

8.5.2. An agrarian household between nature and society – interpretation of an early 19th century farmer's diary

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Introduction

Before the introduction of fossil fuels and fertilisers, agriculture was largely based on local ecosystem resources. In contrast to the present agriculture in most European regions, very little input of energy and plant nutrients occurred from outside of the farm and village.¹ The production relied on a nutrient flow from semi-natural habitats, mainly unfertilised hay-meadows and pastures, via the manure to arable land and household consumption. Much of the activities performed by a pre-industrial agrarian household were related to the extraction and maintenance of ecosystem resources, but, naturally, also to the manoeuvring through the household's socio-economic environment, defined by, for example, microeconomic and macroeconomic conditions, societal structure, and local social relations, including the household's internal gender relations.

It can be assumed that from the household's perspective, the biophysical and the socio-economic environments were fully integrated. Problems and deficits in one environment might on the one hand have been compensated or buffered for by the household's use of potentials in the other environment. On the other hand, problems and deficits in one environment might have enhanced problems in the other, a process often referred to as cascade effect².

Pre-industrial Scandinavian agriculture has been studied from different angles, many including economic history,³ cultural geography⁴, ethnology⁵, or agrarian techniques and land-use history.⁶ Some larger projects have taken a multidisciplinary grasp over the spatio-temporal change of Scandinavian agriculture in a certain region, for example the ecological-geographical Ystad project in southern Sweden⁷, the Barknåre project in central Sweden⁸, and the Ängersjö project in the north.⁹

The outcomes of these projects show the need and benefit of using multidisciplinary approaches for understanding historical agriculture¹⁰, especially at the micro level. They also indicate that there are few methods for integrating several multiple variables, which simultaneously provided the arena for historical agrarian households.¹¹ As a result, there are few studies of the interactions between the biophysical and socio-economic environments, and of how agrarian households could act to integrate the different aspects of their subsistence systems. In this study we apply a social-ecological framework¹² on an early 19th century Swedish agrarian household. We base the study on the detailed diary by the farmer and Dean J. F. Muncktell (1764-1848). We focus on variables and

¹ Emanuelsson 1988.

² Kinzig et al. 2006; Janssen et al. 2006.

³ E.g. Isacson 1979; Gadd 1983.

⁴ Vestbö-Franzén 2004.

⁵ E.g. several older case studies such as Levander in the northern province of Dalarna (Gustav Adolfsakademien 11:3, Stockholm 1944), or Johansson in Frostviken in the province of Jämtland (Landsmåls- och folkminnesarkivet B:3, Uppsala 1947).

⁶ E.g. Dahlström 2006.

⁷ Berglund (ed.) 1991.

⁸ E.g. Ranheden 1989; Windelhed 1995; Renting 1996.

⁹ Johansson 2002.

¹⁰ Liu et al. 2007.

¹¹ E.g. Introduction and Chapter 1 in Jansson and Mårald (eds.) 2005.

¹² Berkes and Folke 1998.

activities being important for the resilience of the subsistence system against biophysical variation triggered by the harsh weather conditions during some years in the 1810's.¹³

Using this approach, we view the agrarian subsistence as a dynamic social-ecological system (SES) in which the household acts across different ecological, economic, and social domains, and across different spatial, temporal, and organisational scales within each domain. A SES is based on local traditional knowledge about how to use the local ecosystems, and on the socio-economic and cultural properties of the underlying society.¹⁴ A social-ecological approach is often used to analyse how societies deal with ecological or socio-economic change, and how societies can build capacity to adapt to change or to shape change for sustainability.¹⁵

The pre-industrial agriculture, based on unfertilised meadows and pastures, gradually vanished in Scandinavia from the late 19th century. This change was largely a result of the “agrarian revolution”,¹⁶ in Scandinavia c. 1700-1870. New agricultural systems, new crops and techniques were introduced. The process has mainly been analysed from a macroeconomic perspective. Examples of macroeconomic drivers subject to studies are population increase, new tools and techniques, land reclamation, new cultivation systems, better livestock, and enclosures. There are fewer studies of microeconomic factors related to the agrarian revolution. Most studies describe the observed changes of agriculture, and attempt to interpret microeconomic drivers and processes based on before-after analyses.

In this study we can observe how an agrarian subsistence system was performed, changed, and perceived by a single household during a period of rapid change of the Scandinavian agriculture.¹⁷ This provides an inside perspective on the possibilities and problems encountered by a pre-industrial farmer. Specifically, we address the following questions:

- Which were the main social-ecological domains and scales in the farmer Muncktell's agrarian subsistence system?
- How did the household utilise different domains in order to overcome the resource problems that were caused by bad harvest years? In other words, how did weather-induced problems in the ecosystem domain affect other domains in the social-ecological system?
- How can this manoeuvring by the household indicate interactions between domains and between scales, in terms of buffering and cascade effects?
- Can a social-ecological analysis of the diary indicate deficits, unbalances, or other conditions which may have been microeconomic drivers for the regime shifts that we know occurred later, during the agrarian revolution?

Methods

A diary by a farmer and dean

¹³ Utterström 1957.

¹⁴ Berkes et al. 2003, Introduction, pp. 1-29.

¹⁵ Berkes et al. 2003, Introduction, pp. 1-29.

¹⁶ Overton 1996; Allen 1992.

¹⁷ Gadd 2011.

During a period of 15 years the dean Muncktell wrote a diary, rich in notations about the household's agriculture and subsistence. The subsistence of Swedish countryside priests during pre-modern time was based on a combination of tithe from the parish and income from their own agriculture. The priest's farms were managed under the same prerequisites as other farms. Although they rarely performed labour work on the farm, they usually planned and led the work. The diary shows that Muncktell constantly aimed at developing his farms, both by bringing novel techniques to the parish and by own experimenting.

Study area

At the beginning of the diary, Muncktell held a vicarage in Kärrobo parish. After two years of writing (1815) he moved to Sevalle vicarage. Both are situated in the county of Västmanland in central Sweden. At the time of our study this region was characterised by social and demographically stagnated population development, proximity to several urban centra with developed markets, and by strong social polarization with large mansions and an increasing landless population. The agriculture was directed towards grain production which economically dominated over livestock production and the landscape was therefore dominated by arable land, however with important elements of hay meadows and forest/outland for pasture.¹⁸

Interpretation of the diary

The study is based on notations in Muncktell's diary concerning conditions, activities, and, to some extent, results of the activities. Notations related to the handling of ecosystem services are decomposed into their social-ecological components, such as site and time, labour, cost, productivity, gender, dynamics, techniques. In that way the notations can be interpreted and characterized by domain and scale, and interactions between the different domains can be identified.

These tasks require that different disciplines interpret the notations from different perspectives. Furthermore, that questions are repeatedly asked across the disciplines, and that results are brought back into the interpretation process, using a hermeneutic interdisciplinary approach.¹⁹ The interpretation process includes shifting between the general and the specific, in which we see how the separate notations confirm the whole, and vice versa.²⁰ We have chosen the household's handling of ecosystem resources as the door to Muncktell's farming system, but we could as well have used any other type of notation in the diary as starting point.

When interpreting the diary we need to be aware of that we necessarily apply other perspectives when reading, than Muncktell did when writing. For example, the diary provides a day by day description, which is influenced by an inherited system, largely unknown by us, of social structures, experiences, and beliefs, as well as of inherited ecosystems which were largely formed by earlier generations of farmers. On the other hand, we read Muncktell's notations through goggles sharpened by our knowledge about the changes of agriculture and society that were to follow, but of which Muncktell was unaware. Another example is that the diary notations from Muncktell's perspective are sturdily founded in his world and everyday's life, comprising a fine-meshed fabric of

¹⁸ Gadd 1998; Sporrang 1996.

¹⁹ Gadamer 2002; Ricoeur 1993; Ödman 2007.

²⁰ Ödman 2007, p. 67.

social-ecological details. Although his diary is exceptionally rich in reflexions and explanations, 200 years later we can only partly understand his world. On the other hand, we can retrospectively place Muncktell's world in a larger, national and international, societal and economic context, than he was able to do.

Other sources and analysis tools

The notations in the diary, as well as our interpretations of them, needed to be confronted with other sources of knowledge surrounding the diary.

Ecology of ecosystem resources

Muncktell's production system relies on three main types of ecosystem resources: summer pastures, meadows for the production of winter fodder (hay), and arable land, mainly for the production of cereals, vegetables, and flax, but sometimes for hay production. A large proportion of the diary's notations describe activities and reflections related to the ecosystem resources. Knowledge about the relations between land-use activities and ecosystem processes and dynamics is necessary for interpreting the notations in an ecosystem resource perspective. Today, Muncktell's arable land and much of his hay-meadows are entirely changed by subsequent cultivation, whereas most of his pastures, situated on till ridges in the landscape, can be studied in the field. We estimated the productivity and drought-sensitivity of the ground vegetation based on classification of vegetation types.²¹ We also estimated the effect of grazing and of clearing of shrubs and trees on the productivity by comparing cleared and forested areas, as well as grazed and ungrazed areas.

Based on these ecological perspectives on the activities and conditions described in the diary, we made an ecological classification of the activities.

Cultural geography of Muncktell's farms

The spatial frameworks in which Muncktell was acting can be seen in several cadastral maps. The first map over the vicarage Kärrobo was made in 1848 as part of the Swedish enclosure process, 35 years after Muncktell left. The adjacent farm Täby, that he partly used, was mapped earlier. A forest partition motivated a map in 1728 while the infields were divided in 1788, the time of Muncktells arrival in Kärrobo. In addition, Kärrobo was part of a national initiative to map and describe entire parishes in 1852. In his second vicarage, Sevallå, the situation is similar. The forest was mapped due to a forest delineation in 1741 and all land took part in the enclosure act in 1861. Both concerned land division between the vicarage and the neighbouring village Bro. A small scale economical map from 1863 covers both parishes, as well as a later economic map based on an aerial photo from 1959. The origin of each map determines how it should be valued as a source. In our study cadastral maps offers a spatial framework in which main features of the agriculture, cadastral conditions, activities noted in the diary, social relations, and labour can be understood. The area of different land-use is given, and the productivity can be understood through notes made by the surveyor. Sometimes grain yields (return on seed), and production of hay (hay carts) and pasture (livestock number) are given in text. As mentioned above, we further evaluated the productivity of forest pastures. Social relations can be read in the maps, such as where the landless lived. People found in the diary and catechetical registers can be connected to specific locations, i.e. where different labourers lived in

²¹ Pålsson 1994.

relation to where work was performed in the landscape and the size of the available work force. The combination of notes in the diary and places in the map enables us to see where different activities were performed and social patterns can be placed in the map²².

Market and monetary economy

The diary contains numerous notations about selling and buying, prices and markets. We attempt to compile these notations in order to describe the monetary aspect of Muncktell's subsistence system, both the supply and the demand. This overall view is related to annual market and production conditions in larger geographical and organisational scales, in the parish,²³ county, and nation.^{24,25} Some particularly important sources of data are market price scales (markegångstaxor) and governors reports from the county administration boards (landshövdingeberättelser).²⁶

Results

As mentioned, we use the ecosystem resources as starting point for the analysis of the diary in a social-ecological perspective. The notations in Muncktell's diary provide a wealth of explicit information about activities and conditions more or less directly related to these resources. The information include both land-use and socio-economic aspects of ecosystem resources. More information of the same kind can be implicitly derived from the notations if they are interpreted in their social-ecological context and aided by other sources. The notations can thereby be readily assigned to different domains and scales in a social-ecological system that sharpens the more we process the diary.

At a first classification we identified seven domains that were related to the household's handling of ecosystem resources: social relations, market and monetary economy, labour and technique, the ecosystems, the dean's tenure, culture and local society, and legislations. The influence of legislations is expressed by the diary as notations about duties of road maintenance and conveyance, and as state tax. The diary showed legislations to be less important for the agrarian subsistence, and we therefore omitted this domain from the further analyses. The domains social relations, dean's tenure, and culture/local society appeared closely related and could be merged into one domain: culture and social relations.

The remaining four domains are described below, followed by some examples of causality chains and relationships in Muncktell's farming, illustrating interactions between domains.

Social-ecological domains and scales

Ecosystem resources

²² The historical maps can be found at <http://www.lantmateriet.se/Kartor-och-geografisk-information/Historiska-kartor/>.

²³ E.g. Kärrobo parish archive, Statistical tables, G1, ULA.

²⁴ Jörberg 1972, vol. 1.

²⁵ Harvest assessments in Utterström 1957, p. 437-441 (1798-1819).

²⁶ Jörberg 1972, BiSOS, serie H = Bidrag till Sveriges officiella statistik. Serie H) Kongl. Maj:ts befallningshafvandes femårsberättelser

Muncktell's diary shows that during the studied period 1814-1821, his household is repeatedly affected by deficit of different ecosystem resources, in particular hay and pasture. Muncktell reflects over causes of the problems, and over how to solve them. He describes various measures for increasing and improving the resources, in addition to the descriptions of the recurrent and periodic every day's activities performed by his labour in fields, meadows, and pastures.

In Kärrobo, most of Muncktell's ecosystem resource consisted of the farmland he uses himself regarding meadows, arable land and some of the pastures, and of the village territory regarding the common pastures. In Sevalla, his dean's tenure in addition eligible for tithe from the parish. The tithe expands Muncktell's "ecosystem territory" to the entire parish, but the tithe varies synchronously with his own harvest according to weather conditions. The diary show no signs of weather-induced deficit of Muncktell's own resource being buffered by parish tithe. Buffering was instead made by buying and loaning cereals and hay, mainly from parish neighbours, based on his social network (see below). This network thereby provided a flexible geographical and organisational expansion of the resource.

We see that Muncktell used four main types of land-use activities to provide the household with the needed ecosystem resources, namely measures for *shaping, transforming, maintaining,* and *sowing/harvesting* the resources. Using this palette of land-use tools, he tried to optimise the type, amount, and stability of various products. The production was however strongly affected by conditions out of the farmer's control, such as weather and soil. Measures of the first three types were used to improve the resources for a shorter or longer future, while problems day by day were solved by adapting the harvest methods. As will be described in later sections in this paper, the activities for manipulating the ecosystem resources were constantly combined with activities in the socio-economic domains of Muncktell's subsistence system.

Much of the resources used by pre-industrial agrarian societies were extracted from ecosystems being deliberately shaped by the farmers, based on their locally adapted knowledge about ecological and socio-economic conditions.²⁷ More natural forests, wetlands, and shores were transformed into semi-natural ecosystems and areas for cultivation. At the time of the diary, most ecosystem resources in the region were since long shaped and incurred by earlier generation's farmers, but some *shaping* of new pasture resources still seemed to be possible. In Kärrobo in June 1815, after a severe deficit of summer pasture the dry autumn before, Muncktell decides to clear the forest in order so shape semi-natural pastures: "*I walked in the forest between Starbo, Tistebo, Munkbo etc. and designated new areas for enclosed pastures for next year, in which I will let old Jäderholm clear and cut this summer*".²⁸

In October 1815 Muncktell's initiative was rewarded: "*I saw with delight how the cut forest, through fencing and clearing, easily can become a good pasture*".²⁹ In order to further improve the new pastures, Muncktell experiments with leaving some of the litter from pasture clearing hoping that the nutrients in bark, leaves, and twigs can fertilise the grass.

²⁷ E.g. Berkes et al. 1993; Lennartsson 2010.

²⁸ Muncktell's diary, Kärrobo p. 117.

²⁹ Muncktell's diary, Kärrobo, p 170.

By using cadastral maps in combination with place-names given in the diary, it is possible to locate Muncktell's pastures in today's landscape. Field observations of cleared and uncleared, and of grazed and ungrazed forest in Kärrobo, on the one hand confirmed that the vegetation responded rapidly to the increased light influx following cutting, and, hence, that Muncktell's measures increased the pasture supply considerably in good years. Also the grazing *per se* contributed to shaping a good pasture by favouring grasses and herbs on the cost of rushes, ferns, and bryophytes. On the other hand, the field observations showed that much of the forest was rich in boulders and rocks, with vegetation types adapted to large variation in soil moisture. This indicates that clearing of the forest would have increased the pasture resources in rainy summers but very little so in dry years. A fluctuating resource will be in deficit occasionally, unless the demand is based on the bad years.³⁰ It is possible that Muncktell would have encountered the 1814 pasture deficit in spite of the new pasture enclosures, since the grass might have vanished by drought before utilised by the cattle.



Figure 1: Kärrobo June 2012. In the pasture left of the fence, grazing and trampling by the cattle have replaced bilberry, bracken and a thick moss layer, by pasture vegetation dominated by grasses and herbs.

Apart from the shaping of pasture from forest, very little new semi-natural ecosystems were shaped during the period of the diary. The area of arable land was increased somewhat through cultivation of hay-meadows, in particular on peaty soils.³¹ This represents a *transformation* of one resource to another, and not an increase of the resource in total. Transformation of resources was used both in shorter and longer time perspectives, for adjusting the supply of resources. Hay-meadows of poorer type could be used as pasture in years of deficit, and the arable land, normally used for production of cereals, could be used for cultivation of hay.

³⁰ Dahlström 2006.

³¹ Täby, delning av skog, Lantmäteristyrelsen T13:81, and Muncktell's diary, Kärrobo, e.g. s 118, s 143, s 150. See in particular p. 201 showing that Muncktell consider the cultivation of a wet meadow a considerable improvement of the farm's condition.

Measures for *maintaining* ecosystem resources were performed in particular in arable fields and in pastures. Muncktell repeatedly uses his labour for clearing the numerous ditches that drain the arable land and delimit the field parcels. When moving from Kärrobo to Sevala Muncktell complains about poor earlier maintenance of his new pastures in terms of bush clearing, as he finds many of the pastures in Sevala being overgrown by Juniper and other shrubs: *“Yesterday I began clearing of the so-called Hästhagen, to the right of the road by the river. It is a both large and beautiful area, which would be highly valuable if not being so neglected and overgrown. ... It will take 50 days of work at the least, which, at a cost of 32 shilling and a drink per day, will cost me at least 35 riksdaler and 22 shilling”*³².

The number of different activities for *harvesting* resources from the ecosystems differed between arable fields, hay-meadows, and pastures, as well as the number of environmental variables being important for the harvest result. In the arable fields, the autumn rye demands good growth conditions³³ which is reflected by the diary. The harvest is the sum of many stages in the rye’s life-cycle: germination in the early autumn, hibernation, start of the spring growth, flowering, summer growth, seed maturation – all combined with the success of cutting and drying of the rye. Of all these variables, Muncktell could only influence the sowing in the autumn and the harvest in the following summer. The meadow hay, in contrast, regenerates naturally and was therefore independent of the germination phase that made cereals vulnerable. Muncktell could only influence the mowing and drying, by utilising the days with good weather if possible, and by arranging for easier drying of the hay during rainy summers. The resource on the pastures, finally, is only determined by the summer growth. Since it can be assumed that the grazing animals can acquire the available fodder, the pasture resource should be independent of the harvest success. Muncktell attempted to improve the summer growth by delaying the onset of grazing in some pastures in order to increase the growth capacity.

Market and monetary economy

Muncktell’s household was involved in a monetary economy at different levels, mainly for consumption and salaries. Although the own production provided a subsistence base in terms of cereals, potato, vegetables, dairy products, meat, alcohol, and textile fibre, the household’s social position created a need also for other products, from markets far away from the farm and parish. The household normally purchased one or two oxen for meat, pigs, poultry, meat products, fish, butter, cheese, syrup, sugar, salt, lemons, raisins, prunes, coffee, tea, red wine, hops, snuff, and tobacco. The labour was paid in both cash and in kind, and the labour costs varied with the market-dependent salaries.

Muncktell’s main source of income was the rye, which he sold on a cereal market that he followed carefully to find the best prices, and which was already internationally integrated. This implies that the growth and supply of rye at the small scale, on Muncktell’s farm, did not necessarily match the demand and prices at markets at larger scales. For example, in the two bad years of 1814 and 1815 Muncktell’s harvest was poor, as was the local rye output in general in the parish of Kärrobo, with

³² Muncktell’s diary, Sevala p. 196

³³ Palm 1997.

output as low as 5 harvested grains per sown seed.³⁴ However, neither the average Swedish harvest assessments, nor the price records indicate crop failure at a larger scale.³⁵ The rye prices at the northern European market were relatively low, implying that Muncktell's economy suffered both from low production and low prices.

Muncktell also had problems both with his hay supply *per se* and with the highly fluctuating prices on hay.³⁶ Since hay could not be transported long distances at a fair cost, the hay market was poorly integrated.³⁷ Therefore, deficit of hay was mainly solved by reducing the number of animals and via the "semi-monetary" social network, as described in the previous section, rather than within the market domain. Reduction of the number of animals was a simple and logical solution to the hay problem from an ecosystem perspective, but more complicated from an economic point of view. Muncktell was often forced to sell in the winter when prices were lower than in the spring when he needed to buy new animals.

The potato is a crop which exemplifies how an ecosystem product could be used flexible, both for the household and in relation to the market. When the price was low in 1815, Muncktell sold only six barrels of potato to Stockholm, compared to around 30 barrels a normal year. Instead, he considered burning alcohol on some of the harvest, feeding the pigs, and even to buy more potato for the animals since the hay was expensive.³⁸

Labour and technique

Muncktell's household was comparable with a large Swedish farm, at which the owner planned and partly directed the physical work, but without directly participating. Muncktell's wife and daughters seemed to have participated in the housework, and Muncktell himself was daily inspecting his land and workers, and decided in detail most of the what, where, and when regarding the farming work. The diary shows numerous decisions about sowing, harvest, mowing time, digging of ditches, building of fences, clearing, land use changes etc. The family comprised a decision-making core, surrounded by a large, more or less fluctuating staff of workers, mainly from the parish.

The diary provides notations about the number of dayworks and their price. At the priest's farm in Kärrobo, the permanent labour consisted of 3 maids, 2 farmhands and one boy, who were paid in kind. Furthermore of 5 crofters and one tenant crofter with their wives, who inhabited different crofts on the farm's land. The crofters each had to make two days of work per week, except for the inhabitants of the tenant croft Trångan, who worked half as much. Each crofter's family was annually paid by Muncktell 12 barrels of cereals, 2 carts of hay, and 6 pounds of meat. In addition, the crofters made many extra dayworks, which were paid for in cash. During the year September 1814 to September 1815, the five male crofters made 350 extra dayworks, thus c 920 dayworks in total by the crofters. Beside this permanent labour staff, Muncktell hired extra labour when needed, both

³⁴ Kärrobo Parish archive, Statistical tables G1, ULA. Even worse harvest were to come 1818 and 1820.

³⁵ Harvest assessments: Utterström 1957 p. 437-441 (1798-1819); Prices: Jörberg 1972, p. 142.

³⁶ *Kärrobo* p. 41.

³⁷ Variation coefficient for hay prices in the province of Västmanland 1803-20 are 42.7. For rye 29.6. Calculation from Jörberg (1972).

³⁸ *Kärrobo* p. 54. (29/10 1814). Analogous reasoning p. 196, 5/11 1815.

men and women, and often among “the poor”: *“By the end of the week I let some poor clear for pasture in my home forest, and gave them 24 shilling in cereals a day”*.³⁹

As mentioned, the fact that a large proportion of the parish inhabitants lacked own land, was a prerequisite for Muncktell’s potentials for recruiting labour to his large farm. By combining the diary with catechetical registers and cadastral maps, the size, the demographic composition, and the geographical localisation of the labour resource could be estimated.

In general, Muncktells farming was based on extensive manual labour but at a low technical level. He experimented with some technical development, but often discovered shortcomings related to the consumption of time or ecosystem resources. One example is his attempt to replace manual threshing using flails with ox-driven machine threshing: *“Through the machine threshing more hay is needed for the oxen, which yet grow thin by the doubled work.”*⁴⁰ *...In general I have had little gain of the threshing machine. In all, each barrel of rye threshed using machine this winter has cost me 2 riksdaler. Even worse, the straw becomes too damaged to be useful as roofing material. As I need much roof-straw I will now thresh one barn of rye manually, which I think will cost no more than 1.5 riksdaler.*⁴¹

Social relations

The dean Muncktell was a man of the church, but also one of the larger farmers in his parish. He was in need of and had access to labour from outside of his own family. He was a considerable employer of labour from the lower social strata (see below). The social stratification in the region, providing cheap labour, was, conversely, a prerequisite for much of Muncktell’s agricultural activities. Muncktell noted that the extensive cutting of forest for pasture in Sevala was possible only due to the low labour costs.

The tight connection between social stratification and Muncktell’s need for labour is also shown by his handling of the dean’s social duties towards the poor. He tried to find arrangements for taking care of single mothers in ways that fitted into the agricultural activities, for example in October 1815: *“I finally finished the cottage of Wooden-legged Stina for Nettle-Anna and her children, in which I built double floor and mended the stove etc, so that neither vapour from the soil, nor draught, gas etc, that ended the previous poor woman, may harm this now hard-working maid and her little children. She is now living well, to earn herself with caring my oxen, having her boy in school, and as a maid earn some further support etc, which pleases me in my heart since it cost me more than 25 labour days”*.⁴²

At a larger geographic scale, Muncktell’s social network, particularly among the higher classes in the parish, fellow deans, and among relatives, was vast. The network functioned as a safety net that complemented the monetary economy and often provided him with products below the market price and other solutions to different temporary problems. This made him part of a reciprocal

³⁹ Muncktell’s diary, Sevala p. 239.

⁴⁰ Muncktell’s diary, Kärrobo p. 39.

⁴¹ Muncktell’s diary, Kärrobo p. 77.

⁴² Muncktell’s diary, Kärrobo, p. 173.

system of favours as he was expected to make favours in return. On the other hand, maintaining his social status and relations was costly. His duties of being a good host to people from his own social stratum are described as an economic burden; not least how the horses of guests staying overnight become a strain to his meagre hay supply.

At the smallest organisational scale, the agrarian household of Munktell had a, for its time, typical division in male and female working spheres. In simplified terms grain production and use of land for fodder, grazing and forest were responsibilities of men, while milk production, food processing etc were the women's responsibility.⁴³ Women took care of the animals except for the horses and oxen, which worked within the male sphere. A certain competition for resources between the spheres can be assumed, as well as some diverging choices and priorities, but the diary rarely mentions it. One example is when Munktell and his wife, Christina, came to different conclusions regarding the rational of producing flax. Christina questioned the profitability, but Munktell could change the equation by lending 12 days work of "his" labour to Christina for the processing of flax. He found the cost of this work to be low since it could be performed at a time of the year (November) when the workers had few other duties.

The differences between the male and female spheres comprise a methodological problem since the diary often only mentions half of the problems and solutions. From Munktell's perspective the pasture deficit affected his oxen and horses, and the diary describes how their welfare, but not the cows' and sheep's was his driver for improving the pastures. The lack of female perspective may on the one hand make the household look more homogenous than it was, but may on the other hand hide an intertwining of the two spheres. Although not mentioned in the diary, the drought was naturally a problem also for the cows and his wife's milk production, and, conversely, Munktell's and his men's actions to overcome the deficit of pasture and hay also benefited the dairy cows.

Interactions between social-ecological domains and scales

Munktell's detailed diary provides several examples of networks of household activities and causal connections between activities. The connections and many of the activities can be regarded as interactions between domains and scales in the social-ecological system

Below we describe two examples of activity-causality networks related to the weather's effects on the ecosystem resources.

The background of both examples is Munktell's extensive cultivation of cereals, in particularly rye, which is his major cash crop. This was in turn motivated by the household's high costs for labour and consumption, the latter largely caused by its social status. The rye cultivation required many oxen and horses for traction power. Munktell held up to 12 oxen and 4-5 horses, with which he cultivated c. 50 hectares of arable land per year. The animals required large quantities of hay and large areas of pasture, which made the system sensitive to years with low production due to unfavourable weather. The rye cultivation *per se* also affected the supply of hay, since rye was favoured on arable land at the expense of hay cultivation. In both examples bad weather caused

⁴³ Verdier 1981, Segalen 1983, Östman, A-C 2000

deficit of hay and pasture, in a subsistence system having little margins and tolerance to fluctuations.

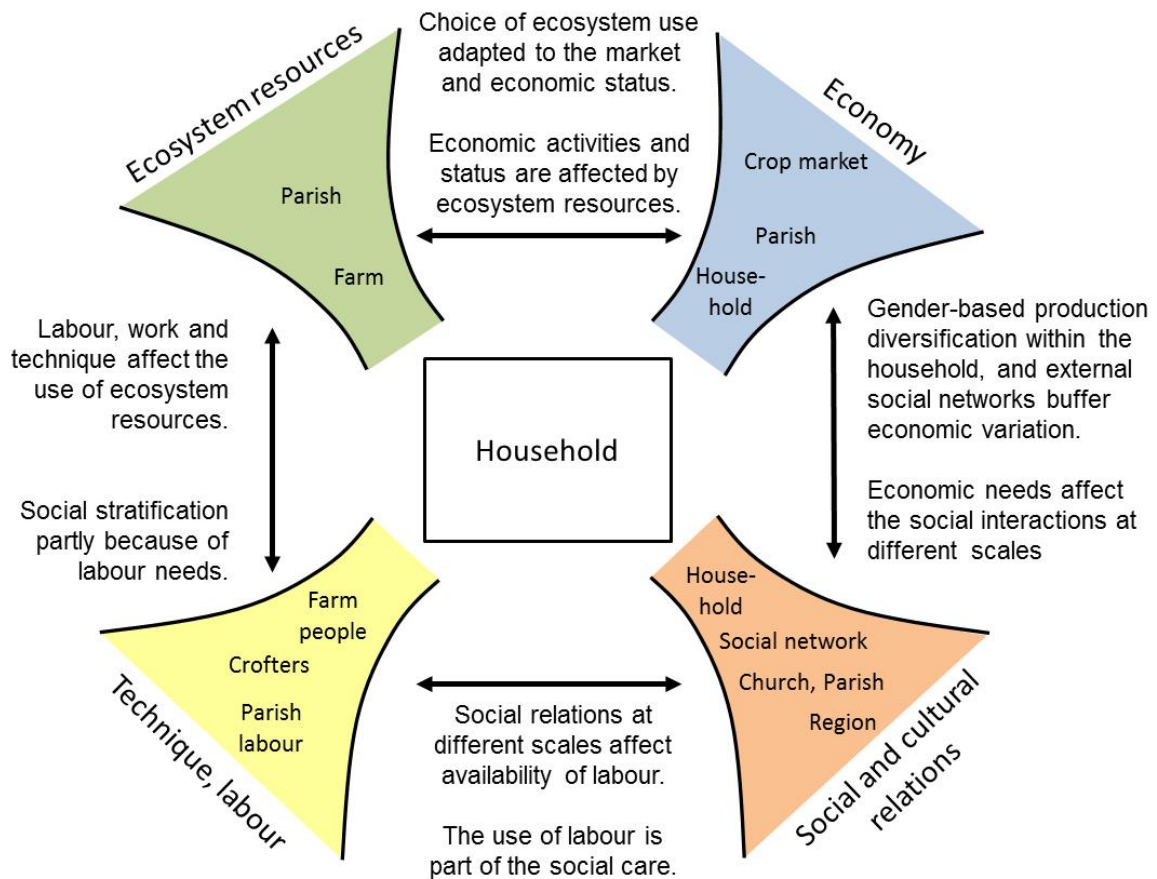


Figure 2: The dean Muncktell's pre-industrial farm as part of a social-ecological system, consisting of four domains. Each domain contains different spatial and organisational scales, from the smallest scale, often within the household, larger scales. The household's activities consists of manoeuvring within and between domains and scales, thereby forming links and interactions between domains and scales. The household's actions are triggered by conditions and changes within or between domains.

Example 1, Pasture deficit.

In Sevala, the forests did not provide enough pasture for Muncktell's oxen, which therefore tended to break through fences to graze on meadows and fields of other villagers (1 in Figure 3). This caused problems for the neighbours and for Muncktell's relations to them (1a). Muncktell tried several ways to overcome the pasture deficit. He logged and shaped new pastures in the forest (2), and noted that the clearing was possible because of the cheap labour (2a).⁴⁴ He also experimented with delayed grazing and other means to increase the grass production in the new pastures (3). Delayed grazing required herding of the cattle in the forest until the new pastures were ready, and for the job he employed a herder (3a). The diary shows an unexpected social effect of this measure. Muncktell sometimes took care of poor children: hosted them and put them in school. When employing a herder he could not any longer afford to care for the poor girl he had at the moment, and she was

⁴⁴ Muncktell's diary, Sevala p. 279.

“sent back to the pack of beggers” (3b).⁴⁵ When the pasture became scarce in the autumn, the oxen were fed with supplementary straw at night (4). Muncktell mended a cottage for the poor mother Nettle-Anna in order to have her taking care of the feeding of oxen (4a). As an emergency measure in Kärrobo, Muncktell even used hay already in the autumn (5), which enhanced the deficit of hay, see next example.

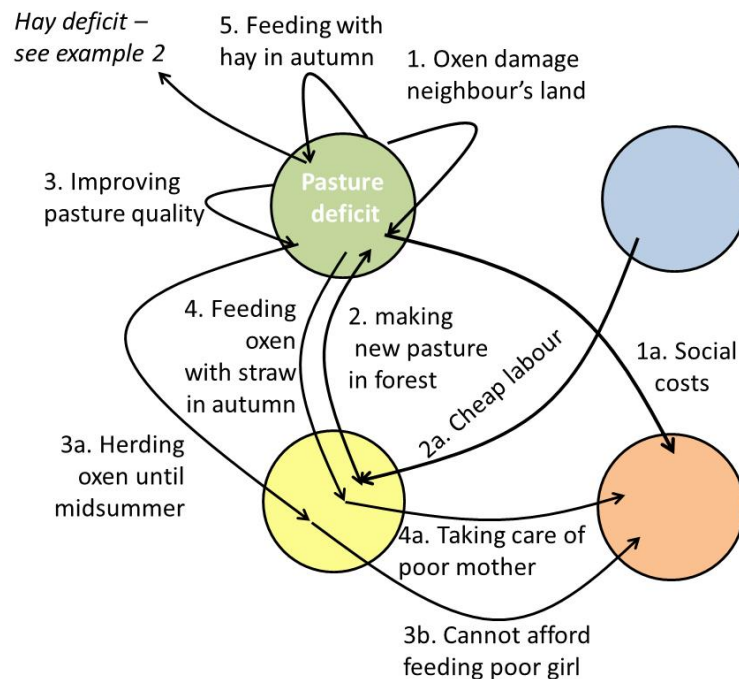


Figure 3: Activities of Muncktell’s household related to pasture deficit in dry years during the period 1815-1821. See example 1 for explanation. Colours are consistent with the colours of the domains in Figure 2.

Example 2, Hay deficit.

Muncktell seemed to regularly have suffered from deficit of hay in the late winter. He combined different measures to solve the problem. One was to use arable land for hay production (1, Figure 4), either by sowing clover or timothy or by allowing natural grass growth. This reduced the area available for production of rye (1a). Another measure was to sell a horse in the autumn, and later buy one back in the spring (2). The most important measure was to borrow or buy hay from his social network of friends and neighbours (3). This created social debts (3a) and Muncktell was expected to make favours in return, for example to provide cheap 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 had to sell (4a). Finally, Muncktell used the boys he was teaching for collecting leaf fodder to supplement the hay (5).

⁴⁵ Muncktell’s diary, Sevala p. 269.

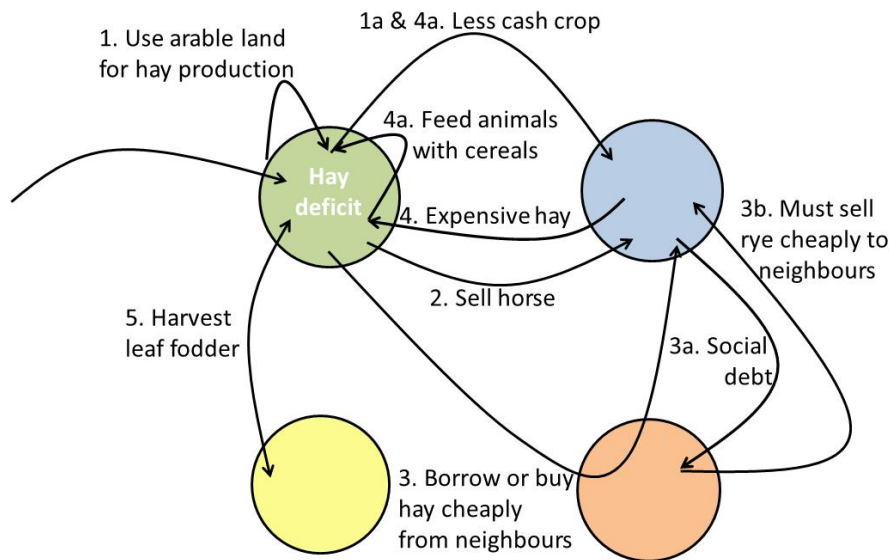


Figure 4: Activities of Muncktell's household related to hay deficit during the period 1815-1821. See example 2 for explanation. Colours are consistent with the colours of the domains in Figure 2.

Discussion

Social-ecological domains and scales

The social-ecological framework proved to be a useful tool for sorting and analysing the immense amount of information provided by the Dean Muncktell's diary. The diary is filled with observations and reflections regarding the preconditions for the household and its agriculture, i.e. ecological and socio-economic problems, constraints, and possibilities, and their variability and change. Decomposition of the household's entire arena into different domains enabled a categorising of this information. Four main domains could be identified, as described above. If necessary for certain types of analyses, these main domains can be further decomposed.

A description of a domain in Muncktell's household will thus largely be built up by information about the state and conditions of the domain, and about the variation and change of these conditions over time and over scales within the domain. The sum of all domains will provide a structured blueprint of the household's social-ecological arena.

The range of scales differed between the domains. The *ecosystem resource domain* was mainly restricted to Muncktell's own farms, with some minor spatial extensions to the neighbourhood via borrowing or purchasing products from neighbours, and to entire parish in Seville via the tithe. The *labour and technique domain* is based on labour for help in the house, crofters inhabiting the crofts at Muncktell's farms, and temporary labour, mainly poor people from the parish. In the *social and cultural relations domain*, the household's social network spanned from the internal household relations, to a geographically spread network of relatives and clerical colleagues. Most of the household's social relations, however, occurred within the parish or its close neighbourhood, either with persons of Muncktell's own social status, or with the poor, who served as labour on his farm. The *market and monetary economy domain*, finally, ranged from trade of products and labour within the parish, to trade of products on a northern European market.

Cumming et al.⁴⁶ hypothesized that problems in managing ecosystem resources may arise because of a mismatch between the spatial, temporal, or organisational scale of the use of ecosystem resources, and the scale of the ecological processes being managed. In Muncktell's household, most of the important conditions and activities in all domains were related to the farm and the parish scale, and scale mismatches do not seem to be important in this social-ecological system.

Interactions between social-ecological domains

Muncktell's diary is also filled with information about activities performed by the household. Most of the activities appear to constitute *interactions between domains*. The activities can be regarded as the glue that keep the domains together, that tightly connect the socio-economic and the biophysical parts of the household's arena.

In some years during the study period, bad weather and poor harvest caused resource problems, which Muncktell frequently described in terms of crises: "*I have now farmed this land for 19 years, and this is the worst failure of crops I have experienced. ... How I will be able to manage this year passes my comprehension.*"⁴⁷ The household handled these problems in the ecosystem domain mainly by utilising the buffering capacity of other domains.

The two examples show that deficits of the two types of fodder, pasture and hay, were handled differently by Muncktell's household. The *pasture deficit* initiated labour-intensive improvement and extension of the farm's pasture, i.e. measures to increase the resource. The availability of labour was in turn based on Muncktell's relations to the lowest social groups in the parish (Figure 3). Muncktell thus used labour from the lower social groups to buffer the weather-induced ecosystem problems, both in order to solve the immediate problems, and for reducing the risk of future pasture deficit. The *deficit of hay* was, in contrast, mainly through Muncktell's relations to the higher social groups, from which he could borrow or cheaply buy hay, and to a lesser extent through the market (Figure 4). No significant actions were taken to increase the ecosystem resource. The difference between pasture and hay illustrates how the pasture resource, in comparison with the hay, was more dependent on the ecosystem conditions and less linked to the market, and that the shaping of pasture resources was labour-intensive.

The relationship between the agriculture's labour and social stratification has been studied at regional and national levels.⁴⁸ The analysis of Muncktell's diary illustrates this relationship at a micro-level. Labour was needed as result of ecological pressure, either for larger works such as clearing of forest for pasture, or for special tasks such as herding of oxen. In some cases, poor people could be employed more or less temporarily, but to a considerable extent Muncktell obtained labour by providing a set of social-economic positions, partly connected to accommodation, i.e. cottages and crofts⁴⁹. Many different tasks on Muncktell's farm were thus linked to some social and economic security, not the least to a shelter for the winter.

⁴⁶ Cumming et al. 2006.

⁴⁷ February 1815; Muncktell's diary, Kärrobo p. 84.

⁴⁸ E.g. Utterström 1957; Harnesk 1990.

⁴⁹ See, e.g., the Nettle-Anna example cited in the results; Muncktell's diary, Kärrobo p. 173.

The analysis of the diary also suggests an interesting link between the social organisation of agrarian labour and the utilisation of ecosystem resources. Cultural-geographic information shows the geography of Muncktell's croft-holders and cottage holders, and the information can be used to find and study the old croft-sites in the field in order to estimate their resource potential. In both Kärrobo and Sevala, the arable land and meadow utilised by the croft-holders, consisted of small, fragmented, often distant, pockets. It is likely that these constraining factors would have made it difficult for the main farm to directly utilise the crofter's land, without help from crofters settled at the sites. The crofter's system may be regarded as an expansion of the ecosystem use to areas and resources which otherwise would have had low profitability for the main farm. The crofters transferred ecosystem resources from these marginal areas to the main farm, either through products or through their daywork duties.

In summary, ecological pressure affected the economy of the household, the social relations with neighbours and people of Muncktell's own social status, and the use of labour, which in turn interplayed with the social stratification in the parish and the conditions of the poor. These interactions between domains are manifested by the household's activities. As mentioned, many of the activities aimed at buffering for ecosystem problems by using the potentials in other domains. Since Muncktell had more debts than monetary capital, the market domain was used relatively little as buffer. Instead, buffering was achieved by Muncktell either by utilising his reputation and social network within the higher classes of the society, or by increasing the amount of manual work, based on the lower classes of the society.

In opposite to buffering, problems in one domain may enhance problems in other domains. Such, so-called cascade effects,⁵⁰ were not found by our analysis of Muncktell's agrarian household, apart from a negative feedback loop including rye cultivation, winter fodder, and monetary result, which is discussed in the following section.

Occasional catastrophe or unbalanced agriculture?

In this study, we have in particular looked for effects of the bad weather years in the early 19th century. Drought, frost, and rain forced Muncktell to take drastic actions, especially for dealing with the pasture deficit. As mentioned, in 1814, he had to feed his oxen with hay already before the end of the grazing season: *"I had no other way out than to use the spring barn, which, thus, must be filled with purchased hay in the spring."*⁵¹ He sold horses in the autumn only to buy new ones in the spring, and he considered selling the sheep.⁵²

Measures like those may have served as occasional emergency exits which caused temporary problems, but without affecting the subsistence in the long run. There are, however, signs of more permanent, or at least regular, unbalance between supply and demand. For example, Muncktell complained over a constant hay deficit: *"The old problems with hay deficit, also this year seems to fall on my lot."*⁵³ Also the fact that severe pasture deficit occurred in the late summer and autumn of 1814, in spite of that year not being extremely dry, judging from other crops at Muncktell's farm.

⁵⁰ Kinzig et al. 2006.

⁵¹ Muncktell's diary, Kärrobo p. 41.

⁵² Muncktell's diary, Kärrobo p. 141 & 144.

⁵³ Muncktell's diary, Kärrobo p. 86.

This indicates that the system was too vulnerable, even to moderate reductions of pasture growth. It seems likely that Muncktell's problems with the fodder supply was mainly a question of too large demand, not too little production capacity on the farms. The demand of fodder was a result of his large stock of oxen, which was necessary for working his large rye fields. Both for hay and pasture, the animal number seems to have reached a critical maximum threshold, above which there were no margins for years with lower production – years that inevitably would come. Muncktell's extensive rye cultivation had generated a feedback loop which leaked resources in every turn: Large areas of rye required many oxen to work the fields, which needed hay (even in the summer because of pasture deficit), and the hay must partly be bought with money emerging from the rye, which required even larger rye fields, etc. This situation also illustrates, at the micro-level, the so-called dilemma of reclamation, implying that increased areas of cultivated arable land leads to an unbalance of the proportions of arable fields, hay-meadow, and pasture in the production system.⁵⁴

Interestingly, Muncktell's diary shows that he was not ecologically confined to cultivation of cereals on arable land, but could have used a suitable proportion of the fields for production of hay and pasture. The transformation of meadows and pastures to arable fields was not irreversible. Hay was cultivated, e.g. timothy, but to a small extent, and in emergency situations Muncktell could transform arable land to pasture: *"I decided to transform both fields at Tistebo to pastures. ... As I don't have manure at Tistebo, and the fields at home need all the manure that can be found, I find this measure wise, especially since there is now so unusually little pasture."*⁵⁵

The reasons for an unbalanced field-meadow-pasture ratio were socio-economic rather than ecological, probably emerging from Muncktell's costly social status, which had forced or tempted him to cultivate cash-crops also on land he would have needed for production of fodder. The societal pressures made Muncktell approaching a monetary-based agriculture, but his resource base was still largely in the hands of weather variation and ecological processes out of his control. If interpreted in a social-ecological perspective, Muncktell's diary becomes a description of a household's struggle to combine a changing society with a conservative nature.

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⁵⁴ Gadd 2011, p. 235 ff.

⁵⁵ Muncktell's diary, Kärrobo p. 136.

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