

Linking practice to policy: Dairy farmers' understanding of ecosystem services for long term farm sustainability

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Abstract: During the last ten years the number of dairy farms has decreased with app 40% in Sweden. Low viability and low competitiveness are main reasons, but also a lack of interest among young people to chose to become a full-time dairy farmer. High investment costs imply an important threshold effect. We experience the consequences in different ways; loss of biological and ecological diversity; decreased economic activity in rural areas; erosion of social community, and changes on landscape level.

To survive there are two dominant strategies. The first is to increase in size (high input), the second is to decrease costs by using local resources as efficient as possible (low input). For the latter group, ecosystem services are purposefully integrated into planning of the agricultural production systems. The question of resources allocations, at different system levels, becomes crucial. As farmers will have a central role in the societal transition towards a bio-based economy, their experimental learning and practical knowledge, in terms of conservation and provision of ecosystem services must be taken into account. Thus, we argue that how small-scale dairy farmers handle the challenge regarding the continued maintenance of ecosystem services, and the question of resource allocations within a farm, is important to learn from when developing future strategies and policies for Swedish agriculture.

This paper builds on field studies within a qualitative research project (AgResource) that focuses on farmers and their knowledge about local resources and ecosystem services, and its ecological effects on the farm and landscape scale, as well as its socio-economic consequences. We conclude that the experiences and knowledge among small-scale and resource efficient dairy farmers are important to learn from. Learning from practice to inform policy will support the necessary shift towards a bio-based economy. An integrated perspective on farm development, including farmers' view in ecosystem services, is crucial for long term farm sustainability.

Keywords: Dairy farming, land use, resource allocation, Swedish agriculture, local resources, landscape, ecosystem services

A farming sector in radical transition

Threats and consequences in Swedish dairy sector

Swedish agriculture goes through a quick process of structural change. Increased international competition, changes in consumer preferences, and a focus on cost reduction and economy of scale have had consequences on many levels of farming and the farming system. This is especially true for the dairy sector. The most obvious consequence of these trends is the structural change towards fewer, but bigger farms (SCB, 2012) (Table 1). The average size of a milk herd has gone from 32 milk cows/farm in 1999 to 70 milk cows/farm in 2012 (SCB, 2013).

Table 1. The development of the dairy sector in Sweden regarding the number of firms and animals between 1990 and 2010 (SCB, 2012).

	Year			Development, 1990–2010
	1990	1999	2010	
No. of firms in dairy production	25 921	13 936	5 619	-78%
No. of dairy cows	576 409	448 520	348 095	-39%

The profitability of Swedish farms lies below the long-term sustainable level needed to sustain employment and create growth (LRF Konsult, 2011). During the last 10 years the number full-time employees in Swedish agriculture has decreased by 37%, and the number of farmers has fallen by 15% (SJV, 2011) (Table 2). In 2012, almost 75% of the Swedish farms made no profit or had negative results (LRF Konsult, 2013).

Table 2. The number of persons working in Swedish agriculture between 1999 and 2010 (SJV, 2011).

	Year		Development, 1999–2010
	1999	2010	
No. of farmers	75 916	65 853	-15%
No. of full-time agricultural workers	35 079	21 946	-37%

Although most farming companies have learned to manage annual fluctuations in productivity and profitability, it is not possible to survive a long period of decline. Active farmers find other work and fewer young people are willing to enter or continue farming when there is a change of generations (LRF Konsult, 2011). This overall trend also has negative implications for other aspects of rural community life, agricultural-related activities and values (Ekman and Gullstrand, 2006; Shucksmith and Rønningen, 2011; Pinter and Kirner, 2014) and the rural landscape.

The environmental consequences of such structural changes within the dairy sector become more and more obvious; the landscape changes as marginal land is abandoned and biodiversity decrease (Lindborg et al, 2006). A continued farming as such is today as important as environmentally friendly management. Without active farming and grazing animals, important biological and cultural values risk to erode (e.g. biodiversity loss, climate regulation, fresh water quality and quantity, circulation of nutrients etc.). From a broader sustainability perspective the accelerated environmental change we experience make several fundamental ecosystem services (ES) to be reaching critical limits (e.g. MEA 2005; Rockström et al. 2009). Environmental goals and development goals are increasingly becoming conflictive. The tension between production and conservation goals generates a broad range of political, ecological, social and economic consequences and conflict. Trade-offs are part of today's decision-making, and new approaches need to consider the correlations between different aspects of sustainability in dairy production.

Society's responses to support the dairy sector

The pressure on the farming community and the rural landscape has resulted in different responses in the Swedish political debate. The Ministry of Rural Affairs has suggested economic support to meet an increased international competition, the Farmer Federation has urged for loosening up rules and regulations, Environmental NGO's demand increased societal support for public goods, while some researchers argue for continuous structural changes to enable viable farms, and at the same time support collaborative efforts among farmers in order to secure a positive environmental impact. For instance, Kumm (2013) argues that "*one way to counter this threat can be high-quality conservation in limited areas while releasing other land for food and bioenergy production*".

Most suggested strategies reflect a reactive approach, where today's challenges are met by increasing public support or decreasing societal restrictions. Whether or not these strategies will be able to stop the agricultural treadmill or not is questionable. Especially the social dimension of long-term sustainability is seldom discussed. In addition, the development toward multifunctional farms, where the existing variety of ES on farm level can be capitalized is almost never put forward as an option.

At the moment, there are two main trails to encourage farmers to nurture and evaluate ES on their land: (1) By creating a market for ES and pay for the cultivation/management of these (PES, Payment for Ecosystem Services), and (2) to support agricultural/forest production systems based on renewable resources (ES) and integrating production of food and fibre cultivation of ES. Today's incentive structures in Sweden to compensate the user for the ES as farm produce are particularly the EU agro-environmental schemes (AESs), a kind of PES, a regulatory and control systems that provide detailed rules on what and how farm activities should be carried out by land users in order to provide ES to the global society.

Farmers and ecosystem services

The societal value of ecosystem services has been thoroughly discussed and researched for over 30 years now (eg. Costanza and Daly, 1992; Costanza et al, 1997). Fisher et al (2008) states that it has become essential in policy and decision-making circles to think about the economic benefits (in addition to moral and scientific motivations) humans derive from well-functioning ecosystems. The basic rationale is that when a monetary value is put on a service, it is also possible to decide which incentives to use to support it in a, for the society, cost-effective way (KSLA, 2005). The cost-benefit analysis of economic intervention (f.i., an agro-environmental scheme, AES) vs. non-intervention (f.i., inaction against climate change) is today a well established research area in economics (eg., Fisher et al, 2008; Ring et al, 2010), and has become base-line for many scientific and political arguments regarding policies for sustainable development (eg., MEA, 2005; Davidson, 2012). In a bio-based (or ecosystem-based) economy the ecosystem services, ES, are the only, sustainable resources to be managed. The question is which these services are and how they can be maintained and maybe even strengthened, both on farm and landscape level. For a farmer it implies that s/he must be able to use existing ES and allocate these resources in a way which strengthen the long term viability of the farm business.

There is an emerging amount of research focused on understanding farmers' willingness to supply ES to the society (Buckley et al. 2012; Jolejole et al. 2009; Mante and Gerowitt 2009). When the AESs were first implemented in Europe, it was assumed that participating in those would also lead to a change in farmers' attitudes towards farm management and nature conservation (Boonstra et al. 2011). However several studies shows how farmers participate in schemes because of financial rewards and/or they participate in those schemes that do not intervene in their current management too much i.e. they are the ones already concern and are already doing the conservation management. Therefore, the schemes can be seen as a system that reinforce rather

than change farmers' attitudes (Bartholdson et al. 2012; Burton et al. 2008). But many farmers also have a personal environmental commitment which they are not compensated for, because they feel that the measures are good for the environment (Bartholdson et al. 2012).

There are also important ES trade-offs in management choices by farmers, intentionally or otherwise, and these have implications for the magnitude and relative mix of services provided by the ecosystems. Trade-offs can be classified in terms of their temporal scale, spatial scale, and their degree of reversibility (Rodríguez et al. 2006). When it comes to agriculture there are important trade-offs with biodiversity, water, soils quality and water availability for present and future uses and understanding such trade-offs are important to comprehend the long term effect of land management and ecosystem services provision and the inherent complexities of ecosystem management. (Rodríguez et al. 2006).

For farmers there are two dominant strategies to respond to new demands and threats, both representing the ambition to increase the competitiveness of their milk production. The first strategy is to increase in size (specialization and depending on a high level of external inputs), the second is to decrease costs by using local resources as efficient as possible (low external input into the production system often combined with an increased multi-functionality). For the latter group, ES are often purposefully integrated into planning of the agricultural production systems. The question of resources allocations, at different system levels, becomes crucial. As farmers will have a central role in the societal transition towards an ecosystem-based economy, their experimental learning and practical knowledge, in terms of preservation and promotion of ES must be taken into account. Thus, we argue that how small-scale dairy farmers handle the challenge regarding the continued functioning of ES, and the question of resource allocations within a farm, is important to learn from when developing future strategies and policies for Swedish agriculture

Furthermore, it is the farmers that will transform new policies into practice. In order to be able to support farmers and other actors in continue doing what they do or doing things slightly differently, we need to understand their perspective and how they use and manage ES today. Such knowledge is often missing in policy decisions. If we are able to involve and engage farmers, bringing their local knowledge and practices into the policy process, new ideas might arise which support the development of a more sustainable agriculture.

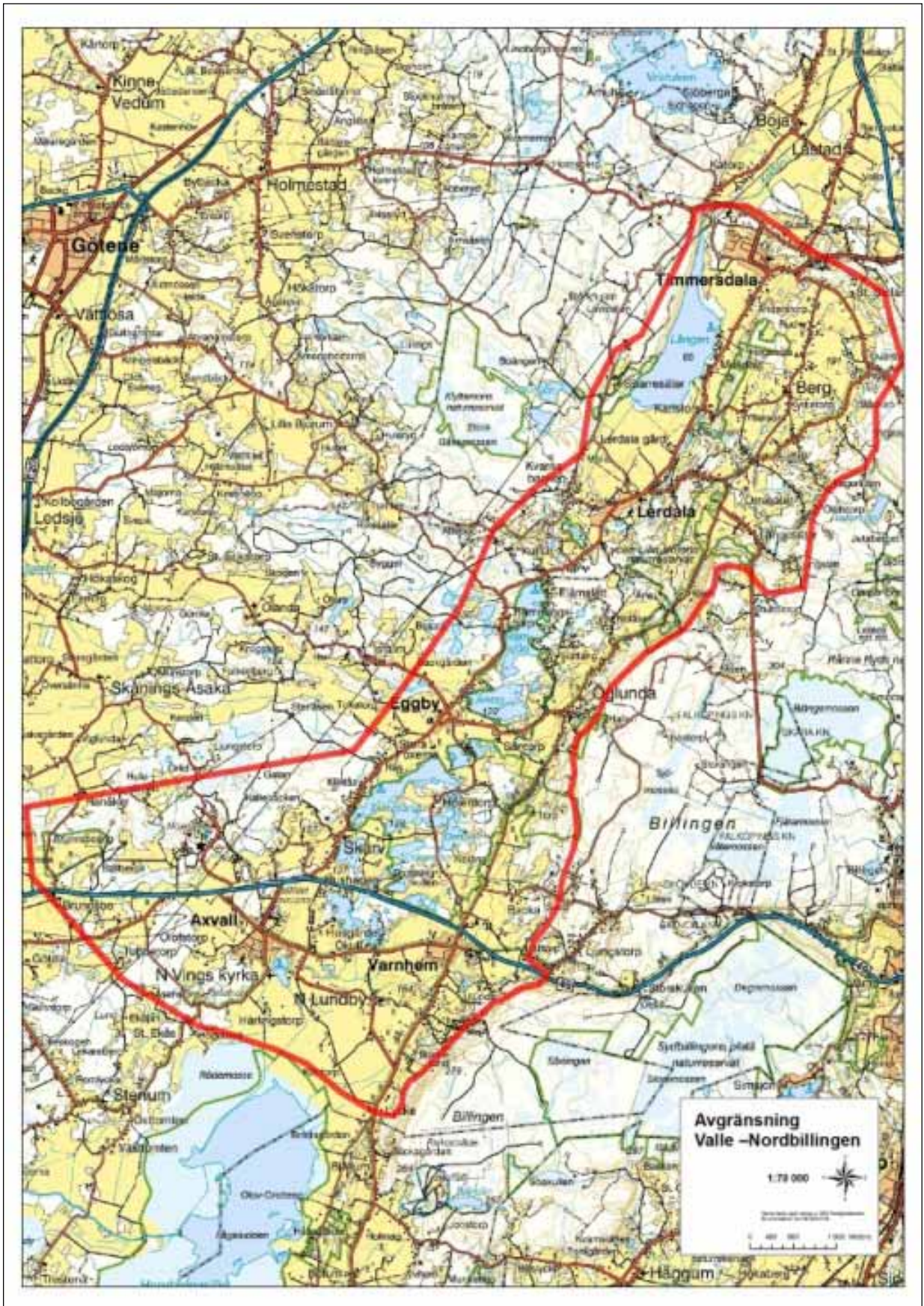
Understanding Swedish dairy farmers' perspective

This paper builds on field studies within a qualitative research project (AgResource) that focuses on how farmer reason about ES and how they plan (or not) for the management of ES when allocating resources within their production system. We are especially interested in a better understanding on how farmers handle the conflict between production and environmental goals, both on short and long term basis.

The case study area

Dairy production is particularly interesting in this perspective as it often involve the management of ES rich pasture lands (Winqvist 2013), and as described earlier this is also a sector where the structural changes goes quickly at this point (Holmström 2013). We therefore focus this study on dairy farmers in an area that has a long history of livestock production which has shaped the natural and cultural landscape and thus high levels of ES, functions which today are under pressure. The paper aims to describe how dairy farmers understand and use local resources and ES in their production system, and which implications that might have for agricultural policy.

Figure 1: The case study area is 14.300 ha, and delimited by red lines on the map.



The case study area is 14.300 hectare, characterised by a small-scale agricultural structure. The area is varied with arable land in-between leaf forests, small lakes and wetlands (figure 1). It has,

from a Swedish perspective, good preconditions for farming – enough water and permeable soils, good micro-climat, and productive soils. On the other hand, the fields are small and there are 14 nature reserves, and a lot of other restrictions for farming and commercial activities in the area. The area is nevertheless perfect for grazing animals, like cows, sheep and horses, while less suitable for cereals. The average size of dairy farms in the case study area is lower compared to the rest of Sweden (table 3). We have chosen this area due to its long farming continuity, diverse farm businesses and high biological and cultural values. But as for the rest of Sweden the amount of dairy farms is decreasing.

Table 3. Dairy farming in the case study area compared to Sweden in general in 2010 (SCB, 2012).

	Average	
	Farm size (ha)	Milk herds (cows)
In the case study area	31	40
In Sweden at large	37	65

Capturing farmer's perspective

Farmers' actions have consequences not only on farm level, but also on landscape level. By interviewing as many farmers and landowners as possible in a limited area we have tried to understand the ecological and social consequences of many peoples' (un)coordinated actions. Data has been gathered using semi-structured interviews on farms, sometimes with one, sometimes with two farm members at the same time. Approximately 20 interviews have been conducted. Each interview took between 45-90 minutes. Important information has also been gained from two agricultural advisors and one university biologist living in the area, as well as written documentation of natural and cultural values.

Ecosystem services, resource allocation, landscape level, etc., are all abstract concepts that for most farmers have little practical meaning. Doing interviews about such aspects forces you as a researcher to translate the general concepts into the realities that every farmer knows very well. We have done that by asking them to describe their farm, their activities, what they value, how they use different resources, etc. It is our interpretations that later transform these stories into a general and theoretical understanding.

Findings: Aiming for sustainability in spite of rather than because of existing regulations

Farmers' view on their own role

The story told by most farmers are that if they only were left or relieved a bit from bureaucratic demands and control, with a possibility to manage their land the way they wanted, it would fulfil all the different environmental goals and thereby also contributing to achieving societal goals. This perspective was grounded in a historical and practical experience. It is the many measures taken by independent farmers and landowners, over hundreds of years, that have created the values that society now want to preserve or support. The farmers argued that it was not by means of regulations and state incentives that they would continue to do this. They further stated that authorities do not understand them, do not trust them, and sometimes forces them to act in a way which many perceive as being counter-productive to even collective goals. If instead, they have had the possibility to take their own management decisions, use local resources the way they wanted, adapt their management strategies to local preconditions, in the way they found suitable

for their land,, dairy farming in the area would be more sustainable. At the same time they realise that if the consumers are not willing to pay for their products nothing can stop today's development.

In general most farmers saw no conflict between production and environmental goals, they expressed it as a bureaucratically created dichotomy rather than a problem of agriculture as such. Some argued that it was the bureaucracy and regulations per se that gave rise to the conflicts, while others argued that it was the lack of participation in decisions taken about environmental goals that, together with low farm viability, made goal conflicts more salient. An increased collaboration between actors, creating platforms for social learning, would be an important way forward for the latter. Not least when finding sustainable management regimes for the many nature reserves in the area.

Farmer's stories about local resources and ecosystem services

Most farmers value local resources and existing ES high, but take many of the latter for granted (regulatory and/or supporting ES, clean water, natural predators, pollination, etc), while others are perceived as decreasing or even threatened (biodiversity with cultural value, access to nutrient in the long term, public acceptance of farming activities, etc.). Even though there might be some smaller problems on their own farm, the major challenges facing agriculture were related to other geographic areas or other production systems (especially annual crop production system).

At the same time, and during the interviews, they started to reflect upon ES and how they manage them. The farmers do not necessarily conceptualise ES as resources, but rather as something which creates a sense-of-place, historical continuity and identity. Several of the farmers specifically stated that they do more environmental work than they are paid for because they don't like to see how the landscape was becoming overgrown. That is, local resources and ES are not most often perceived as precondition for farming, but rather as an outcome of farming activities. They are created from farm activity and thus in need of farm continuity for their existence. Consequently, some farmers argue that direct payments for preserving agricultural objects will not save these. Instead payments must be directly linked to the agricultural production. This is an argument that in some ways stand in contrast to their overall will to be more autonomous and decoupled from the regulatory framework of today.

Several farmers stated that they would have liked to manage their pasture differently, but as they are located in protected areas they are submitted to rules and regulation for how to manage these areas. They would like to use the areas more intensive for animal grazing and also clear away more trees and bushes than they are allowed to. They would also like to use the broad leaf forest areas for grazing as it traditionally has been used, and argue that the intentionally fast re-growth of under vegetation in oak forest promoted by the County Administrative Board is not having the wished effect (to protect the oak forests) rather degrading them as not selective re-generation management is allowed. Some farmers said that their extensive production system already where highly resource efficient, why the bottle neck for long-term sustainability is the income their production generates, that is, the consumers and citizens willingness to pay. A non-functioning market disables them to be viable, although having low costs. Growing bigger was for many of these no alternative, because they could not see the economic benefits from it. It would only lead to high investments costs, logistic problems, and less site-specific knowledge on best management of specific fields.

In general they would like to have the landscape more open than today and have the ability to have more control over the species and number of trees in the pasture and forest areas. On the other hand is the high cost for putting up fencing for the grazing animals seen as a big obstacle

for taking up grazing, especially as many plots are small, highly lacinated and therefore require substantial amount of fencing material.

The role of local knowledge and trust in sustainable dairy farming

Low input farming is perceived as the most sustainable for most of the farmers in this area. Making use of what you have and not abusing the system are seen as important management principles. Local knowledge, f.i., which fields fits for what purpose, is something that risk to disappear when big farm units starts to use the land. The nuances will be harder to manage, thus, decreasing resource efficiency and allocation. Small-scale farming has also consequences for the possibility to maintain natural and cultural values, when every farmer/landowner have their unique way of doing things, thus creating a higher pluralism in management regimes.

Many farmers felt an increased distrust in public authorities. One example in this area was how they have been promised to get costs covered by the County Administrative Board for managing protected areas, but how the promises never were fulfilled and how they perceive that the County Administrative Board expected them to cover for a costly management of historical landscapes themselves. It was also mentioned how they take on quite time consuming ES management tasks although the payment for it was very small. For example, cutting mower was done by one farmer in order to maintain the orchid flora at the farm, however the payment for the work did not correspond to the work effort. However, the same farmers also stated that this kind of voluntary maintenance of ES, due to the farmer's understanding of historical and aesthetical values, will probably decrease drastically in the future.

It was stated by most farmers that one has to approach your farm as a whole and that there are a lot of synergies between different activists on farm and landscape level. All farmers argued for example for the importance of balancing the number of animals and amount of land in order to have a balance between amount of feed for the animals and amount of manure for the fields. They advertised for advisors and agricultural bureaucrats that could see ES from the farm perspective instead focusing on a particular part of the farm (animal welfare, feed production, biodiversity management, etc.). They mention that to take ES management further it would need to be detailed management plans on each farm describing how they could enhance ES. A view that stands in contrast to the universal payments for specific landscape objects.

The challenge can in short be described as a development process where one both take the individual values, motives, knowledge, and practice of the farmer into account, while at the same time analyse existing resources and ES from a business potential perspective. Making some of the values which are invisible for the farmer visible and manageable. When discussing these issues more in detail, some of the interviewees reflected upon that they had potentials at their farm which they hadn't realised before. Although most had hard time see how these resources would increase their viability if managed more consciously. Nevertheless, their role as entrepreneurs in a bio- or ecosystem-based economy was put forward as a potential.

Discussion - Learning from practice to inform policy

Several authors (e.g. Boonstra et al. 2011; Burton et al. 2008) have highlighted that participation in AESs does not require any farming skills from farmers. Many studies have also reported on problems concerning highly detailed regulation and the inflexibility in the application of the schemes (Bartholdson et al. 2012; Kaljonen 2006; Rabinowicz 2010). The consequence of such detailed and inflexible rules is that they do not promote voluntary action for environmental protection, rather just following compulsory practices (Burton et al. 2008). The standard rules are linked to production processes rather than outputs; there is no need to learn and no need to innovate. However, to be innovative is something that is often highly prized among farmers and often part of their self-identity (Burton et al. 2008).

It is clear that the dairy farmers interviewed in this study have the ambition to be sustainable, both from an ecological, social and economic perspective. They realise that these dimensions are integrated on farm and landscape level. At the same time they perceive that they are forced to make choices due to external pressures (rules and regulations, incentives, market development, etc.) which they do not like. They perceive that these external factors contribute to a decreased viability and as a consequence less interest from the next generation to continue farming. When the farm family accept that no one will continue their work, they slowly start to exit farming. This is most clearly shown in the lack of re-investments at some farms. They themselves continue as long as they have low costs, energy, health and a joy of being a farmer. The question is what measures that are necessary to take in order to change the negative development?

First of all, we conclude that the experiences and knowledge among small-scale and resource efficient dairy farmers are important to learn from. Learning from practice to inform policy will support the necessary shift towards sustainable agriculture and a more bio-based economy. An integrated perspective on farm development, including farmers' view on ES, is thus crucial for long term farm sustainability. Existing interventions and policy development does not initiate the desired agrarian and social processes of change, a shift towards what really create natural and cultural values in the rural landscape is urgently needed. One important measure is to develop farm specific management plans, and farm-specific, long-term contracts between society and farms (f.i, through public procurements).

Secondly, an integrated perspective on farm development must include farmers' view on and knowledge about local ES. This is an eroding knowledge base. Local knowledge is situated and related to a continuous and ongoing interaction with the eco-systems and local resources. Therefore the issue of scale becomes an important aspect to take into account in policy decisions. Many farmers witness that bigger farm units will have harder to withhold the detailed knowledge about qualities and ES on specific locations, especially in those areas that from an agriculture point of view are seen as marginal land but which often from a biological perspective is highly valuable land. Thus, there are strong arguments for analysing which ES each and different farms should focus on, in order to reach goals and manage trade-offs both on farm and landscape level.

Thirdly, there is a need to move beyond the farm gate, when discussing local resources and ES in dairy farming. Traditionally farmers have collaborated in order to optimize their use of local resources and many ES have been managed as collective goods. Now this has changed. Regulations, financial incentives, lack of relevant advisory services, and a new social context make the farm the only unit for management and development (a kind of system delimitation). Nonetheless, most farmers in this study realise the importance of collaboration between neighbouring farmers, and not least when it comes to sustaining agriculture. There is a need to re-invent platforms for farmers' cooperation, but also to broaden these to also involve other actors strongly involved in the development of sustainable agriculture.

To conclude, there is no quick-fix, instead several different policy areas and measures need to be integrated in order to; a) pay for relevant ecosystem services by focusing on the farm activities which give rise to or preserve them, b) support the development of new ecosystem services, especially those which can be developed into new business ideas, c) enable collaborative measures on landscape level between farmers and between farmers and other actors, and d) create long-term and stable conditions for farm development through long-term societal contracts and individual farm plans.

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References

- Bartholdson, Ö., Beckman, M., Engström, L., Jacobson, K., Marquardt, K. & Salomonsson, L. (2012) Does paying pay off? Paying for ecosystem services and exploring alternative possibilities. Report series at Department of Urban and Rural Development. SLU: Uppsala.
- Boonstra, W., Ahnström, J. & Hallgren, L. (2011) Swedish Farmers Talking about Nature - A Study of the Interrelations between Farmers' Values and the Sociocultural Notion of Naturintresse. *Sociologia Ruralis* 51: 420-435.
- Buckley, C., Hynes, S. & Mehan, S. (2012) Supply of an ecosystem service - Farmers' willingness to adopt riparian buffer zones in agricultural catchments. *Environmental Science & Policy* 24: 101-109.
- Burton, R., Kuczera, C. & Schwarz, G. (2008) Exploring Farmers' Cultural Resistance to Voluntary Agri-environmental Schemes. *Sociologia Ruralis* 48: 16-37.
- Costanza, R. & Daly, H. (1992) Natural capital and sustainable development. *Conservation Biology*, 6 (1): 37-46.
- Costanza, R et al. (1997) The total value of the world's ecosystem services and natural capital. *Nature* 387: 253-260.
- Davidson, M. (2012) Distributive justice in the international regulation of global ecosystem services. *Global Environmental Change* 22 (4): 852-861.
- Ekman, S. & Gullstrand, G. (2006) Lantbruket & konkurrenskraften. Livsmedelsekonomiska institutet, Rapport 2006:4. MCT/Rahms: Malmö.
- Fisher, B. et al. (2008) Ecosystem services and economic theory: Integration for policy-relevant research. *Ecological Applications* 18: 2050-2067.
- Holmström, L. (2013). Strukturrapport från LRF Mjöljk. [online] http://www.lrf.se/PageFiles/140943/Strukturrapport%20_November%202013%20inkl%20tabeller.pdf [2014-02-27]
- Jolejole, C., Swinton, S. & Lupi, F. (2009) Incentives to supply enhanced ecosystem services from cropland. In Incentives to Supply Enhanced Ecosystem Services from Cropland, Selected Paper prepared for presentation in the Agricultural & Applied Economic Association's 2009 AAEA & ACCI Joint Meeting, Milwaukee, WI, July 26-28 2009.
- Kaljonen, M. (2006) Co-construction of agency and environmental management. The case of agri-environmental policy implementation at Finnish farms. *Journal of Rural Studies* 22: 205-216.
- KSLA (2005) Jakten på den gröna marknadskraften – om en marknad för ekosystemtjänster som styrmedel för hållbar utveckling. Documentation from KSLA's conference the 20th of October 2005. Stockholm: KSLA.

- Kumm, K-I. (2013) På väg mot ett ekonomiskt hållbart, högproducerande och klimatsmart jordbruk med höga landskapsvärden. Rapport 6578. Naturvårdsverket: Stockholm.
- Lindborg, R. et al. (2006) Naturbetesmarker i landskapsperspektiv – en analys av kvaliteter och värden på landskapsnivå. CBM:s skriftserie 12. Centrum för biologisk mångfald: Uppsala
- LRF Konsult (2011) Preliminär 2011: Lantbrukets lönsamhet. Strålfors: Stockholm.
- LRF Konsult (2013). Preliminär 2013: Lantbrukets lönsamhet. Strålfors: Stockholm.
- Mante, J. & Gerowitt, B. (2009) Learning from farmers' needs: Identifying obstacles to the successful implementation of field margin measures in intensive arable regions. *Landscape and Urban Planning* 93: 229-237.
- MEA (Millennium Ecosystem Assessment) (2005) *Ecosystems and Human Well Being: Synthesis*. Island Press: Washington D.C.
- Pinter, M & Kirner, L. (2014) Strategies of disadvantaged mountain dairy farmers as indicators of agricultural structural change: A case study of Murau, Austria. *Land Use Policy*, 38: 441-453.
- Rabinowicz, E. (2010) Redovisning av uppdrag om halvtidsutvärdering av Landsbygdsprogram för Sverige 2007–2013. SLU: Uppsala.
- Ring, I, et al. (2010) Challenges in framing the economics of ecosystems and biodiversity: the TEEB initiative. *Current Opinion in Environmental Sustainability* 2: 15-26.
- Rockström, J. et al. (2009) Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society* 14 (2): 32.
- Rodríguez, J.P., Beard, T.D., Bennet, E.M., Cumming, G.S., Cork, S.J., Agard, J., Dobson, A.P. & Peterson, G.D. (2006) Trade-offs across space, time, and ecosystem services. *Ecology and Society* 11: 28.
- SCB (2012) Yearbook of agricultural statistics 2012 – including food statistics. Official Statistics of Sweden.
- SCB (2013) Yearbook of agricultural statistics 2012 – including food statistics. Official Statistics of Sweden.
- Shucksmith, M. & Rønningen, K. (2011) The Uplands after neoliberalism? – The role of the small farm in rural sustainability. *Journal of Rural Studies* 27: 275-287.
- SJV (2011) The development of male and female participation in managing of agricultural holdings in Sweden 1999-2010. Statistik från Jordbruksverket. Statistikrapport.
- Winqvist, C. (2013) Ekologiskt lantbruk, biologisk mångfald och ekosystemtjänster – i ett landskapsperspektiv. SLU EPOK: Uppsala.

Economic impacts of strategy selection in Austrian dairy farming: an empirical assessment

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Abstract: In order to cope with changes in agricultural policy and an increasing volatility in agricultural input and output markets, dairy farmers might select certain strategies regarding external input use to increase competitiveness. The selection of one strategy has different impacts on economic farm performance under different prices. The objective of this paper is to identify such strategies in an agricultural bookkeeping dataset and assess economic impacts of a low-input strategy selection under volatile prices situations. We use data from 509 specialised dairy farms and apply cluster analysis and direct covariates matching. The cluster analysis can identify one low-input cluster with low levels of input use and three clusters with higher input levels. Those clusters differ in site conditions, farm size and milk production but have similar farm income. The results indicate that low-input farms are less depending on external markets and volatile input price markets and competitive with high-output farms.

Keywords: dairy farming, farm strategies, cluster analysis, matching method

Introduction

Due to the high share of grassland and quite good natural site conditions dairy farming plays a major role in Austrian agriculture. Dairy farms are often small and plot structure is scattered, so profitability tends to be low. However, from the societal point of view dairy production goes beyond pure milk production, but contributes to maintain touristic and ecologically valuable areas as well as to increase welfare in rural areas. Consequently, maintaining dairy farms is an important goal of Austrian agrarian policy. But, as public payments will get reduced and milk quota will be abolished, market influence and farm competitiveness will gain in importance.

A decisive factor for the competitiveness of farms is their size. Complementary to several international studies (Schmitt, 1988; Inderhees, 2007; Schaper et al., 2011) Kirner and Kratochvil (2006) show the extraordinary importance of this factor also for Austrian dairy farms. Next to farm size, also natural site conditions influence farm competitiveness. Due to comparatively low opportunity costs for land and labour, mountainous dairy farms show a higher farm income and better financial stability than non-mountainous dairy farms (Kirner and Gazzarin, 2007). It is to annotate that this does solely apply under moderate unfavourable conditions. A further factor, which is to mention, is the availability of capital (Bronsema, 2013). Due to the high share of net worth on total assets in Austrian dairy farming (Kirner and Gazzarin, 2006), this factor is not limiting in farm development. A last factor is labour. Apart from these structural factors the farm manager and its strategic focus is of relevance for farm competitiveness. Of major importance are, beside the farmer's management skills, his attitudes such as openness for innovation and risk tolerance (Schaper et al., 2011).

In this paper we concentrate on analysing farm strategies. Literature describes a variety of strategies in agriculture. A very common strategic question is the decision between diversification and specialization. This aspect is often analysed in literature, underlining the economic potential of