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ENVIRONMENTAL IMPACTS OF ECO-LOCAL FOOD SYSTEMS

– final report from BERAS Work Package 2

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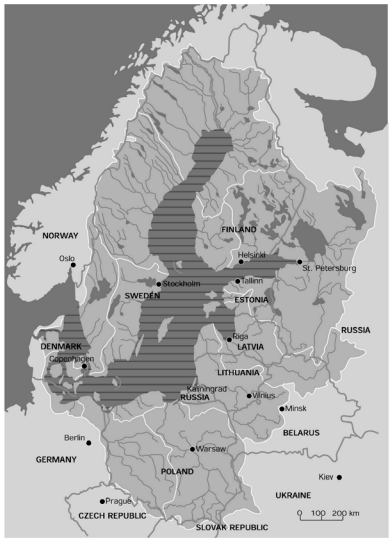

Baltic Ecological Recycling Agriculture and Society (BERAS) Nr. 5

Baltic Sea Region
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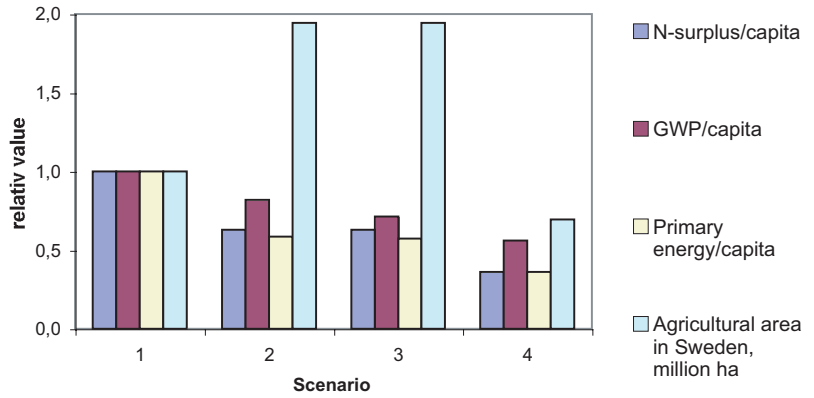

Figure 9-4. N-surplus, Global warming potentials and Primary energy resources consumption per capita and required agricultural area in four scenarios, relative values.

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Food basket scenario, Juva Finland

The aim of this food basket scenario study based on average Finnish food consumption was to investigate i) if it is possible to reduce nitrogen surplus of agriculture by changing agricultural production methods and ii) by how much. Existing average Finnish agricultural practises and ecological farming practises investigated in the BERAS project are compared.

Methodology

The main production on the BERAS-farms in Juva is milk and beef. Therefore it is not possible to assemble a reliable complete food basket scenario based on the data from BERAS-farms. For this reason a food basket consisting of the Finnish average food consumption of bread cereals, milk and beef was selected for study. This represents about 50 % of the total food energy input (Ravintotase 2003). Production of the remaining foodstuffs was assumed to be unchanged and not investigated in this study.

Finnish agricultural production in 2002 was described according to the official statistics Maatilatilastollinen vuosikirja (2003) and Lötjönen et al. (2004). Agricultural land outside Finland used for producing fodder for Finnish agricultural was not included in the scenario.

Nitrogen surplus of the Finnish agriculture was estimated using two different methods. One (a) is based on average nitrogen surplus by field area. The other (b) is based on separating animal and crop production and looking at the field area surplus for each production line separately.

Nutrient balance data and production data for the organic BERAS-farms in Juva are presented in Chapter 2. Data from two specialized crop production farms, three milk farms and three beef farms were used for the food basket scenario. Although the crop production farms produced mainly fodder grains (oat, barley), they were used as a data source for bread grain production.

Results – Nitrogen surplus of Finnish agriculture

Average nitrogen surplus from Finnish agricultural practises is estimated to be 78kg/ha according to the national nitrogen balance (Antikainen et al. 2005)[1]. (See footnote 3, below Table 9-3.) The Finnish agricultural statistics do not present data on field areas divided along different production lines (Maatilatilastollinen vuosikirja, 2003). However, using their data, an estimation was made where half of the agricultural area was used directly for crop production on animal farms and half for crop production on crop farms.

Nitrogen surpluses were also estimated for plant and animal production areas separately using the data of Pyykkönen et al. (2004). Nitrogen surplus from field areas related to animal production has been estimated to be 116 kg/ha and from specialized crop production to be 40 kg/ha (See footnote 4, Table 9-3).

Results – Food basket scenario

Table 9-3 presents the results for the required area and the nitrogen surplus when the food basket is produced by Finnish average agriculture, calculated with methods a) and b) and by ecological agriculture on the BERAS-farms. The required agricultural area of the BERAS farms to produce the food basket is 25 % larger than the conventional agriculture. The difference was largest for cereal production, about 50 %.

The relative difference in nitrogen surplus in crop production and animal production of the methods a) and b) of the Finnish agriculture is presented in Figure 9-5. Based on the data, it is not possible to define the exact surplus from crop and animal production respectively, but method b) indicates that the nitrogen surplus from animal production is much larger than from crop production.

The nitrogen surplus of the food basket produced by the BERAS-farms was found to be 53 % of the average Finnish agricultural surplus (Table 9-3) when the production lines were separated and 73 % when average surplus was assumed. Production of cereals on specialised BERAS-farms (based on green manuring) resulted in a higher nitrogen surplus (140 %) than production of cereals on specialised average Finnish agriculture.

Figure 9-6 shows that about 60 % of the energy content of the studied food basket comes from animal products. However, the share of the nitrogen surplus from animal production is bigger than that, about 97 % on Finnish agriculture and 85 % on the BERAS-farms, calculated using method b). This means that the production and consumption of the animal products causes much more nitrogen surplus than the food crop production does, as a proportion of the energy content of consumed food.

The agricultural land required to produce all the consumed bread cereals, milk and beef according to the methods of BERAS-farms and

[1] It is worth noting, that nitrogen losses outside the field (mainly volatilisation) are missing from the national nitrogen balance (67 kg/ha) (Antikainen et al. 2005).

other 50 % of consumed food remaining as it is, would be about 7 % larger than on the average Finnish agriculture (Table 9-3). If the agricultural area outside of Finland, which is used to produce fodder for Finnish agriculture had been taken into account, average Finnish agriculture would have required a larger agricultural area and more nitrogen surplus would have been generated.

Table 9-3. Agricultural area required (million ha) and nitrogen (N) surplus (kg N/ha and million kg N/food basket) for production of the average Finnish food consumption of bread cereals, milk and beef by conventional Finnish agriculture and by organic agriculture on BERAS-farms in Juva.

		Finnish agriculture 2002			**BERAS farms 2002**		
				%			*%*
Agricultural area in Finland (million ha)		2.24		*100*	2.39[1]		*107*
Agricultural area for Food basket[2] (million ha)		1.06		*100*	1.33		*125*
	where of bread cereals	0.10		*100*	0.15		*152*
	milk	0.63		*100*	0.84		*132*
	beef	0.33		*100*	0.34		*103*
		a[3]	**b[4]**			***a[3]***	***b[4]***
N-surplus (kg/ha)	bread cereals	*78*	40	*100*	36	*46*	*90*
	milk	*78*	116	*100*	*45*	*58*	*39*
	beef	*78*	116	*100*	*54*	*69*	*47*
N-surplus (million kg/Food basket[2])							
	bread cereals	*7.8*	4.0	*100*	*5.5*	*70*	*140*
	milk	*49*	*73*	*100*	*37*	*76*	*51*
	beef	26	38	*100*	18	*71*	*48*
		83	115	*100*	61	*73*	*53*

[1] The agricultural area needed for BERAS agriculture was made up of the Food basket (see note 2 below) and the rest of the food consumption was kept as before.
[2] The Food basket consists of bread cereal, milk and beef and represents about 50 % of the energy content of the average Finnish food consumption for one year.
[3] The division between the agricultural products was made on the grounds of average agricultural area and surplus.
[4] The division between the agricultural products was made on the grounds of the surplus from the animal and crop production hectares separately.

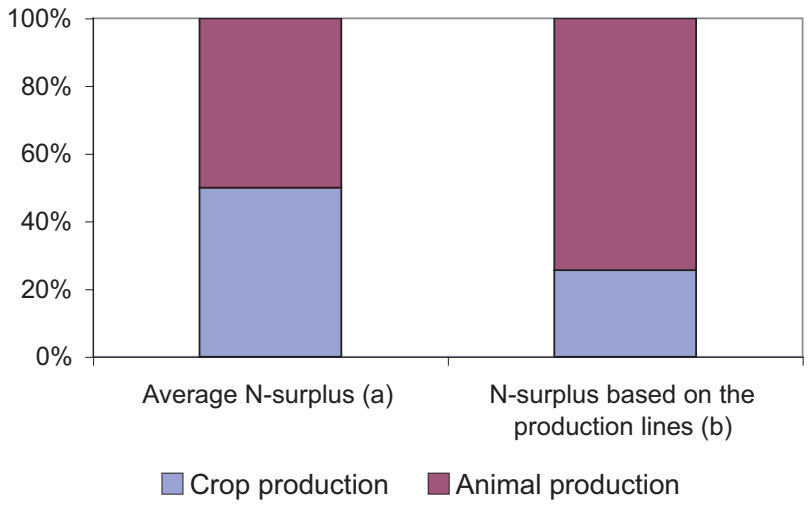

Figure 9-5. Estimated nitrogen (N) surplus in the Finnish agriculture: average surplus (a) and surplus based on the production lines (b) (crop and animal production), relative scale % of the total agricultural N-surplus.

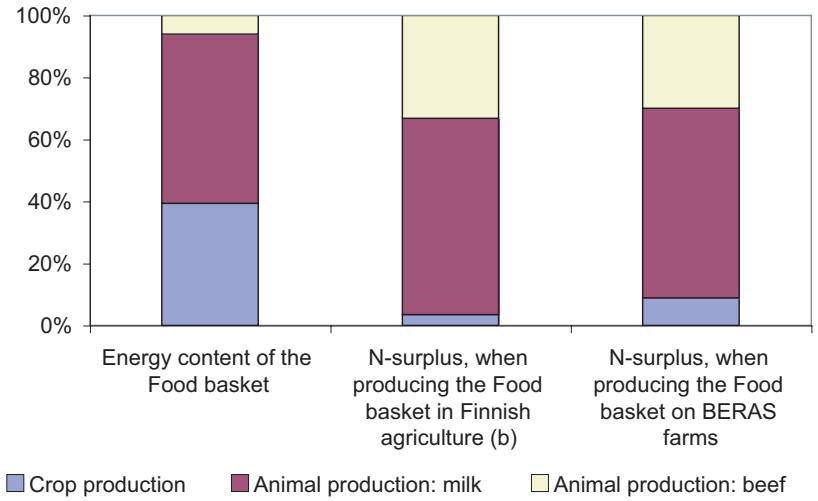

Figure 9-6. Energy content (J) of the Food basket (50 % of the Finnish food energy consumption) and nitrogen (N) surplus (kg) of the Food basket production by two production lines: average Finnish agriculture (b= surplus based on the production lines: crop and animal production) and BERAS-farms, relative scale %.

The production profile of the BERAS-farms differs from the average Finnish food consumption. Main production lines, which are lacking in the studied food basket, are pork and poultry production. Nitrogen surplus from the production of monogastrics differs from that of ruminants. For this reason, the nitrogen surplus of the whole Finnish food consumption, when produced using agricultural practises of the BERAS-farms, was not possible to estimate in this study.

Conclusions

Both scenario studies showed that the nitrogen surplus per hectare and per food basket was lower on the studied BERAS-farms.

The results in the Swedish study clearly show that changes in our food consumption can reduce the environmental impact of the food system. If these consumption changes are combined with a change in production from conventional agriculture to ERA (Ecological Recycling Agriculture) farming, a large reduction of the environmental impacts would occur. If all Swedes were to change their food consumption preferences in accordance with the eco-local food basket presented here the nitrogen surplus would decrease to 36 % of what it is today – and at the same time the agricultural area could be decreased to about 70 % of what it is today. The remaining 30 % could then be used for e.g. energy or fibre production.

Another conclusion drawn from the Swedish study is that a complete change to ERA would decrease the environmental impacts, even when the food consumption profile remains as the Swedish average of today. The agricultural area needed would, however, increase substantially making this scenario unrealistic. The conversion to 100 %

ERA produced food would, thus, also require a change in people's food consumption profile.

Locally produced food showed a somewhat reduced global warming impact in the Swedish cases studied but the consumption of primary energy resources did not change.

References

Antikainen, R., Lemola, R., Nousiainen, J.I., Sokka, L., Esala, M., Huhtanen, P. & Rekolainen, S. 2005. Stocks and flows of nitrogen and phosphorus in the Finnish food production and consumption system. Agriculture, Ecosystems and Environment 107: 287-305.

CTN. 2001. *Ät S.M.A.R.T. – ett utbildningsmaterial om maten, hälsan och miljön (in Swedish).* Centrum för tillämpad näringslära (Centre for Applied Nutrition), Samhällsmedicin. Stockholms läns landsting. Stockholm. Available on www.sll.se/w_ctn/3938.cs.

Johansson, S. 2005. *The Swedish Foodprint – An Agroecological Study of Food Consumption.* Doctoral Thesis 2005:56. Acta Universitatis Agriculturae Sueciae. Uppsala.

Lötjönen, T., Muuttomaa, E., Koikkalainen, K., Seuri, P & Klemola, E. 2004. Laajamittaisen luomutuotannon teknologia – taloudellinen toteutettavuus ja ekologinen kestävyys. (Technology of large-scale organic production.) Maa- ja elintarveketalouden tutkimuskeskus. Maa- ja elintarviketalous 44. 131 pp. http://www.mtt.fi/met/pdf/met44.pdf

Maatilatilastollinen vuosikirja 2003. 2003. (Year book of farm statistic 2003.) Maa- ja metsätalousministeriön Tietopalvelukeskus. Helsinki. 266 pp.

Myrbeck, Å. 1999. *Nutrient flows and balances in different farming systems – A study of 1300 Swedish farms.* Bulletins from the Division of Soil Management, Department of Soil Sciences, Swedish University of Agricultural Sciences. 30: 1-47, 11 app.

Pyykkönen, S., Grönroos, J., Rankinen, K., Laitinen, P., Karhu, E. & Granlund, K. 2004. Ympäristötuen mukaiset viljelytoimenpiteet ja niiden vaikutukset vesistökuormitukseen vuosina 2000-2002. (Cultivation measures in 2000-2003 and their effects to the nutrient runoff to the waters in the farms committed to the Agri-Environmental Programme.) Suomen ympäristö 711. Suomen ympäristökeskus. Helsinki. 119 pp. http://www.ymparisto.fi/download.asp?contentid=21907&lan=fi

Ravintotase 2002 ja 2003 (ennakko). 2003. (Food balance 2002 and 2003 (advance).) Maa- ja metsätalousministeriön Tietopalvelukeskus. Helsinki. 27 pp.