BALTIC ECOLOGICAL RECYCLING AGRICULTURE AND SOCIETY
(BERAS)

EXECUTIVE SUMMARY (draft)

21st January 2006

Editor: Artur Granstedt

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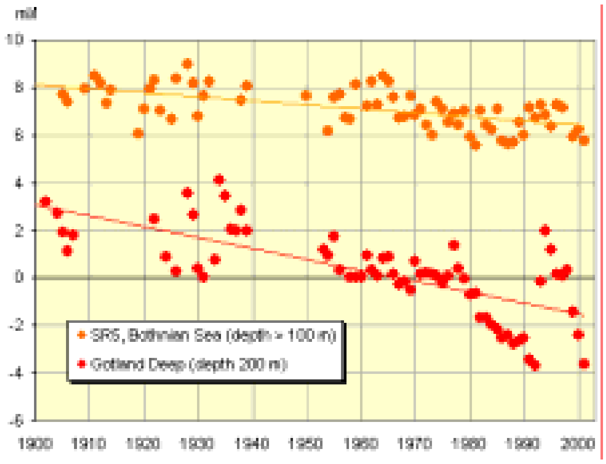
OVER ALL INTRODUCTION

Problem description

Excessive nutrient inputs to the Baltic Sea produce harmful effects: the extensive blue-green algal blooms observed in the Baltic Sea are obvious signs of eutrophication. Increasing eutrophication and the resulting increase in produced organic matter cause environmental problems when their decomposition consumes oxygen, and is contributing to depletion in deeper waters. Anoxic conditions have been a frequent phenomena in the deeper basins of the Baltic Proper for a long time (Figure 1 and Figure 2). Eutrophication causing anoxic conditions is also affecting, with increasing frequency, vast areas in the Baltic Sea and the Gulf of Finland.



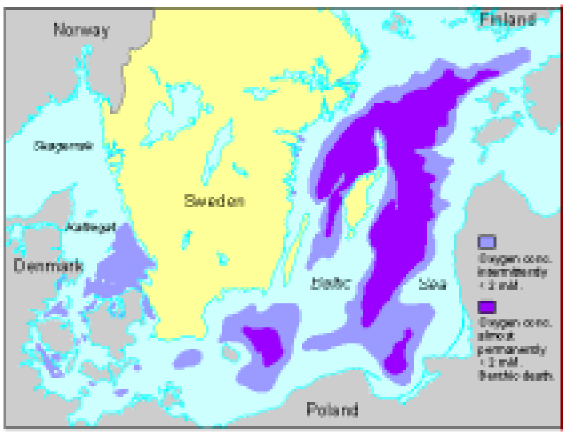
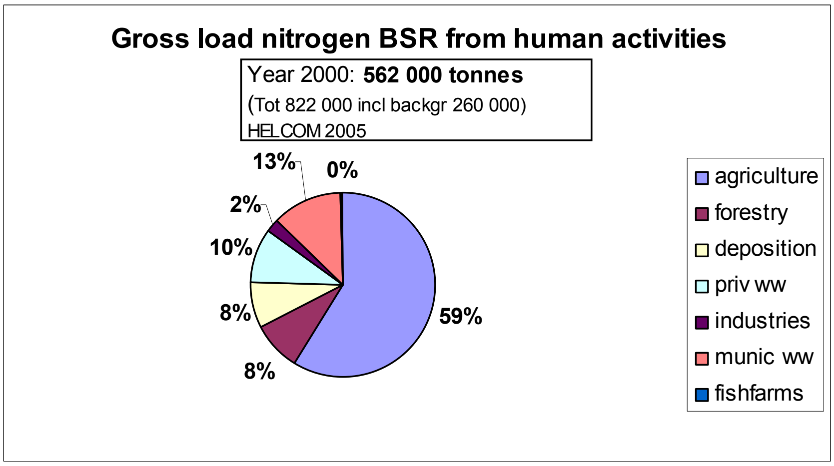


Figure 1. Oxygen trends in the Bothnian Sea and the Baltic proper (Gotland Deep) ml/l (Source: Swedish Environmental Protection Agency)

Figure 2. Oxygen deficiency near the sea bottom. (Source: Swedish Environmental Protection Agency)

Annual loads of nitrogen and phosphorus within the Baltic Sea catchments area in 2000 are estimated at 822 250 and 41 200 tons, respectively. Large proportions of these originate far away from the Sea from the land within the Baltic drainage area. These loads include discharges from point sources as well as the losses from diffuse sources including natural background loads (HELCOM, 2004). Phosphorus and nitrogen levels in the Baltic are currently 8 and 4 times higher, respectively, than they were in 1900 (Enell, 1996). This increase is a result of human activities around the Baltic Sea. Agriculture is responsible for a large share of the leaching of nutrients to watercourses (including groundwater), lakes and finally the sea. In Sweden about 50 % of the anthropogenic load of nitrogen (53 % of the gross load) and close to 50 % of the anthropogenic phosphorus load (46 % of the gross load) can be attributed to agriculture.



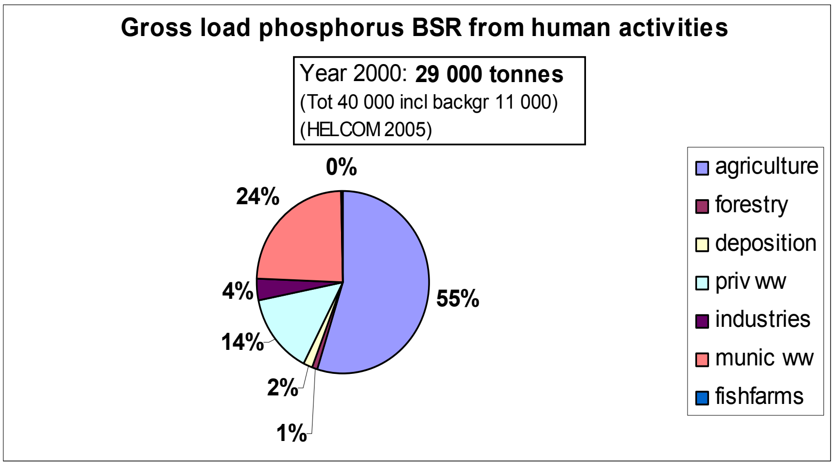


Figure 3. Gross load of nitrogen and phosphorus from human activities within Baltic Sea Region (BSR) according to HELCOM (2005).

The countries around the Baltic Sea have made international commitments, within HELCOM and OSPARCOM, to halve their discharges of nitrogen and to reduce their discharges of phosphorus from human activities. These goals have not been achieved during the target period 1987-1995 and no improvements have been observed between 1995 and 2000 according to the Executive Summary of the Fourth Baltic Sea Pollution Load Compilation. Measurements in streams to the Baltic Sea show no significant decrease of the total load (HELCOM, 1998; 2004).

In addition to emissions of reactive nitrogen and phosphorus there are also negative environmental consequences from pesticides used in agriculture and the global warming caused by the use of non renewable fossil energy resources in the food chain.

Causes and possible solutions

The serious environmental situation in the Baltic Sea is a consequence of agricultural specialisation, pollution from industries, incorrect waste management and the unsustainable lifestyle prevailing in the countries around the Baltic Sea (i.e. in its drainage basin). Reduced use of non-renewable energy and other limited natural resources and the elimination of pesticides would result in less pollution of air, water and soil (Granstedt 2000). In the BERAS background report it was concluded that increased recycling of nutrients within the agricultural systems through integration of plants and animals in the farming system will reduce the emissions of plant nutrients. More effective recycling and reduced pollution are important goals for a more sustainable lifestyle and can also contribute positively to regional development. Significant local initiatives in this direction can be found in small rural communities in the countries of the Baltic Sea region. The BERAS project has addressed the need to analyse their environmental and socio-economic consequences as well as the opportunities and obstacles facing the various actors in the food system, i.e. producers, processors, traders and consumers. It is necessary to develop knowledge and skills in this area and to better understand the potential for and consequences of a larger-scale changeover to such systems throughout the region.

Objectives

*The aim of the BERAS project is to e*valuate and demonstrate the potential of ecological recycling-based agriculture in combination with prioritizing local and regional processing, distribution and consumption, to achieve reduced consumption of limited resources, reduced emissions of nitrogen and phosphorus to the Baltic Sea drainage area by half or more and reduced emissions of greenhouse gases in line with environmental policy goals established at national and EU level. To be more informative, this evaluation looked at environmental, economic and social implications of ERA for society as a whole. Already established local initiatives in the eight countries participating in the BERAS project took part with a view to also improve their ongoing activities. This was achieved through exchanges of experience, learning and cooperation among actors involved in local ecological agricultural production, local processing, distribution and consumption (private consumer, schools and institutions), adapted to different environmental, economic and sociological conditions, and combined with well-motivated rural development. Their initiatives included examples of the integration of animal and crop production and consumption in the local region, with the aim of achieving greater recycling of plant nutrients, shorter distances for transport, and hence decreased consumption of limited resources and a significant reduction in dangerous emissions of chemicals from agriculture.

Methodological approach

The BERAS project includes five Work Packages (WP). The first WP (1) has promoted selected, already established local ecological food initiatives and recycling farms in each country and the exchange of experiences with other initiatives within and among the project countries. Obstacles have been identified and learning promoted through exchanges with others who have been involved with finding solutions to similar problems in their own country.

The second WP (2) has studied what environmental benefits can be achieved through local ecological food consumption, processing and ecological recycling agriculture (ERA), in comparison with conventional food systems. Energy use, greenhouse gas emissions, surplus and emissions of reactive nitrogen (air/water pollution) and surplus of phosphorus compounds of the agriculture-society system have been quantified and related to food consumption. Most of the studies have been done for Sweden and Finland, and only to a more limited extent, in the other countries participating in the project. However the results are relevant for and can be utilised by all participating countries.

The third WP (3) assessed the possibilities for switching to ERA and the economic consequences of this by evaluating market aspects, economic consequences at the societal level and consequences from a natural resource economy perspective.

The fourth WP (4) looked at social consequences at the societal level including rural development and job opportunities. The fifth and final WP (5) has drawn together the lessons learned from the other WPs in order to present an Agenda with recommendations for implementation and dissemination.

Locations and criteria for participating farms

Studies of various aspects of the whole food system are located in all EU member states around the Baltic Sea. These include: (1) Järna, Stockholm County, Sweden; (2) Vassmolösa, Kalmar County, Sweden; (3) Juva, Mikkeli County Finland; (4) Funen County, Denmark; (5) Bio ranch Zempow Brandenburg, Germany; (6) Kluczbork and (7) Brodniza, Poland; (8) Raseiniai, Lithuania; (9) Organic farmer organisation, Aizkraukle District, Latvia; (10) Pahkla Camphill Village, Prillimäe, Estonia. Totally 42 reference farms were selected to do on farm studies. They were mainly chosen for calculations of plant nutrient balances and selected to cover the main environmental and farming conditions. Together they were also representative of a major part of the basic food production in each country respectively. To meet the criteria of an ERA farm they had to have a high degree of plant nutrient recycling based on a balance between animal and crop production and a low dependence on purchased fodder.

Food systems, especially their socio-economic characters, and the role and structure of agriculture differ markedly between the countries. As a consequence, their locality and degree of recycling as well as the obstacles for their development vary. Sweden, Finland, Germany and Denmark represent countries that industrialised early through a market economy that was supported by successful political efforts to provide cheap food, higher farm income and labour for other industries. The agriculture in these countries is intensive, specialised and dependant on external inputs. In the countries of the former Soviet Union - Estonia, Latvia, Lithuania and the former DDR - agriculture was industrialized after the Second World War through a planned economy, while small subsistence farms continued to also exist. In these Baltic countries, the DDR and Poland the changeover to a market economy occurred around 1990 and resulted in large-scale, market-oriented farms. However agriculture in Poland is clearly less industrialized than in the rest of EU including the post-communist countries. Poland had the most privately owned farms even before the political change in 1989. In 2000, only half of the farms produced mainly for the market and 470% of the farms were smaller than 5 ha. (Add information about how many people in Poland are dependent on farms for their livelihood) As a result of joining EU in 2004, Baltic and Polish agriculture is faced with the challenge of integration.

The BERAS project was an EU-funded INTERREG III B programme

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CASE STUDIES (WP 1)

Organic food systems around the Baltic Sea

(BERAS report 1 edited by Laura Seppanen)

Introduction

The restructuring of agriculture is necessarily linked to structural changes in the rest of the society. Creating new local food chains and systems has the potential to move the restructuring task forward. Local integration of food production and consumption requires that farming is considered in a wider system of production, processing, and marketing instead of a production system only. (Lockie & Kitto 2000). And for this purpose, cooperation among farmers, processors, consumers, shopkeepers and many others is needed. An additional reason for the interest in local and organic food is rural development. Value adding and processing brings employment and economic prosperity to small rural communities. Local and organic food systems and chains can potentially strengthen local identities and build creative environments for innovation and good quality of life. Local recycling and close links between producers and consumers are of importance also from the point of the organic agriculture movement. In the BERAS project selected cases of local and organic food chains and systems around the Baltic Sea are studied with the aim of analyzing, on the one hand, their environmental, economic and social impact, and on the other hand, developing knowledge of how local and organic food chains and systems can be developed further. This Work Package 1 aims to document and promote cooperation, interaction and learning within the food systems for more sustainable rural development.

Cooperation in local ecological (i.e. organic) food systems

What is needed for local food systems to emerge? First, *time*. It is most likely that the processes towards local food systems are slow. Juva in Finland has a history in organic agriculture for more than 20 years, and what is seen in Järna is a result of more than 40 years of work. A project of three years can, of course, accomplish something but it is a relatively short period of time. Sometimes initiatives or activities done today may yield positive outcome only after years to come. So we need to be patient!

Second, *active people* are needed. None of the cases involved in BERAS would have been possible without local people who worked to create marketing channels for local and organic products. In Kluczbork and Zbiczno in Poland active farmer couples, Janusz and Iwona Sliczni, and Mieczyslaw and Aleksandra Babalscy have been important driving forces for the local and organic initiatives. In Solmarka, Sweden, Hugo Johansson was the person to change the management of the farm into biodynamic production.

In order to be sustainable local and ecological food chains need to be, at least to some extent, *economically profitable*. Local and organic food is mostly based on relatively small rural enterprises. The question of a suitable scale or amount of production and processing is often discussed in connection with local and organic food. There needs to be enough demand and customers, and therefore big cities or other sites of consumption nearby may help build local food systems. This is seen in Järna where the local actors recognize Stockholm and its farmers' markets as useful for marketing, and in Bioranch Zempow where most of the demand for organic beef exists in Berlin. The box scheme as presented in Nörregaard, Denmark, allows deliveries to outside the local area. By increasing the scale it is possible, to some extent, to lower the price, which often is a barrier for municipal kitchens and consumers to buy local and organic products. The increase in scale emphasizes the need for cooperation among producers.

There are many other factors affecting the functioning of local and organic food systems. Often food processing regulations are made with big companies in mind. As a result they often present obstacles to small-scale food processing. For small enterprises, the fulfilling of these requirements may entail economic and work time resources that are not available. For the marketing of dairy products in Pahkla Camphill Village, Estonia, new expensive processing facilities were needed to fulfil the hygiene regulations according to the new EU-standards.

Despite these factors there is a lot that can be done and cooperation between producers, shopkeepers, advisors and many others is central.

Cooperation is probably the only way the transformation to local organic food systems can take place. How significant the transformation is depends on the historically-rooted circumstances in each case. Environmental concerns such as in Bioranch Zempow in former East Germany, or desires to strengthen local identities and innovation, questions of rural entrepreneurship and development, or many other purposes can fuel meetings, face-to face interactions and other forms of communication between farmers, processors, consumers and others. In cooperation different actors recognize and regard each other as important and useful resources. The formation of a local organic food system requires that people find *new purposes and objects* (Engström et al. 2003) for their activities: this means that both individuals and collective groups find new answers to the questions: who and why food is produced, processed and delivered and what the consequences of production and consumption are for sociological, economical and cultural development in the countryside and the environment. The common consciousness in the food system of Järna, Sweden, most likely manifests such a collective object.

Cooperation and interaction is indispensable in developing new purposes and practices for food systems. It is the heterogeneity of the actors such as farmers, processors, consumers and others that enables the possibility to mutually benefit each other. With cooperation new relations are formed which can strengthen and further modify the building of the food systems.

Shared spaces or instruments, or ’boundary objects’ (Star 1989), which help various actors, are needed for collaborative food systems. Devices in logistics, timetables or deliveries, agreement, newsletters mediating information from farmers to customers as in Nörregaard, Denmark, more experimental kitchens where new products can be developed as in Juva, Finland, are examples of such instruments. It is useful to enhance shared instruments and spaces for the formation and maintenance of food chains and systems.

Cooperation in local food is promoted by *small initiatives and projects*. One starting point in many cases has been one or several organic farmers who somehow have to organize the selling of their products. For instance in Raseiniai, Lithuania, farmers have used new market forms such as marketing and delivery to homes. A bicycle route in Kluczbork, Poland, meetings and seminars on Nörregaard farm in Denmark are other examples. In Juva, Finland, joint product development with a processor, institutional food services and research takes place. Presentations in local shops, market place activities, excursions to other sites, farm-visit cooperation between schools and farms, and promotional events are additional examples of initiatives to enhance cooperation between producers and consumers. Social interaction influences consumer preferences as well as general awareness about environmental and rural issues. One way to move forward is community supported agriculture (CSA) which is known in the USA (O'Hara and Stagl 2002).

There is not one right model for all organic and ecological food systems. Each case has its own history, nature and characteristics and has found its own solutions. It is not the size of the food system that is important – rather, it is crucial that the parts of the system fit together well to fulfil their function. The different types of local food systems, their suitable scales and functioning require further analysis.

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ENVIRONMENTAL CONSEQUENCES (WP 2)

Effective recycling agriculture. Background report

((BERAS report 2 edited by Artur Granstedt)

Introduction

The objective of Work Package 2 in BERAS was to promote reduced consumption of limited resources, reduced emission of nitrogen and phosphorus compounds to the Baltic Sea, reduced emission of greenhouse gases, and to promote the biological diversity of life within the food chain. This was realised through evaluation and demonstration of the potential of ecological recycling-based agriculture, local and regional processing, distribution and consumption. Already established initiatives in the countries involved were utilised and promoted during the project period. As a background to this work the present situation and the reason for the high load of reactive nitrogen and phosphorus to the Baltic Sea was analysed based on previous studies.

Increased input, surplus and losses of plant nutrients at country level

At country level the inputs of nitrogen, phosphorus and potassium in the form of inorganic fertiliser and imported fodder have greatly increased in relation to their outputs in the form of foodstuffs such as milk, meat and bread grain from 1950 to 1980 in Sweden and Finland. The surplus of nitrogen increased with more than 100 % during these 30 years. Despite programmes to reduce nutrient losses from the society and the agriculture sector the surplus of nitrogen has remained at the same level in these countries during the past decades.

In Sweden and Finland today, the input of nitrogen to the agricultural systems is about three times higher than the output of nitrogen in the form of food products such as bread and cereal grains, milk and meat. About 80 percent of the arable land is used for producing animal fodder Granstedt, 2004). This was also true in 1950, but during the last 40 years the number of animal production farms has steadily decreased, while the animal density (i.e. au/ha) on the remaining animal farms has increased.

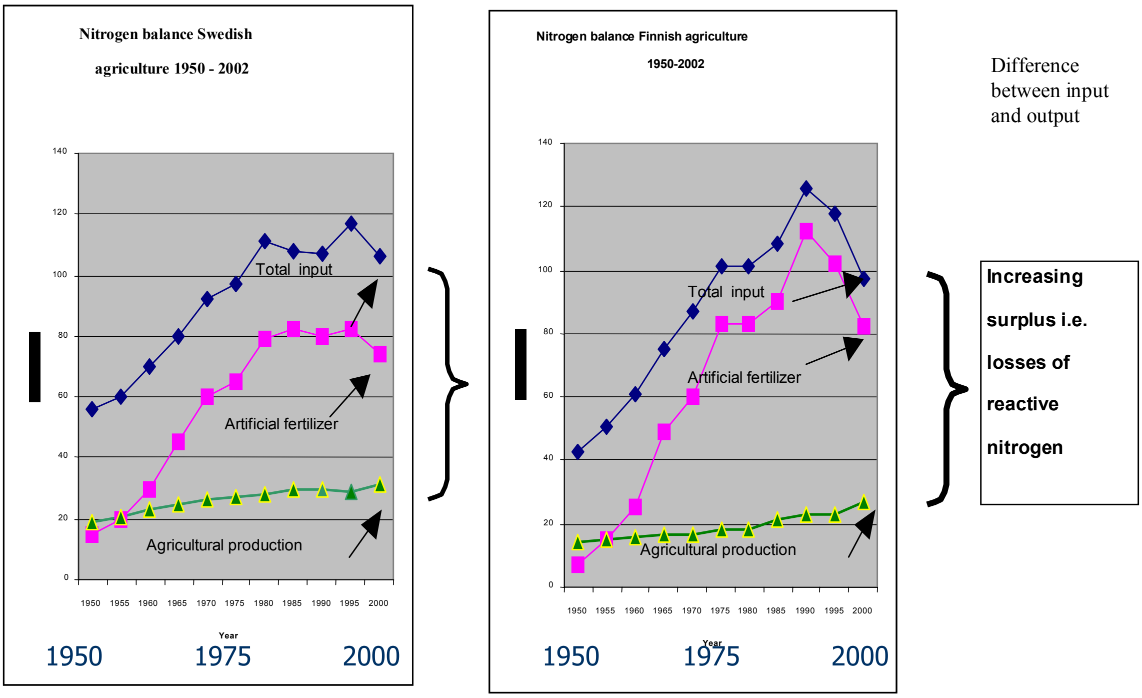


Figure 4 . From 1950 to 1980 in both Sweden and Finland, inputs of nitrogen, phosphorus and potassium in the form of inorganic fertilizers and imported fodder increased substantially in relation to their outputs (in agriculturally produced foodstuffs such as milk, meat and bread grain) with an increased surplus and potential emissions of plant nutrients to the environment as a consequence.

The broken recycling of plant nutrients

Since 1950 crop and animal production has become more and more separated. Farms with only crop and no animal production are dependent on artificial fertilisers. They produce mainly fodder for animals. This fodder is exported to the intensively managed animal farms where it results in excessive loads of plant nutrients. For example, about 5 percent of Swedish farming enterprises produce 90 percent of the pork (SCB, 2003). In some counties in southern Sweden and in Finland this concentration is particularly marked (i.e. in Blekinge, Halland and certain parts of Skåne in Sweden, in Österbotten in Finland). A similar trend towards not only local but also regional specialisation in agriculture within a county and within a whole country can be observed in the other European countries. Oomen et al (1998) show that the environmental nitrogen problem connected with agriculture in the European Union (EU) is related to the recent specialisation that has led to the separation of animal and crop production. The whole of Denmark has a higher specialisation and average density of animal production based on partly imported fodder then the other Baltic countries

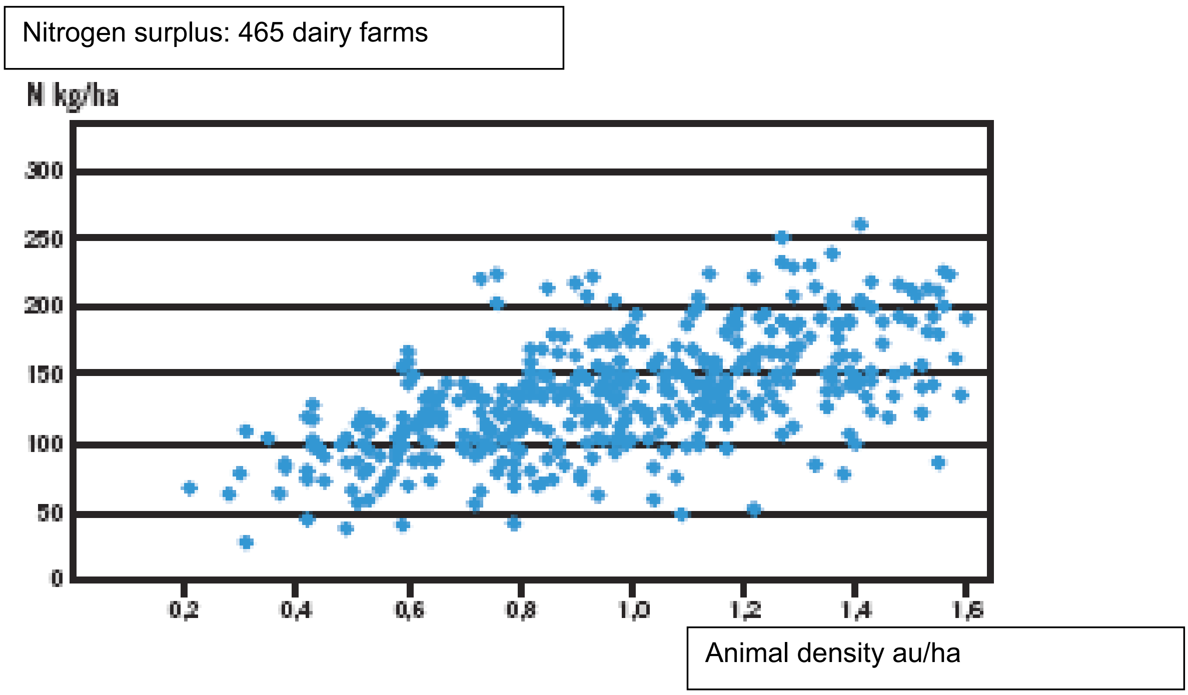
(0,9 au/ha compared to, for example, Sweden with 0,6 au/ha).There are also differences within countries with some regions having especially high animal production (Granstedt et al 2004).

Before the introduction of artificial fertiliser agriculture depended on two main sources of nitrogen for crop production:

• Nitrogen fixation by legumes included in the crop rotation;

• Ruminant animals on each farm that could use coarse crops to produce food and manure so that the major part of the nutrients could be recycled to the soil.

This integrated crop and animal production with high degree of recycling, common only 50 years ago, is today broken with the help of an increased input of artificial fertilisers to the specialised crop farms and imported fodder to the specialised animal farms.



'Figure 5. Animal density and nitrogen surplus on 465 dairy farms in Sweden. This illustrate the higher surplus of nutrients on animal farms with higher animal density. On the farms with higher animal density it is a need of external area to produce purchased fodder (Figure from Greppa näringen, 2005).

Low intensive agriculture in Poland and extensive agriculture in the Baltic countries

- a potential risk factor

The Baltic Drainage Area also includes large areas where the structure of the agricultural sector is mostly pre-industrial. For example in a large part of Poland there is a low input of artificial fertilisers and a high crop and animal diversity on farms and also in the surrounding landscape. In some areas farms still integrate crop and animal production and nutrients are recycled within the system. Some of the farms in the Baltic countries also have a very low level of inputs today but also a very low production of agricultural products. This extensification of both crop and animal production is the result of the agricultural collapse in the wake of the Soviet Union break-up and the resulting loss of the Soviet and Russian markets. This was compounded by the fast adaptation to a market economy characterised by cheap imports of heavily subsidised agricultural products from EU countries up until 2004. Now that they have joined EU there is, once again, a very new agricultural situation in these countries.

It is of utmost importance that these new EU countries take into consideration the negative consequences of agricultural specialisation as they proceed to introduce changes in their agricultural sectors. Otherwise, there may be, according to the final conclusions of the INTERREG IIIB BERNET project Baltic Eutrophication Research Network (Fyn's Amt, 2002), a dramatic increase in nutrient loads from Poland and the Baltic states.

An overall reduction of the nutrient loads to the Baltic Sea by 50% is one of the nationally and internationally agreed environmental goals for the Baltic Sea Region (HELCOM, 2004). This implies different strategies for the different countries. In countries with nutrient intensive agriculture like Sweden, Finland and Denmark loads have to be decreased. In countries with nutrient extensive agriculture like Estonia, Latvia and Lithuania the development of agriculture towards more nutrient intensive methods has to be prevented. The overall goal of the nutrient studies in the BERAS-project is to investigate the potential of ecological recycling agriculture (ERA) to reduce nutrient leaching from agriculture and contribute to the proposed 50% nutrient load reduction.

Results from the evaluation of Ecological Recycling Agriculture

The concept of Ecological Recycling Agriculture (ERA) is to produce food and other products on following basic ecological principles:

1. Diversity of life
2. Renewable energy.
3. Recycling of plant nutrients

An ERA farm is defined as an ecological (organic) farm (or farms working in close cooperation as one farm unit) without use of artificial nitrogen fertilizers and pesticides, with high rate of recycling of nutrients based on organic, integrated crop and animal production, with an animal density of < 0.75 au/ha and an External Fodder Rate (EFR) of < 0.15. ERA farms were selected in each country in order to evaluate their potential to reduce nutrient surplus and losses from agriculture in the Baltic Sea drainage area. The test-farms are representative for the main agricultural conditions and drainage regions in the area and together also cover humans' needs of both crop and animal food products.

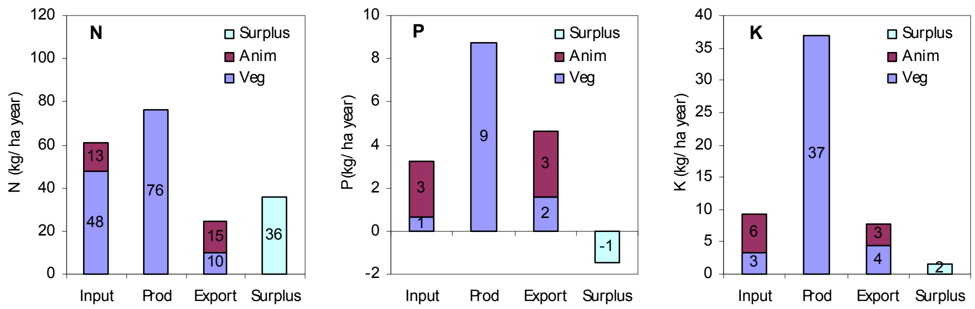


Figure -6a. Average input, plant production, export of farm products and surplus of nitrogen (N), phosphorus (P) and potassium (K) on the 12 BERAS-farms in Sweden 2002-2004.

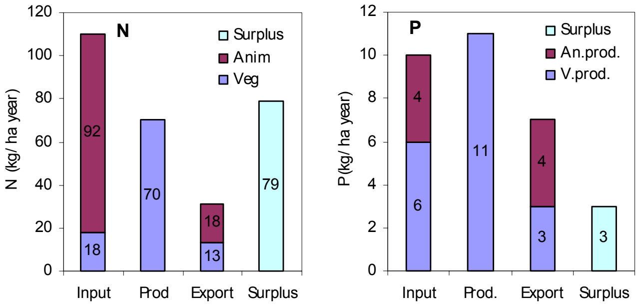


Figure -6b. Average input, plant production, export and surplus of nitrogen (N) and phosphorus (P) for Swedish agriculture 2000-02 (Granstedt et al 2006).

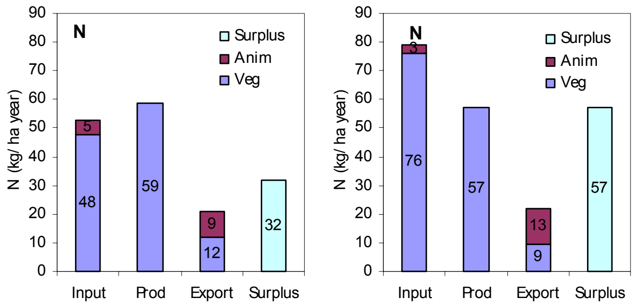


Figure -7. Average input, calculated plant production, export and surplus of nitrogen (N) for the Polish seven BERAS farms and the average Polish agriculture 2000-02 (Granstedt et al 2006).

Longstanding initiatives with Ecological Recycling Agriculture (42 ERA-farms distributed in the eight BERAS countries) were studied between 2003 and 2005.The surplus of nitrogen was 48 - 54 % lower per hectare and year on Swedish and Finnish BERAS-farms compared to the average mostly conventional agriculture (36 kg compared with 79 kg for Swedish and 38 kg compared to 73 kg for Finnish agriculture with the same animal density of 0.6 au/ha). There was no surplus of phosphorous from BERAS farms. The agricultural production was 19 % lower on the Swedish BERAS farms compared to the average agriculture in terms of nitrogen (figure 7). The average surplus of nitrogen for all the 42 BERAS-farms studied in the eight countries was 38 kg. This can be compared to the average agriculture surplus of 56 kg for the eight countries today, which includes the low intensive agriculture in the Baltic countries and Poland. All BERAS-farms with an animal density below 0.75 au per ha have a surplus below 50 kg N/ha.

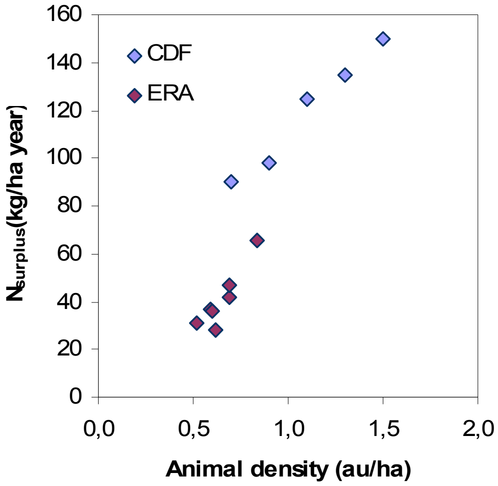


Figure -8a. The six Swedish BERAS dairy farms (ERA) with a low animal density had an average 42 kg N surplus per ha, compared to an average of 131 kg N surplus per ha on 608 conventional dairy farms (CDF) divided in five animal density groups published by Myrbeck (1999).

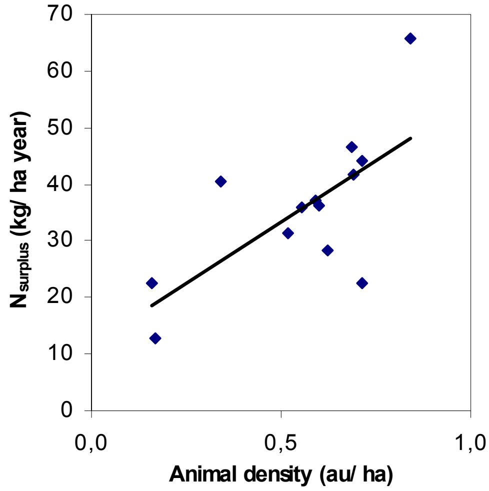


Figure -8b. Average animal density and N-surplus 2002-04 for the twelve Swedish BERAS-farms.

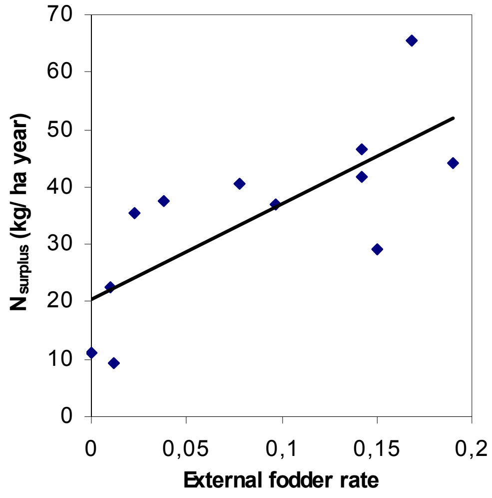


Figure -9. External fodder rate and N-surplus 2002-04 for the Swedish BERAS farms.

In both conventional and ERA agriculture an estimated 30 - 40 % of the nitrogen in animal exudates is lost as NH_4 to the atmosphere (figure 10). This means that the calculated potential nitrogen leaching to ground water from ERA farms is 70 - 75% less than leaching from average Swedish agriculture (7 - 9 kg/ha compared with 28 - 30 kg/ha). The equivalent calculation for all eight BERAS countries gave a reduction of nitrogen leaching with 47 % on BERAS-farms compared to the studied average Baltic Sea agriculture which includes regions with, until now, very extensive agriculture (Granstedt, 2006).

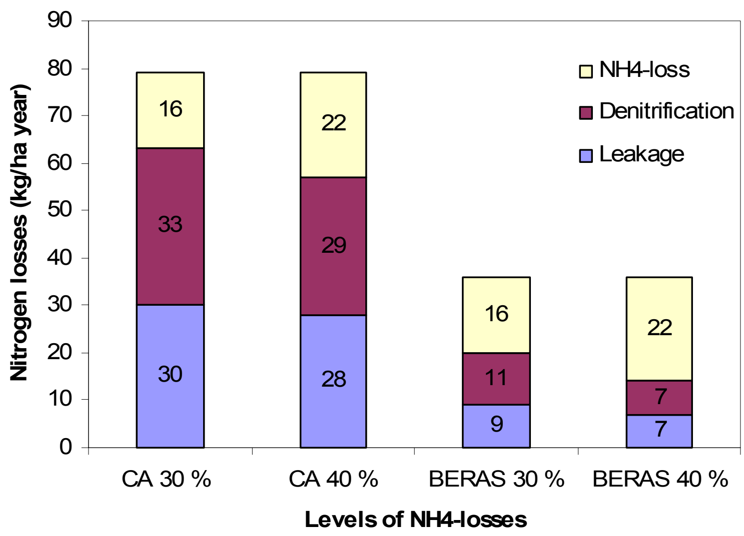


Figure -10. The distribution of N in the calculated N surplus for average Swedish agriculture (CA) and the BERAS-farms with two different manure handling systems (resulting in 30 and 40 percent ammonia losses from the total animal exudates respectively) and estimated leaching calculated as 45 % of surplus in the field balance .

Nitrogen and phosphorus leakage from fields

Within the BERAS project direct measurements of nitrogen and phosphorus leakage from fields were carried out on two ERA farms in Sweden and one in Finland (Schneider, 2006). The data series which is available contains two years of measurements on Skilleby farm (Stockholm County). The data series from Solmarka farm (Kalmar County) and from the Finnish test farm in Partala were too short and are not reported. The results from the measurements from Skilleby farm lead to the following conclusions:

- Nitrogen and phosphorus leakage from the ERA farm in Stockholm County were 8 kg N/ha year and 0.2 kg P/ha year, respectively with an assumed runoff. These results are in good agreement with the official nutrient leakage calculated in the TRK project (Brandt & Ejhed, 2002) for the same area, when taking into account differences in livestock density.
- The measured nitrogen leakage supports the results from the nutrient balances where nitrogen leakage is 7-9 kg/ha year depending on the magnitude of ammoniac loses (figure 10).
- The measured phosphorus leakage together with the deficit in the nutrient balances indicate a constant loss of phosphorus from the soil which most probably is fed by weathering of bedrock material in the soil matrix.

In Denmark Kristensen, Jorgensen and Kristensen (2006) calculated the conversion of Funen agriculture production from mainly conventional to 100 % organic in accordance with the principles outlined in the Danish “Bichel-work”, Anon (2001). This initiative, the “Bichel-work”, was based on a consensus among researchers within agronomy, environment and economic disciplines in Denmark. These recalculations gave a reduction of N-leaching by 41% compared to leaching from conventional agriculture during the same year but the calculations have a high degree of uncertainty.

Method developed to evaluate the efficiency of nutrient utilization

A deeper analysis was made of nitrogen utilization on nine organic farms in eastern Finland, referred to as J-BERAS-farms (Seuri, 2006). Seuri developed concept of Primary Nutrient Efficiency (PNE) (Seuri, 2005) earlier also named Primary Production Balance (PPB) (Seuri, 2004). The farm-gate efficiency, surface efficiency and primary nutrient efficiency (PNE) were calculated for each individual farm. Based on these studies Seuri concluded that in order to reduce the nutrient load there are two possibilities: either produce less or improve the efficiency of nutrient utilization. Since there are no recirculated nutrients (S) on farms without livestock, the circulation factor is always 1.0. On farms with livestock the circulation factor is always higher than 1.0. The balance between livestock and field area (fodder production) was of major importance in reaching a high PNE. Whenever the livestock density was increased by means of purchased fodder, the utilization of farmyard manure was poor and resulted in a lower PNE.

Possible scenarios based on the BERAS studies

Two possible agriculture scenarios were calculated for the BERAS countries: 1) conventional business-as-usual scenario where the Baltic countries and Poland convert to the same structure and use of resources as in average Swedish and Finish agriculture, and 2) ERA scenario where agriculture in the whole Baltic Sea drainage area converts to ERA similar to the results from the 42 ducumented

BERAS-farms. The conventional scenario 1 resulted in an increase of both nitrogen and phosphorus surplus in agriculture and a corresponding increase in the load to the Baltic Sea. The calculated nitrogen surplus through leaching increased by 58 % (Figure 11). The ERA scenario gave a *reduction* of nitrogen surplus from agriculture by 47 % and an elimination of the surplus of phosphorus (Granstedt, 2006). This decrease of potential losses of plant nutrients should be possible without decrease of the total agricultural production in the BERAS countries if the agriculture in Poland and the Baltic countries develops an agriculture similar to the documented well developed BERAS-farms.

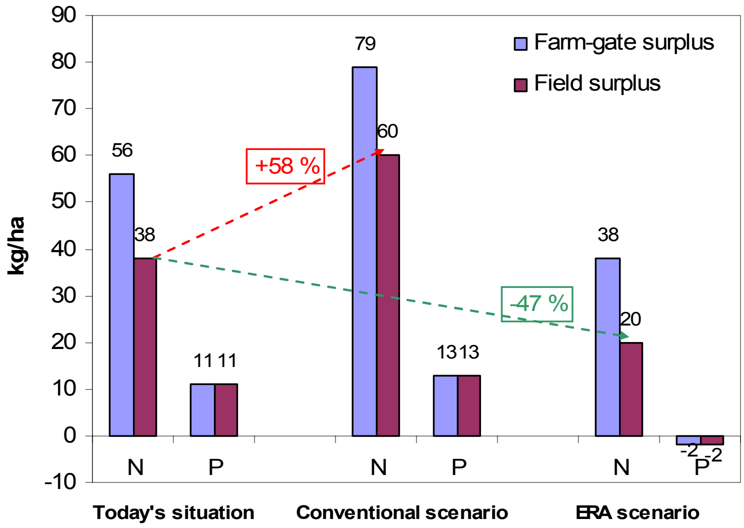


Figure - 11. Surplus of nitrogen and phosphorus in farm-gate and field balances calculated for three alternatives: Today's agriculture situation; a Conventional scenario where agriculture in Poland and the Baltic countries converts to conventional agriculture similar to agriculture in Sweden; and ERA scenario where all agriculture in the Baltic Sea drainage area converts to Ecological Recycling Agriculture.

<u>Food basket scenarios and effects on nitrogen surplus, global warming impact and consumption of primary energy resources</u>

Four scenarios with different combinations of food consumption profiles, agricultural production systems, and food processing and transportation systems were developed and their environmental impact assessed (Figure 12.

The scenarios are:

1. Average Swedish food consumption, average Swedish agriculture 2002-2004, and conventional food processing and transports
2. Average Swedish food consumption, ERA farms, and conventional food processing and transports
3. Average Swedish food consumption, ERA farms, and local (small-scale) food processing and transports

4. An alternative food consumption (e.g. less and different kinds of meat), ERA farms, and local (small-scale) food processing and transports

The implications of these four Swedish food basket scenarios for nitrogen surplus, global warming impact and consumption of primary energy resources were presented. Scenario 2, where all the food is produced on ERA-farms, would give a global warming impact of 800 kg CO_2-equivalents per capita and year compared to 900 kg in Scenario 1 with conventional agriculture. Scenario 3 with food from ERA-farms and local processing and distribution gave a global warming impact of 700 kg CO_2-equivalents per capita and year. Scenario 4 with food from only ERA-farms, more vegetable and less meat consumption and local processing and distribution gave a global warming impact of 500 kg CO_2-equivalents per capita and year. This is a reduction by about 45 % compared to Scenario 1. Also nitrogen surplus and consumption of primary energy resources were reduced to different degrees for all alternative system settings. The results clearly indicate the importance of also changing our food consumption patterns in addition to the necessary changes in the production, processing and distribution of food in order to reduce negative environmental impacts (Thomsson, 2006). Production of renewable energy in a biogas plant was implemented and documented on one of the BERAS farms. This has the potential to increase the recycling of plant nutrients from the food sector, reduce the use of primary energy resources and reduce global worming from the food chain further.

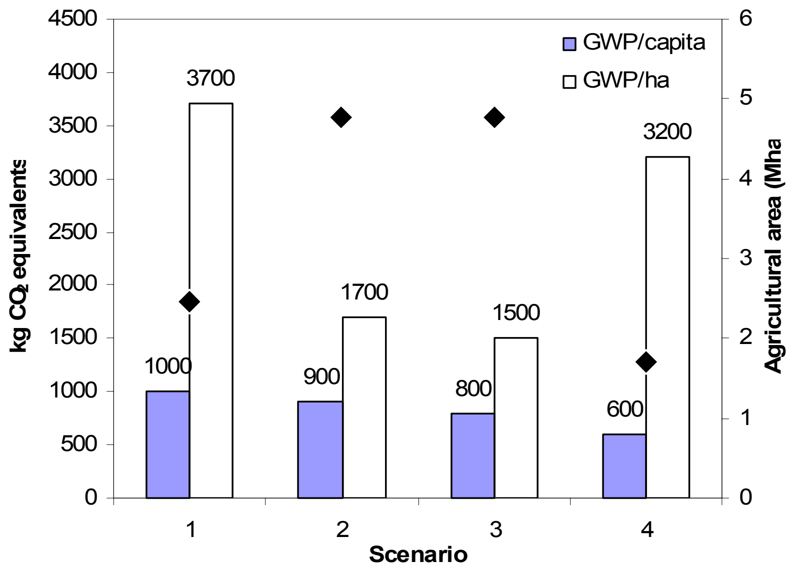


Figure -12. Global warming potentials in four scenarios, *kg CO_2 equivalents per capita and kg CO_2 equivalents per ha.* The black diamonds represent the required area for agricultural production, in *million hectares.*

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ECONOMIC CONSEQUENCES (WP3)

Possibilities for and economic consequences of switching to local ecological recycling agriculture (BERAS-report 3, edited by John Sumelius)

Introduction

As a concept, ecological recycling agriculture is close to organic farming. Farmers, consumers and society at large are increasingly supporting this type of agriculture for a number of reasons. For all three groups the most notable reason for supporting localised organic production systems is likely to be the reduction of nitrogen and phosphorus loads into the waterways and into the Baltic Sea. (Granstedt, Seuri and Thomsson, 2004). This research begins by analysing the economic consequences of switching to local ecological production. This entails focusing on both organic agriculture and localised production simultaneously. The outcome depends on which actor one analyses: the farmer, the consumer, the local community or municipality or society at large.

Results

The economical studies start out at the production level with an analysis by Reeder of the costs of production of organic milk on a dairy farm in the community of Järna in Sweden (Reeder, H. 2005). From the farmer's point of view, the production of organic milk is connected with higher costs per unit of milk produced. The environmentally friendly mode of production is likely to lead to lower environmental costs for society at large through lower amounts of nutrient emissions. Yet, on the farm level, the requirements of self-sufficiency in feed, local inputs and recycling may lead to fewer attractive alternatives and therefore to higher costs. While it may not be advisable to draw far-reaching conclusions from one in-depth study, Reeder's results are quite clear. Total production costs are in the range of 0.055-0.066 Euro/kg milk (0.50- 0.60 SEK/kg milk) higher than for conventional production. Particularly the fixed costs seem to be much higher for this farm. The higher production costs and the lower milk yield are offset by a 0.055 Euro/kg milk (0.50 SEK/kg milk) higher milk price and a livestock premium of 187 Euro (SEK 1700) per cow.

A production cost survey can give an idea of the costs incurred by individual farmers. However, it does not tell much about the possibilities of changes in the production mix or about the effects of institutional constraints. These issues can be investigated using linear programming models. Bäckman and Krumalová (2005) modelled three organic farms in the municipality of Juva in south eastern Finland. The main production lines on these farms are dairy, forage and beef production respectively. The results of the scenarios show the ecological production options that are available to each farmer in order to improve gross margins. The analyses include the opportunity cost (incomes lost) owing to institutional and environmental constraints, for instance the requirement of self-sufficiency in feed. Bäckman and Krumalová also point out that trade between farmers is an important feature of local markets and generally improves the economy of the farmers. The article raises some important questions concerning the effects of the CAP reform, which will come into effect 2006.

From society's point of view nutrient emissions lead to eutrophication of waterways and the Baltic Sea and are therefore a social cost (Larsson, 2005). The argument in favour of rapid action is that prevention is less expensive than cleaning up after environmental degradation has already taken place.

Larsson cites two studies by Gren (1997, 2001) according to which the cost of a 50% reduction of total nitrogen emissions to the Baltic Sea is estimated to be 1.32 billion Euros (SEK 12 billion) per year if the most efficient solutions are applied. This estimate requires countries to cooperate since cleaning costs may be less expensive in one country than in another. Citing Söderqvist, Larsson reports that the combined willingness-to-pay of the population around the Baltic Sea has been estimated to be 3.4 billion Euros (SEK 31 billion) per year. Larsson proposes some economic and administrative instruments for achieving sustainable agriculture, and he suggests some dietary options for consumers.

From the local community's point of view, an increase in demand for local foodstuffs is likely to have a positive effect on the regional economy in terms of increased employment and increased tax returns. Decreased transports may lead to a decrease in energy consumption. Vihma (2004) has estimated these effects in the so-called RegAe input–output model.

Thomsson (2005) followed the food expenditures of 15 environmentally conscious households in Järna, Sweden. He then compared these food expenditures with the average expenditures for Swedish households. While the environmentally conscious household had substantially higher food expenditures, the variation within households was large. With this reservation, an average of 25 % higher food expenditure was observed. Households consuming large amounts of animal products usually had higher expenditures than those consuming large amounts of plant products. Citing Statistics Finland, Hannula (2005) notes that the average Finnish household spends 1580 Euro/person/year on food (in Sweden 1800 Euro/person/year). She studied ten households in the BERAS case study municipality Juva in southeastern Finland. She found per capita expenditures in the same range as the Finnish average. However, individual differences between households were large. Taken as a whole, the publication sheds additional light on the possibilities, constraints and strengths of local organic agriculture.

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SOCIETY AND SOCIOLOGICAL CONSEQUENCES (WP 4)

Obstacles and solutions in use of local and organic food

(BERAS Report 4 edited by Salla Kakrianen, 2005)

Local food is a concept which is understood in many different ways and raises different connotations (small scale production, direct contact between farmer and consumer, a combination of local and organic production). The definitions of 'local' varies from one village all the way to the whole of Europe. A definition often used in Finland is: "Local food is defined as production and consumption which utilises the inputs and raw materials of ones own area improving the regional economy and employment." (Maaseuupolitiikan yhteisyöryhma 2000). In the BERAS project local food is understood as food which is produced using local resources in an agriculture that is ecological and recycling-based and which is also processed and consumed in the local area. Due to different geographical realities and different ways that societies are organised it is not sensible to set a strict distance limit for local food. Common to all cases is still the perception that local recycling is not only recycling of organic matter but also of money and human resources.

All together there are eight countries participating in the BERAS project (Sweden, Finland, Denmark, Germany, Poland, Estonia, Latvia, Lithuania). The agriculture sectors in these countries are very different. Lithuania has a young organic agriculture movement and small-scale traditional farming. Poland has strong small-scale traditional farming and an organic movement with a long history. In Latvia the organic market is just developing. Sweden, Finland and Denmark have a high contribution of pollutants to the Baltic in spite of strong agriculture movements. The Green Movement has a long history in Germany but, at the same time, the organic market in former DDR is still young. The organic movement in these countries has a large-scale food industry to deal with. This makes the challenge quite different here than in countries where the traditional small-scale farming and food industry is still very much alive. It is important to be aware of this.

The organic sector in Lithuanian is growing (Biciene and Eidukeviciene, 2005). At the moment markets are developing more slowly than the production. This is partly due to the certification systems, a lack of processing facilities and higher prices. The formation of an organic food market does take time, but it is positive to see that according to a consumer study there is a positive attitude towards organic products and some people are also willing to pay extra.

In contrast to Lithuania, the organic movement in Sweden started to grow immediately after World War II at the same time as the traditional small-scale farm structure start to break down. In Lithuania it started just fifteen years ago and remnants of traditional small-scale farming are still there as are remnants of the big-scale farms from the Soviet time.

In line with the goals for this part of the BERAS project, this report presents case studies of local initiatives that have overcome obstacles and successfully promoted local food.

To start an initiative that is ecologically, economically and socially sustainable and links organic food production with recycling and society is a complicated task. Although goals may be clear with regard to local and organic food, food systems are complex and many people in different positions are involved. In such a situation it is not always easy to see how the desired change can be initiated.

Entry points to initiating such changes have been very different in the different cases. Farmers and NGOs have been constructing a bicycle path and eco museums in Poland. In Finland, administrators have set up an electronic ordering system and farmers and shopkeepers have introduced a label for local products. Farmers in Sweden have set up a cooperative to help with marketing and processing. All these examples stress the importance of cooperation among actors within the local food chain. A school program in Sweden illustrates how the education sector can be included and the benefits from this. A bag of groceries in the classroom challenges students in the 12th grade to follow the route these groceries have travelled and teaches them how complex the food system is. The highlight of the course is spending a few days on a farm. Through such a course it is possible to implant critical thinking towards food systems among adolescents

One example of the cooperation among organic farmers in Sweden (Holmberg and Sven, 2005) is the formation of a cooperative association in order to better organise production and share the costs of investments. Their latest idea is to invest in tomato processing equipment. This approach is comparable to the solution in Poland. Because organic markets are far from farmers, products are processed so that they can be transported easily.

A larger-scale action under the brand "Farmers' Own" (von Essen, 2005) strives to strengthen the link between consumers and producers through marketing campaigns and holding organic farmers' markets that also are an enjoyable experience for consumers.

Kakriainen (2005) describes a case where a Finnish rural municipality has made the development and use of local organic food part of a larger development strategy for the whole municipality, including the processing sector. In Juva, a label for local products from their own municipality was how farmers and shopkeepers showed consumers that a variety of local products are available. These cases illustrate the need for people to take action on a practical level in their work as well as the need for policy makers and others who can influence the system on a more general level, e.g. policy and legislation. They can help to create a foundation and a positive atmosphere for implementing the desired changes.

It seems that in every country local food chains and systems need to develop further. They are not yet strong enough to compete with conventional systems which are becoming increasingly centralised and international. These changes will require continuous adaptation as well. The cases in this study present many examples of how to further strengthen and develop food systems.

For example in Järna there has been an ambition to raise awareness of consumers and to promote a life style based on local and biodynamic food (Essen and Sven, 2005). The non-governmental organisation "Initiative Locally Grown" has goals to support cooperation among schools and consumer education.

The Finnish case study Tuhkanen (2005) describes a solution based on an electronic ordering system and use of a middle man. This system answers to a problem which many institutional kitchens have had: where to get local products. An ordering system alone is often not enough. Deliveries also have to be organised in an effective way. An electronic ordering system can also serve as a catalogue and price list for the small firms. The "Farmers' Own" initiative also uses an electronic ordering system.

Hajduk (1995) describes how organic production in Polish Kluzborg has developed and how location has had an effect on the production. Raising environmental awareness and state support has made the position of organic farming better.

Simple is beautiful. The examples show that simple and down-to-earth ideas speak to the heart and make the initiative powerful. This simplicity also makes it easier for others to join in and support the effort which is very important. If the costs for joining become too high, it might be easier to reinvent the whole thing from the beginning. On the other hand, a new initiative needs to be protected and nurtured in the beginning. When the initiative is strong and has enough supporters it can face the rules set up by society and even contribute to modifying them for the benefit of everyone. But facing such obstacles too early can kill the initiative before it takes wing. For example the Bag of Groceries school project needs support also from actors in the food chain to be successful. Without information from the actors it is impossible to do the task.

One of the big challenges for alternative food systems is how to compete with the mainstream large-scale food industry. They cannot compete with the same products but local specialised products can find markets of their own. The concepts of large-scale food industry and local food systems are in many ways incompatible. The very idea of the food industry is to mechanize the production and gain large-scale advantages. Such an industry requires raw products of uniform quality and trucks that deliver loads regularly. It is easiest for very large farms with highly specialized monoculture production to fulfil these needs.

Local organic food systems (alternative systems that include consumers and have their own specific food chain) develop unconventional ways of working. As the cases Initiative Locally Grown and Bag of Groceries show, new ideas need a certain degree of freedom and space to be able to grow.

Cooperation is a prerequisite for creating local food systems. A British project run by the Soil Association has listed the lessons they have learned while working with local and ecological food. The goal they had was to increase the share of local and organic food in schools. Although their efforts were limited toschools, the main points in the ten-point checklist are similar to the lessons learned from the cases presented in this report.

Establish *mutual objectives* in the beginning. Ensure all partners can devote to the objectives so they feel they have ownership of the project and its outcomes.

Catering managers will prefer to deal with only one individual *to coordinate supply.* They rarely have time to deal with many different people individually.

**Educational support* is crucial to supply this market.

*The public procurement market is not an easy market to access. *Don’t be put off by the difficulties*, however, as there is plenty of support available. Don’t underestimate the time this process needs.

*When approaching any school, hospital or county caterer, *find out how their catering system works and what facilities they have.*

*It is crucial to have the support from *producers, procurers, distributors, parents, governors* and pupils. It is necessary for the whole chain to want to change the existing supply chain.

**Producer co-operation* is the key to success in setting up an efficient supply chain.

*It is helpful, although not essential, to have an *impartial co-ordinator who must not seek to gain financially more than others from the process.*

*It is important to *link with other markets* and not rely on this market alone.

Local processing facilities are crucial to set up of the supply chain. Ensure that someone can provide support with certification requirements.

**Affordability of organic produce* is a limiting issue. In-season local organic produce can often be more competitive. Clustering schools so that volumes are greater is also a helpful way to manage costs.(Soil Association, 2004)

Despite overwhelming difficulties, some individuals continue to make great efforts and are successful in overcoming many obstacles. Why such enthusiasm? The reasons they give vary, as do the cases. One main reason is that local and organic food is good for the environment, for example through recycling agriculture and by avoiding unnecessary transportation. nother is that it supports the local economy and production and has a positive effect on local development. A third important reason is the good quality of local products. Their flavour and freshness are valued by both individual and institutional consumers. Standardised processed products are sold over large areas whereas local food helps to sustain local food cultures and diversified tastes as well as local knowledge about ways to use raw materials to make local specialities.

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Social Sustainability of Alternative Food Systems viewed through Actor Argumentation

(BERAS report number 5, edited by Kari Vesala)

This study used a qualitative approach which is based on the generation and analysis of argumentation. The material was produced by presenting selected statements concerning different aspects of social sustainability to the interviewees and asking them to comment on the statements. Thus the material is comprised of argumentation in which the actors' attitudes and experiences on the alternative food production are displayed.

The social aspects of the alternative food systems were captured on the different shores of the Baltic Sea. In addition to Finland, similar parallel studies were conducted in Sweden, Poland and Estonia. All the studies were conducted along the lines of qualitative attitude research using the same interview questions (statements) translated into the different languages.

Locally produced food as a concept places emphasis on the spatial dimensions of the whole chain related to food. The concept of food chain refers to a value-added, consumption continuum from primary production through processing to consumption (Seppänen 2004, 5-6). The food system refers to the entity of the food chain from the systemic perspective going beyond the production-consumption chain by adding the use of inputs as well as the consequences for the natural environment as topics of interest. We understand in this study that local food involves, by definition, no restriction on the mode of production, such as the use of non-organic and external inputs. Hence, in essence, the local food system is an alternative to a global system with regard to the channels of distribution. By introducing a local and short connection between the production, distribution and consumption of food, a horizontal alternative is created as opposed to the conventional, vertically-structured food chain..

One can summarise the differences between the actors' positions in the study. All of the actors in the study were interviewed as representatives of certain positions, i.e., either as farmers, processors, merchants, public kitchen matrons, local politicians or consumers. The differences in attitude construction are relatively modest between the different actor groups. On the contrary, the interviewees seem to be quite a homogenous sample. The coherence of the argumentation may also indicate small spatial and social distance between the different levels of the food chain in Juva. Also the solidarity between the actor-groups (for example the matrons' and the customers' willingness to support the local farmers) suggest this. Nevertheless, there are still some differences between the actor groups. First of all, the farmers seemed to be the most pessimistic group regarding their own power position in the food systems. At some points, as when discussing the farmers' chances to influence their own performance in organic production, this pessimism suggested that farmers have faced real problems, particularly as the general attitude towards alternative production was positive among the farmers. The view that the farmers in general have few chances to influence their own performance – regardless of the type of food system – was conveyed solely by farmers. This was the only clearly position ally-determined stand. The second positional feature in the argumentation was that the matrons were more concerned about the quality of the products, which is by no means surprising, although respondents of other positions also used product arguments.

Borttaget: positionally

An interesting finding related to the actor position was a conflict of interest between the farmers or processors on the one hand, and the merchants on the other. The higher price of organic products was considered a positive factor among farmers but among the merchants the extra price of organic food was considered an obstacle to expanding organic business: what was considered an opportunity by the farmer was considered a bottleneck by the merchant. The same conflict of interest was presented in the question of equitable distribution of benefits. Many of the farmers or processors accused the merchants of reaping unfair benefits at the cost of organic farmers, while the merchants defended themselves from such accusations, even though the respondents were not aware of each other's comments. This indicates that these contrasting positions on the question of equity are part of a commonly shared discourse among the food chain actors in the Juva community. In this sense AFSs (What are AFSs?) can also be seen to cause some social divisions within the local community.

The mode of distribution seems to explain many of the conflicts of interest. The conflict was brought out more often when discussing organic products, which are usually distributed in the vertical food chain. Also, feelings of injustice were more often expressed in the context of the conventional rather than the local chain. In other words, when the local food chain was discussed the conflicts and feelings related to unfairness did not come up so often, even though they were occasionally present also in the context of local food production. The actors' chances of having an influence on the food system seems to be a key to understanding the conflict between actor groups. If the actor felt that there were some chances to influence the distribution process, the actual distribution was never considered unfair.

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MOVING TOWARDS A SUSTAINABLE AGRICULTURE AND SOCIETY - RECOMMENDATIONS TO DISCUSS FOR SUPPORTING BALTIC ECOLOGICAL RECYCLING – BASED AGRICULTURE (WP5)

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The concept of Ecological Recycling Agriculture (ERA) has been put into practice under very different economic, practical and environmental conditions in the eight BERAS-countries around the Baltic Sea. ERA can be implemented on a small family farm with 10,5 ha in Poland with an extremely divers production of animal and crops as well as on the former Estonia Sovjet farm Saida with 1043 ha. The principles of a diverse pesticide-free production, self-sufficiency in fodder through balanced integration of crop and animal production and maintenance/improvement of soil fertility through grasslands that include nitrogen fixing leguminous plants are equally relevant for all agriculture production, if it is to be sustainable. Nitrogen fixation with clover and leys work the same way on all farms. This makes possible a high degree of recycling of plant nutrients, reduced emissions of reactive nitrogen and phosphorus to the environment, improvement of soil fertility and a pesticide free environment that protects biological diversity.

In the eight BERAS-countries there are also different examples of more local or regional self-sufficient food systems with local food processing and distribution to the local or regional market. The most developed local systems studied are in Järna, Sweden and Juva, Finland. Here ecological consumers' families' food baskets, environmental consequences of processing and transport and consumer costs for purchasing ERA products were studied and evaluated. Järna is a community with ERA-farms, where a broad spectra of the most common agricultural products are produced and processed. There exist local, small scale a processing industries for horticultural products, cereals, dairy and meat products. This provides an example of an eco-region, where the consumers, through their preferences can, so to speak, buy their way into a sustainable future. By making the 'right' choices they can reduce emissions of plant nutrients by a magnitude of more than 50 %, reduce global warming from the food chain (processing and transport) by up to 40 % and nurture biodiversity by rejecting the use of pesticides in agriculture. The extra costs involved – here calculated to about 25 % - do not seem not to be unreasonable for a well-motivated family. These extra costs can be reduced if the family changes its food consumption to include more vegetables and other non- animal foods – a necessary step in the introduction of ERA on a large scale.

Looking at the environmental consequences, though the costs are difficult to calculate for society as a whole what other choice do we have if we wish to restore the Baltic Sea, stop the pollution of the environment with pesticides and maintain human life without increasing the global warming? The documented examples of more locally based consumption of food from ERA-farms also brings other local economic and social benefits - increased local job opportunities, a more active rural population engaged in building networks and associations of consumers and producers. All of this helps to conserve and develop local competence within many different sectors. The many examples illustrate a spectrum of local initiatives to develop local and regional markets as an alternative to the main stream vertical global food market. But it is also clear from the studies that these very well-motivated group of producers, processors, consumers and other actors in the local food system (teachers, local government officials, etc) are too few and, with little power, remain very vulnerable. There also is a need for strong support from society if their numbers are to grow and their efforts are to thrive so that they can increasingly bring about the large-scale changes that are necessary.

These examples of ecological agriculture and local food systems documented by the BERAS project can form the basis for **a** vision, not only of the agriculture but also of the more horizontal and locally based food systems, of tomorrow. The Yttereneby-Skilleby farm in Järna, with the same farm data and surplus of nitrogen and phosphorus as the average for all the BERAS-farms, is a good reference. It provides an example of cooperation between farms to integrate crop and animal production and produce their own fodder. It also integrates the whole spectra of crop and horticulture production, recycling of wastes from the human food sector combined with production of renewable energy from the biogas plant on the farm. It demonstrates how a farm in cooperation with the other nearby farms and together with the local food industries and a strong network of well-motivated consumers can create a sustainable local food system that is a benefit to society as a whole – environmentally, socially and economically.

However, having a vision to inspire us, principles to guide us and practical examples to encourage us is not sufficient. We also need a strategy to help us move forward. The way will not be easy as the challenges are great and our time limited. For this reason it will require a concerted effort that draws on the knowledge and skills of all the concerned actors who agree on the need for a high degree of recycling of plant nutrients, reduced emissions of reactive nitrogen and phosphorus to the environment, improvement of soil fertility and protection of the biological diversity by not using pesticides

This strategy for a stepwise reorientation of agriculture requires a scope similar to the program designed to carry out the new agricultural policy decided upon after the Second World War. This included economic instruments economic support to farmers to help them make the necessary investments combined with technical advice from the agriculture extension service, education programs and teacher training to build up knowledge on specialised intensive agriculture in the agricultural schools. Today a similar wide based, multi-pronged program is needed to support the restructuring of the agricultural sector once again. Such a program needs to be implemented in all the countries around the Baltic Sea with the common goal to save the Baltic Sea, stop the use of pesticides and reduce the use of non-renewable resources, including fossil energy. This program must include not only agriculture but also the whole food system and must build on international and EU agreements such as the following:

1. In 1992 leaders from 150 countries signed The **Rio Earth Summit document,** including The Convention on Biological Diversity which is dedicated to promoting sustainable development. Conceived as a practical tool for putting the principles of Agenda 21 into practice, the Convention recognizes that biological diversity is about more than plants, animals and micro-organisms and their ecosystems. It is about people and our need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment in which to live.
2. The Sixth **European Environment Action Programme** (6th EAP), which was adopted by the European Parliament and Council in 2002 and runs until 2012, requires the European Commission to prepare thematic strategies covering seven areas: 1)Air pollution (adopted 21/09/2005), 2)Prevention and recycling of waste (adopted 21/12/2005), 3)Protection and conservation of the Marine Environment (adopted 24/10/2005), 4 Soil, 5) Sustainable use of pesticides, 6) Sustainable use of resources (adopted 21/12/2005).
3. On 23 October 2000, the of the European Parliament and of the Council adopted the **EU Water Framework Directive** (EU Directive 2000/60/EC) concerning clean water. EU has also passed the HELCOM goals one of which is to reduce nitrogen and phosphorus loads to water courses by 50 % (HELCOM, 2004).
4. The **European Climate Change Programme** (ECCP II) **and the Kyoto Protocol**.

At national level Sweden has set goals to improve the environmental situation in water, soil and the atmosphere and to reduce the use of non-renewable resources. Changes in the agricultural sector and in food systems more generally must, therefore, support these national environmental goals. The results of the BERAS studies show how ERA can do just this. The intensification in the agriculture over the past decades has led to an increased surplus of agricultural products and increasing environmental problems. One of the driving forces of this intensification has been agricultural subsidies that have been paid out in accordance with the volume of production. On 26 June 2003; the EU farm ministers adopted a fundamental reform of the Common Agricultural Policy (CAP) which will completely change the way the EU supports its agricultural sector. The new CAP will be geared towards consumers and taxpayers, while giving EU farmers the freedom to produce what the market wants. In future, the vast majority of subsidies will be paid independently of the volume of production. To avoid abandonment of production, Member States may choose to maintain a limited link between subsidy and production under well-defined conditions and within clear limits. These new "single farm payments" will be linked to the respect of environmental, food safety and animal welfare standards. The intentions of this new CAP are now in line with and can support the kind of changes necessary to bring about a sustainable agricultural sector.

However it is necessary to go further. Based on the BERAS studies and looking at the situation from this local ecological perspective the following measures to support the restructuring of the agricultural sector are suggested:

These measures are of course not claiming to be complete. They reflect ERA farmers' perspectives and understanding of the issues. It is hoped that in presenting these it will stimulate others to offer their suggestions from their perspective and understanding. In this way a meaningful dialogue can be initiated to identify comprehensive and realistic measures that build on the diverse knowledge of the many concerned actors. This is our common challenge for our common future.

On farm level:

1. Pay single farm payments to ERA farmers to a level which can give the same economy on ERA-farms as on conventional agriculture. The ERA subsidy program should be a complement to existing payments to organic farming and include the criteria for ERA agriculture that restrict animal density on the farm (or nearby farms in cooperation) to their own feeding capacity.
2. Provide economic compensation for initiating and implementing restructuring.
3. Set up investment programs to support diversification of specialised farms and ecological investments for more effective recycling of plant nutrients and production of renewable energy, for example investments in biogas production on farm level.
4. Introduce, step by step, regulations on animal density until a level is reached that permits self-sufficiency in fodder (i.e. on farm production of all fodder needed) on individual farms or farms working in closed cooperation with both fodder and manure.
5. Discuss the consequences of introduce step by step, taxes on non-renewable resources with negative environmental impact, in the event that other economic instruments are not effective in bringing about the necessary changes.
6. Set up an education program mandatory for all farmers receiving payments for restructuring and a more general information program for all farmers to support knowledge development in the broader farming system and food system concepts.
7. Introduce farm ecology and environmental protection courses in all educational institutions from basic to university level so that this understanding can influence life-style decisions.
8. Establish a special program to support farmers' cooperation in establishing ecological recycling-based activities including the development of long term contracts and economic compensation.

On society level:

1. Provide economic support for buildings, equipment and marketing to entrepreneurs to establish local/regional food processing industries for the local/regional market.
2. Provide advisory services to entrepreneurs establishing local/regional food processing industries for the local/regional market including help with market studies, setting up farmers' cooperatives, etc. (See the examples in the BERAS study)
3. Provide special support for local small-scale entrepreneurs to fulfil the hygienic standards. .
4. Help farmers and small-scale entrepreneurs to collaborate in writing joint tenders and coordinate deliveries to the public institutional kitchens that are motivated to purchase local/regional ERA farmed and local/ regional processed food.

Spatial planning and timeframes

The biggest challenge is the regional specialisation within countries where regions specialise in animal production or crop production or horticultural production. The subsidises for restructuring and investing to diversify and integrate farm production requires a long-term plan that allows enough time for economic compensation and for investments in infrastructure for intensive specialised production, to be written off more quickly. The costs involved will depend on the time required and different alternatives need to be evaluated.

The examples presented in BERAS project were mainly farmer and consumer driven initiatives. These also need more support in future. **Their costs and benefits - economic, social and environmental - need to be evaluated over the long term and across sectors**. This includes small scale processing industries and more local and regional food distribution which needs to be better able to compete with the multinational, centralised food processing industries and food distributing corporations.

POSTSCRIPT - A short history of agriculture – looking back to help us look forward

A short history of agriculture – looking back to help us look forward

A quick look back into the short history of agriculture can help us put our present predicament into perspective and guide us in finding a way forward.

Until 100 a hundred years ago agriculture was based on the capacity of human beings to harvest the organic resources build up by nature. These resources are products from often complex systems of interaction among living organisms and these systems' interaction with the biotic energy and nutrient resources in the soil and atmosphere. The natural system's capacity to transform biotic resources to biological resources through biological photosynthesis, withering processes and nitrogen fixation was utilized in different ways. Energy rich carbohydrates, proteins and mineral nutrients in the biomass and soil were utilised for feeding domestic animals and cultivating plants to produce food to meet humans' needs. Some human occupied ecosystems, like the Asiatic and Mediterranean river deltas have had a nature-given regenerative capacity for long periods of time.

With the colonisation of Europe and Nordic countries, the nomadic way of life was replaced by more stationary agriculture societies. In the beginning agriculture was based on the clearing and burning of woodland, a rather primitive form of using up natural resources. This was followed by an agriculture that was increasingly dominated by the cultivated meadow up until the agricultural revolution that started in Europe about two hundred years ago. During the 19th century an agro-culture based on well developed crop rotation with clover grass followed by cereals and root crops integrated with the animal production was spreading to the Nordic countries. By using legume based nitrogen fixation, cereal production was no longer limited to areas that could be fertilized with the manure that came from animals grazing on the cultivated meadow land. This made it was possible to increase the ploughed area in countries like Sweden and Finland (Granstedt, 1998). By 1950, before the introduction of pesticides and wide-scale use of artificial fertilizers, crop and animal production had increased by a magnitude between two to four times. This increased capacity to produce food was based on the cultivation using nature–given, renewable resources.

This transformation from a natural to a cultivated ecosystems based on local and renewable resources made it possible to feed the fast growing population. Between 1800 and 1950, before the introduction of artificial fertilizers and pesticides, the population in Sweden grew from 2 to 7 millions.

The next agricultural revolution, which in Sweden picked up steam after WWII, introduced artificial fertilizers and fossil fuel powered technology. Food production became more and more dependent on non-renewable resources. This burning of fossil fuels was rather like the early colonizers burning up the forests – both destroy natural resources built up by the ecosystems over long periods of time.

Through the use of cheap oil resources, food systems have become linear, global, and centralized. They are characterised by regional specialization and transportation among different types of specialised agriculture units and from them to feed and food industries. Rural regions have increasingly specialised in producing and exporting raw material for these industries, while at the same time satisfying their own food needs with industrialised (processed, packaged and transported) products imported from outside the region.

In this way the value added by input production, food processing and food distribution has been transferred from rural to urban areas and increasingly beyond the national boarders to international corporations. In addition, the liberalization of agricultural trade, European Union's agricultural policy and related technological changes have rapidly reduced the number of farms. Because food production on small-scale farms has played a central role in rural vitality, this development has resulted in unemployment, emigration and disintegration of social structures in rural regions of industrialized countries. These developments in our food systems have also crucially changed the nature of the food chains and of the interaction among the actors. Local rural actors have been disempowered - not only farmers but also retailers and small-scale processors. Simultaneously, resources from countries in the South have increasingly been used in the global food systems to support food production in the North undermining the food security of the poor and aggravating global inequity.

Global vertical food systems and regional specialization of agriculture have probably increased the amount of energy used for transportation with all its climatic consequences. They have certainly complicated the recycling of nutrients and carbon both within the food system from the processors and consumers back to agriculture as well as within agriculture from specialised animal production farms back to crop production. This in turn has led to an increase in the use of non-renewable energy to industrially manufacture fertilizers and transport them to regions of crop specialisation. Instead of recycling, the linear flow of nutrients in fertilizers increases nutrient emissions to waters, including the Baltic Sea.

Today however the Baltic Sea drainage area also includes large areas where the structure of the agricultural sector is mostly pre-industrial. This is true for large parts of Poland. Some of the agriculture production in the Baltic states of Lithuania, Latvia and Estonia. countries is also very extensive today. This is a result of the agricultural collapse in the wake of the Soviet Union break-up and the resulting loss of the Russian market coupled with the adaptation to a market economy characterized by cheap imports of heavily subsidized agricultural products from EU countries.
In Poland the nutrient load per capita is only a third that of Sweden or Finland. Agriculture in these areas is characterised by a highly diverse and integrated crop and animal production, a recycling of nutrients within the system and a low input of artificial fertilizers.

After the oil peak our food production must again be based on renewable resources, the protection and improvement of soil fertility and respect for the integrity of diverse biological systems and landscapes. However even before fossil fuels are finished or are too expensive to use in agriculture production unknown environmental damage in the form of eutrophication, accumulation of pesticides and climate change will have occurred. Do we have the capacity to, in time, take our responsibility? This is important both for the next generation as well as for the millions of poor in the world whose survival depends on our ability to share by cutting back on our luxury consumption. We need these good examples of a more sustainable living that provides the basic physical (food, housing, clothing, medicine) and social (identity, love, meaning) necessities where human activities nurture and are nurtured by a cultivated nature. These can form the basis of a vision for the whole society. We also need to work out a strategy for, step by step, realising these goals. It is difficult to say if it will take 20, 50 or 100 years, but clear is that we need to take this new direction immediately.

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