmen and craftsmen, day-laborers, etc.)
- the interrelations between groups exploiting different resources within the same environment
- and the relations of the local area to outside areas which include transportation networks, settlement patterns, and the macro- political and economic systems

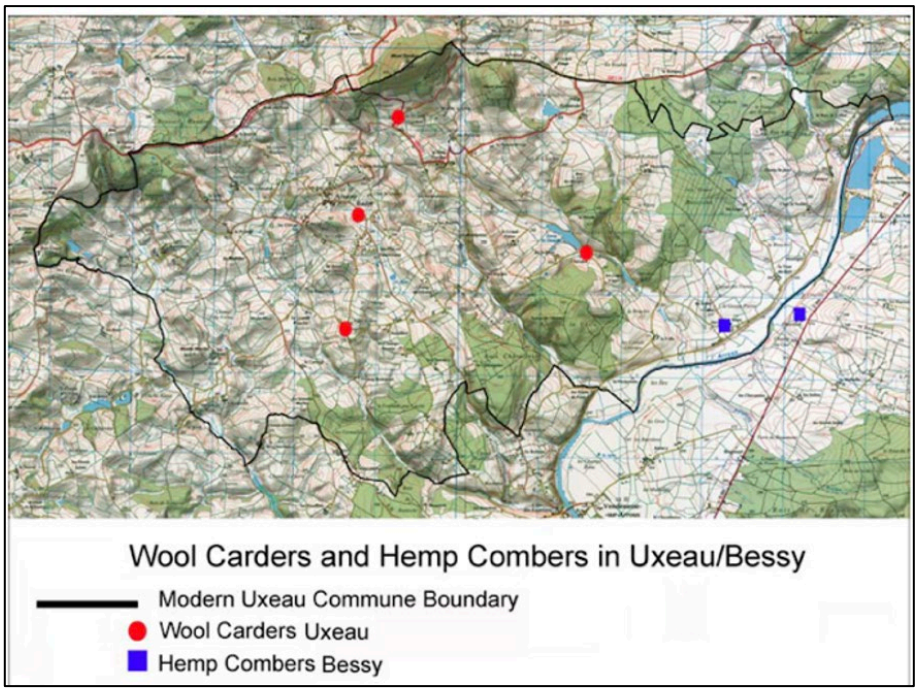


Figure 2.22. Wool carders in Uxeau and hemp combers in Bessy. Background map courtesy IGN.

The two different ecotypes in Uxeau and Bessy hilly uplands and riverine lowlands, and the differential extraction of resources from the environment in this period were also mirrored in the social relationships. The 1690s was a period of climatic upheaval, high taxes, and epidemic disease. At this time, marriage and godparent relationships were often established with people outside their home parish. Alliances outside the one's parish could serve to mitigate risk in times of local crop failure or from the loss of a sharecroppers' contract which resulted in loss of home and land to farm. Alliances were also often established within their own parish but, interestingly, they were rarely established between the two parishes of Uxeau and Bessy.

The different ecotypes offer a possible explanation. Although Uxeau and Bessy had in common that they were growing grains, and many people in both parishes belonged to a large communauté, they were engaged in different kinds of supplemental income activities. The segregation in differing economic activities, rooted in their respective landscape types, may have caused them to travel in different social worlds. Alliances may have formed more easily, and were more helpful against risk, with people that shared the same economic activities, activities that were shaped by the resources available to them in their distinct ecotypes.

The two historical ecotypes follow the topographical differences in the landscape, but today there is no highland-lowland economic difference that would have hinted at this historical difference. Today, both the Uxeau and Bessy land areas are covered with same pastures and fodder crops while vines are now absent throughout. The family reconstitution made in the 1690s revealed much about the connections between ecotypes, historical land-use and social networks in Uxeau, providing new insights into the Historical Ecology of this area.

Limitations and benefits of working with documents in Historical Ecology

Benefits:

- Pre-industrial societies relied on sustainable ecosystems, and most documentary sources therefore, have perspectives relevant to Historical Ecology research.
- Written statements contain information about special occasions as well as everyday life in past times that would otherwise be inaccessible to us today.
- Authorities have often collected consistent data which enables comparisons in time and space, and also the amount of data that allows interpretation and contextualization.
- Many countries have rich archives. The Swedish National Archive alone keeps over 700,000 shelf-meters of documents and 5.7 million maps and drawings. A large portion of these documents have not yet been researched. The French archives are constantly adding new historical documents to their online inventories making this information available for free anywhere in the world. Imagine all the interesting information that waits to be explored.
- Multiple text sources provide for comparisons and cross-checking of data and finding errors, anomalies, and outliers in the information.
- Textual data such as cadastral taxes and land ownership can be spatially integrated in a project GIS system.

Limitations:

- All sources were produced for a specific purpose, and rarely match exactly the specific questions of interest for the researcher. Therefore, it is always necessary to ask how well suited the information is for the research question. Perhaps there are other more relevant or complementary sources to work on?
- Some sources provide useful time series which cover long time periods, while others appear only once or perhaps a few times during a longer time period. Between these occasions, perhaps the intention and instructions have changed, which makes them difficult to compare. It is important to consider if differences are due to real changes or changes in documentation.
- Spatial cover of sources differs between regions, class, and due to shifts in national or internal political borders.

- Data has been lost when some archives have been destroyed by fire, war, or floods.
- Despite a growing number of digitizing projects where archives and museums put more and more documents online, most of the documents are only available in the archive where they are cared for. Working with the documents in archives have many advantages but it is also time consuming, compared to working with digitized documents online.
- Gender, class and ethnic biases are present in most sources. Most documents were written by men, about the male economic sphere and from an authority perspective. E.g. There is much more information about the typical male domains: land ownership, arable land, mining and forestry, than on female domains: household, cows, textiles etc. although they were of equal economic importance. Rarely do we hear the words of women, farmers (of both sexes), and even more rare from poor people.
- "Silent" knowledge, folklore, beliefs, fears and feelings, are almost always absent in these documents, which of course tends to be underestimated in our knowledge about past living. For example, among the factors important for where to place a summer farm were: good pasture land, water, availability, but also if the place was haunted by spirits or was considered in an auspicious location.

Best practices, data access, archiving, sharing and storing

Many of the best practices in dealing with historical documents have been covered above. There are additional considerations particular to historical documents, including dealing with confidential data, storing and sharing personal information, translation, translating, state of preservation, legibility or paleography issues working with hand-written documents, and many more that we have not covered here. For fragile paper documents in a poor state of preservation, it is better to photograph the document than to keep handling it. Photos of the document can also be manipulated in photo editing software to enlarge and heighten the contrast on faded script to make the image more legible.

Most institutional archives generally give open access to their collections. However, some archives have restricted hours of operation, and may also be slow in fetching the sources from the storerooms (which may be off-site) where they are kept safe, which can be frustrating if you are time-limited. Some require registration, including letters of introduction and proof of professional affiliation and your research interests. A growing number of archives now allow open access for publications, while some retain copyright ownership and require written permissions or fees for publication or photographing. On the other hand, sources are becoming increasingly accessible online, to both find, view, download, and share.

Proper archiving of both paper and digital data are vital, once you have acquired and analyzed them. Modern digital archiving systems provide for attribute-tagged digital databases of multiple types of data, including documents, and this is covered in chapter 15. Each chapter in this volume also deals, to some extent, with archival documents, and don't forget that each document you create is itself an archival document worthy of proper conservation and preservation for future researchers. Historical data can be stored, shared, and analyzed both in original paper as well as in scanned digital formats. Data can be easily shared digitally, but we must take care to address any copyright or reproduction issues.

It is also important to ensure that the resulting data are shared not only through academic and professional means, but also with the heirs and families when working with family archives, oral data, etc. These data derive from local communities, and it is generally much appreciated when researchers share back information with these communities. Publishing can also be done in more accessible formats, popular magazines, local museums

and exhibits, and local oral presentations to the public. This can also include the now ubiquitous websites, blogs, and webinars.

Cost and effort required, training needed, data size, complexity issues, and software required

The cost of historical documentary research is generally measured in time and archival access costs such as travel or possibly in the purchase of original historical copies. Training in paleography, the skills of deciphering and reading ancient to early-modern manuscripts, may be required for hand-written documents, as well as learning to read the language of the document, including local dialects. While much documentary research is done simply with pen, paper, and camera, quantitative analysis is becoming more and more common using statistical analysis, genealogy software, spreadsheets like Excel, relational databases, and qualitative analysis software, such as Atlas.Ti. The data are relatively small and less complex and can often be integrated with spatial data in a GIS. Thought should be given to how documentary data can be shared and integrated with other data from other sources, as discussed in chapter 17.

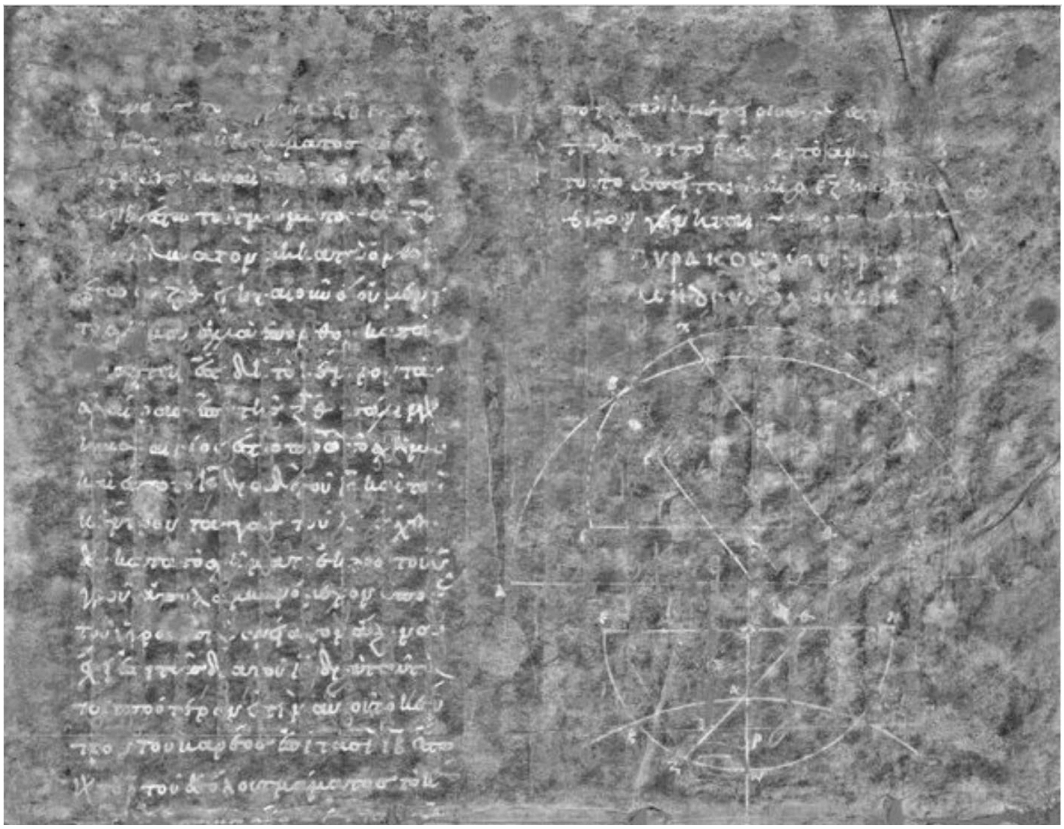


Figure 2.23. An X-Ray radiograph of the Archimedes Palimpsest, showing details not visible with the eye. https://commons.wikimedia.org/wiki/File:ArPalimTyp2.jpg

Future Directions

The newly emerging field of Document Image Analysis and Recognition (DIAR) uses well established and emerging multispectral digital scanning, image analysis, deep learning, AI, and feature recognition for the reconstruction and analysis of historical documents which may be damaged, burned, faded, or copied over (Lombardi 2020a, Mariana and Fujisawa 2008). Imaging a document in X-Rays, infrared, and other portions of the spectrum and conducting digital image processing of the data can bring out faded details and make illegible documents readable (Figure 2.23.). Many documents now are being reconstructed or made readable by scanning them with advanced, multispectral scanners and using digital image analysis, Deep Learning and Artificial Intelligence (AI) to extract and view the content (Lombardi 2020b). Other documents are being translated, reconstructed, and dated using these new approaches, and there will certainly be more advances in this exciting area. This emerging field holds great potential for the rapid deciphering of thousands of damaged, copied over, or difficult-to-read handwritten historical documents. The recent Google DeepMind AI project named Ithica can be used online to decipher ancient Greek texts using neural networks with a 71% accuracy and can even make a prediction of the location of the origin of the text and can predict the date to within 30 years. (https://www.techeblog.com/google-deepmind-ai-artificial-intelligence-ancient-text/).

We also note that in this digital age it is uncertain how historical document analysis of our own time will be able to be conducted in the future, as our generations are leaving very little analog data for future researchers.

Conclusions

Historical documents can be used for a variety of research questions relevant for our understanding of past interrelationships between humans and the ecosystems in which our ancestors lived. In this chapter we have dealt with several of the main sources of data we ourselves are familiar with from our countries and fields of research, means of analysis, and issues relating to their use. We have presented several, brief case studies to illustrate how they can be used and what types of limitations there are. There are also many other types of documents that may be useful in Historical Ecology. Anything that has been considered important enough to be committed to paper may have been kept in archives or elsewhere, for us to read or view today. Many of these past testimonies offer portals to the past. Although working with the documents themselves is very rewarding, they may be even more useful in combination with other types of sources such as archaeological and ecological field data, oral information and cartographic sources. We want to acknowledge, however, that many voices from the past have never been conveyed to the afterworld. In the long view historical perspective, literate people constitute a small proportion of past populations, and history has therefore mainly been told by the people with power and societal positions. Direct testimonies from children, women, poor people and farmers are much rarer, but they sometimes emerge through other people's writing. Likewise, ecosystems are also illiterate, in the sense that they did not write their own history. In that sense the ecological side may be harder to understand through documents than the human side of Historical Ecology. Interestingly though, ecosystems are their own living archive, which can be read and understood in the field. This is explored further in chapter 3.

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