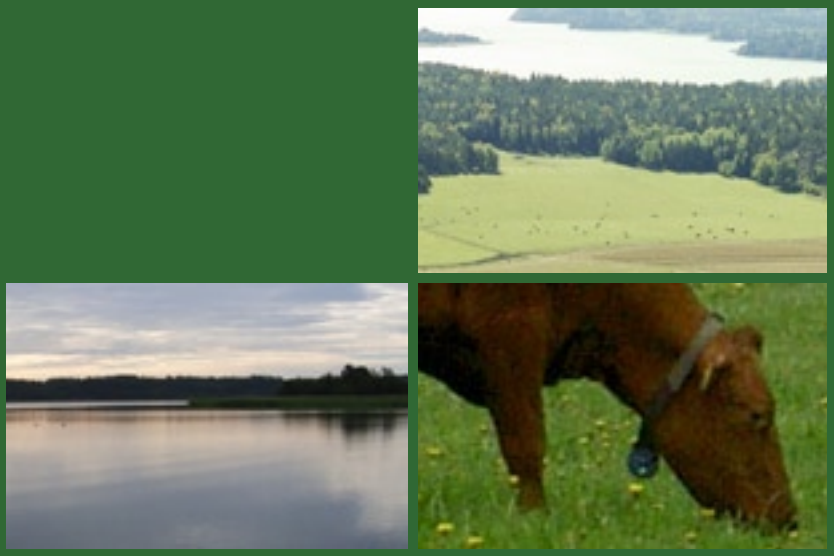

Policy interventions for ecological recycling agriculture

Available options for governments in the Baltic Sea region

Peter Einarsson

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Peter Einarsson

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Executive summary

Ecological recycling agriculture (ERA) is a form of organic farming where crop and animal production are tightly integrated, resulting in low animal densities, high animal feed self-sufficiency, and low plant nutrient surplus. Model estimates indicate that a conversion to ERA would enable agriculture in the Baltic Sea region to meet the plant nutrient reduction targets agreed under the Baltic Sea Action Plan (BSAP).

This paper explores the policy options available to governments that wish to promote a conversion to ERA. It concludes that although WTO and EU memberships impose certain policy restrictions, national flexibility is considerable both in terms of legislation, taxation and financial support schemes.

For EU member states, there exist a number of little-used possibilities to utilize funding from the Common Agricultural Policy (CAP) to reward farmers for recycling practices. While more fundamental reform of the CAP would be needed to introduce ERA on a broad scale, much can be done already in the current policy framework.

A number of policy tools are already used by national governments to address nutrient surpluses in agriculture, but coherent strategies are missing and the systemic nature of nutrient surpluses – emphasized by current science – is not well understood.

Among the key recommendations in this paper are the following measures, all of which are immediately available to national governments.

- Nutrient management legislation, now narrowly focused on regulating manure application and handling, should be refocused on total N and P flows in agriculture. Although artificial fertilizers cause little nutrient leakage where applied, they are the root cause of high animal densities and manure surpluses.
- N and P inputs should be reduced below economically optimal levels. This can be done by taxing nutrient inputs, or by legislated nutrient bookkeeping systems – in combination with professional advice and training.
- Maximum legal stocking rates should be reduced to better match on-farm feed production.
- In advisory systems, environmental legislation, and agri-environment support, measures which improve nutrient recycling should be given priority over passive mitigation measures.
- Better crop rotations, including nitrogen-fixing legumes, should be promoted or required.
- Organic farming should be more systematically promoted. While the current organic baseline is far below the ERA standard of recycling, it is also far ahead of conventional agriculture. Support to organic farming should however be differentiated so that steps toward ERA are rewarded.

Although these and other measures discussed in this paper can be introduced by individual governments, it would be strategic for Baltic Sea region countries to agree on a set of joint actions. This would also create a strong platform to influence future CAP reforms.

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Introduction

Ecological recycling agriculture (ERA) is a concept which was developed in 2003-2006 during the first phase of the BERAS project[1] as a possible response to the excess nutrient leaching from current farming systems in the Baltic Sea region.

The Baltic suffers from heavy eutrophication, and it is generally acknowledged that flows of nitrogen (N) and phosphorus (P) from its catchment area must be radically reduced. The Helsinki Commission, an intergovernmental body comprising all nine states bordering the Baltic, has adopted a Baltic Sea Action Plan (BSAP) with ambitious reduction targets of 18 % for N and 42 % for P (HELCOM 2007a).

It is estimated that agriculture is the source of around half the anthropogenic N and P flows to the Baltic. While contributions from some other sources are decreasing, those from agriculture are not (HELCOM 2010, HELCOM 2011).

On the contrary, under a business-as-usual scenario, a substantial increase of nutrient leaching from agriculture is predicted, as farmers in Poland, Latvia, Lithuania and Estonia are expected to shift from their present low-input technology to the high-input farming which is the current standard in neighbouring Nordic countries and Germany. This could increase N and P flows to the Baltic by as much as 40-50 %, making BSAP targets impossible to achieve (HELCOM 2007b).

In an alternative scenario however, using best possible agricultural practices, this projected increase can be avoided entirely. Instead, current N flows from agriculture can be reduced by half, and P flows from agriculture eliminated altogether. The reduction potential of improved practices is estimated to 116 000 tons N and 5 600 tons P, corresponding to 86 % (N) and 37 % (P) of the total BSAP reduction targets (HELCOM 2007b). This best-available-technology scenario is based on a complete conversion of all farming in the region to ERA.

ECOLOGICAL RECYCLING AGRICULTURE

ERA is based on the well-established organic farming standard, but with added, higher requirements on nutrient recycling. In particular, ERA requires a high degree of physical integration between crop production and animal husbandry. Crops for animal feed must be grown on-farm or on cooperating farms in the immediate vicinity. This is a necessary prerequisite for the very high degree of nutrient recycling possible with ERA.

The reason why crop-animal integration is a key factor is quite obvious. Consider the structure of agriculture in the Baltic Sea region. Like in most of Northern Europe, farming is focused almost completely on animal products. Typically, 70-90 % of arable land is devoted to animal feed crops. In addition, considerable areas of permanent grassland are exclusively used to feed animals, by grazing and/or cutting for winter fodder.

Regional specialization

In the current production system, there is a very high degree of regional specialization, with some regions dominated by animal husbandry, others by crop production with few or no animals. But as the crops produced in crop-growing regions are also mostly for animal feed use, there is a constant one-way flow of plant nutrients out of those regions, and a corresponding one-way influx to animal husbandry regions.

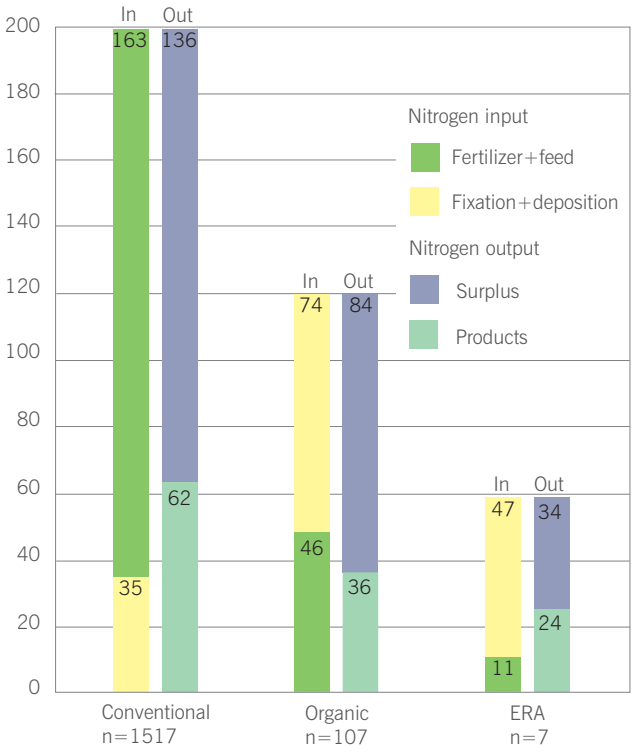
[1] Baltic Ecological Recycling Agriculture and Society; see www.beras.eu

For crop-growing regions, the result is a permanent deficit of plant nutrients, which is covered by application of artificial fertilizers. In animal husbandry regions, the opposite happens. The constant flow of plant nutrients from external sources – national and international – results in a permanent surplus of plant nutrients, parts of which end up as pollutants in air and water, including the Baltic Sea.

While animal husbandry farms and their excess manure are thus the immediate source of nutrient leakage, it is important to realize that in a systems perspective, the root of the problem is the constant inputs of new plant nutrients, which occur mainly on crop-growing farms in the form of artificial fertilizers. It is often noted that nutrient leaching from fertilizer-based crop production is limited. This is correct, but the common conclusion, that artificial fertilizers are therefore not part of the problem, is erroneous. It is in fact the fertilizer use in crop production which enables the nutrient surplus in animal husbandry.

The excess nutrients on animal farms thus directly correspond to the nutrient deficit on crop-growing farms. By recycling them back to crop production, the need for artificial fertilizers can be eliminated. However, manure is a resource that cannot be transported over long distances in a resource-efficient manner. Both in terms of money and energy, the cost is too high. Consequently, the only solution is structural change, co-locating animal husbandry with the corresponding feed crop production, and matching animal numbers to the on-farm or near-farm crop production potential. This is the core of the ERA concept.

NITROGEN BALANCE SWEDISH DAIRY FARMS



Sources: Wivstad et al 2009, Granstedt et al 2005

Effects of ERA

ERA farms always integrate crop and animal production. They have a low animal density of maximum 0.75 livestock units per hectare, and a high level of animal feed self-sufficiency, with a minimum of 85 % produced on-farm or near-farm (Granstedt et al 2008). This production model results in very low plant nutrient levels in the farm ecosystem and highly efficient nutrient recycling. In comparison, the European organic certification standard requires that at least 50 % of the animal feed is produced on-farm or near-farm, and it has no specific limit on animal density, as long as the self-sufficiency level is achieved (EU 2008b).

In 2003-2006, BERAS surveyed a sample of 42 farms meeting the ERA criteria, distributed over eight of the nine states bordering the Baltic. Farmgate nutrient balances were calculated for each farm. On average, the N surplus on ERA farms was more than 30 % lower than the average for the whole Baltic Sea region. In countries with high-input agri-

culture, such as Sweden or Finland, the N surplus on ERA farms was less than half the national average. These figures translate to a reduction in N leaching of around 45 % if all 42 ERA farms are compared to the regional average, or over 70 % if looking at high-input areas only[2] (Granstedt et al 2005).

ERA involves a number of technological changes, notably in crop rotations and animal feed composition, but the main explanation for the very low surplus figures on ERA farms is simply a very low plant nutrient input.

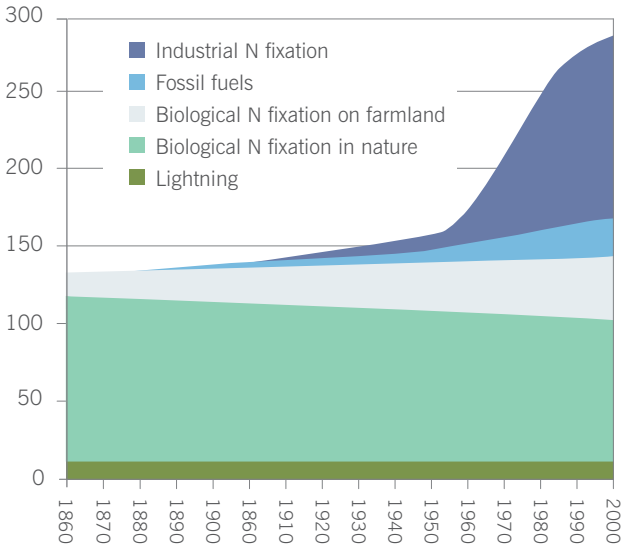
A recent study compared plant nutrient balances from conventional and organic dairy farms in high-input areas of southern Sweden. On average, conventional dairy farms had a total N input of 198 kg per hectare (fertilizer, animal feed, biological nitrogen fixation, atmospheric deposition). The average for organic farms was 120 kg (Wivstad et al 2009). The corresponding figure for the seven Swedish ERA dairy farms in the BERAS sample was 59 kg (calculated by the author based on data in Granstedt et al 2005). N surplus figures followed the same pattern. The average was 136 kg per hectare on conventional farms, 84 on organic farms, and only 34 on ERA farms.

It should be pointed out that there is also a downside to ERA. It does involve a reduction in output per hectare, as must be expected when external nutrient inputs are reduced to a minimum. More land is required to produce the same amount of food. In terms of production per kg N on the other hand, ERA is considerably more efficient than other models. In the Swedish dairy farm study, both conventional and standard organic farms had a nitrogen efficiency of around 30 per cent, while the Swedish ERA dairy farms converted over 40 per cent of their N input into products.

However, comparisons of output figures between ERA and conventional agriculture or standard organic farming are of

REACTIVE NITROGEN CREATION 1860-2000

Million tonnes N per year



Source: Author's calculations based on data in Galloway et al 2003

limited interest, since neither of those two alternatives can sustain current output levels while meeting BSAP reduction targets. ERA is in fact the only option which enables both sufficient food production and sufficient reductions in nutrient flows. There are some other scenarios which could deliver comparable N and P reductions, but they involve large-scale removal of land from agricultural use, and would cause much more drastic cuts in production than ERA.

One such scenario was presented in a report by the Swedish Environmental Protection Agency (Naturvårdsverket 2008). To achieve a reduction of the N load from agriculture corresponding to around 40 per cent of the national target, it was estimated that around 1/3 of all arable land would need to be taken out of production and converted to green fallow

[2] The N surplus in a plant nutrient balance is not equivalent to N leaching, but a high surplus indicates a high risk of leaching. Only a part of the surplus will leach into water bodies. How much varies widely, depending on a number of factors related to soil structure, temperature, rainfall, cropping patterns, etc.

– most of it in highly productive coastal regions in the South. According to the study, this would reduce production of most annual crops – cereals, potatoes, oilseeds and others – by 80-90 per cent, make Sweden completely dependent on food imports, and eliminate up to 38 000 jobs in agriculture and food industry.

GLOBAL N AND P FLOWS

The eutrophication of the Baltic is in itself sufficient rationale for decisive political action. Nevertheless, it is important to remember that it is only a regional instance of what is now widely described as fundamentally disturbed N and P cycles on the global scale. Human activity now adds more N to terrestrial ecosystems every year than all natural processes taken together, and P flows are estimated to be three times larger than pre-industrial levels. In both cases, agricultural activities are the main causes, in particular the application of artificial fertilizers (Rockström et al 2009, Smil 2000).

The main environmental effect of excess P is an over-fertilization of natural ecosystems, most often marine environments such as the Baltic. In marine ecosystems P is typically the limiting factor for organism growth[3].

The effects of elevated N levels are more complex, and have been described as a "nitrogen cascade". N atoms, once transferred from inert nitrogen gas (N_2) into reactive nitrogen compounds, move in largely unpredictable patterns through ecosystems and are capable of destabilizing various natural systems (Galloway et al 2003). Major environmental effects attributed to the global excess of reactive N include

- eutrophication by nitrates (NO_3^-)
- acidification by nitrogen oxides (NO_x)
- global warming by nitrous oxide (N_2O)
- breakdown of stratospheric ozone by nitrous oxide (N_2O)
- reduced biodiversity as N-loving organisms expand their space.

[3] For the full story of "humanity's addiction to phosphate rock", see Cordell et al 2009).

There are essentially only two routes for N to enter ecosystems – as ammonia (NH_3) formed by biological or industrial nitrogen fixation, and as nitrogen oxides (NO_x) created by lightning. But once in place, those compounds can recombine in various ways and multiple steps to form any other nitrogenous compound. This means that it does not matter much where or in what form N is introduced to ecosystems. Any N addition has a potential to contribute to any of the various environmental effects.

Furthermore, as long as reactive nitrogen is not denitrified back into N_2 gas, it will continue to have an impact on ecosystems. This implies that when annual additions of reactive N exceed the denitrification rate – as they have now done for decades on a global scale – there is a cumulative effect. Remaining excess N from years past is still chemically active, and the impact of each year's addition comes on top of that.

There is a strong scientific consensus that anthropogenic flows of both N and P must be drastically reduced, not only in eutrophication-sensitive areas, but on a global level, in order to avoid irreversible damage to major biogeochemical processes. Anthropogenic N flows are identified as the most urgent problem, and may need to be reduced by as much as 75% (Rockström et al 2009). This has major implications for agriculture. According to the recently published European Nitrogen Assessment, farming is responsible for more than 4/5 of all anthropogenic N inputs in Europe, and around 70 % of this comes from artificial fertilizer alone (ENA 2011).

While the urgent need to reduce eutrophication pressure on the Baltic Sea remains the most immediate reason for a conversion to recycling practices in agriculture, the global picture adds weight to the argument. In particular, it should provide reassurance to governments that radical measures for fundamental change in agriculture will not put the region in an isolated or precarious position, but rather give it a head start in a process which will soon need to be adopted by governments worldwide.

BALTIC SEA CATCHMENT AREA

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SCOPE OF PAPER

This paper will explore the policy options available for governments that wish to initiate or support a process of conversion to ecological recycling agriculture. The focus is on the Baltic Sea region both in the narrow sense (the nine states around the coastline[4]) and in the wider sense (the catchment area shared by 14 states[5]). However, much of the analysis should be equally applicable to neighbouring parts of Europe with similar agricultural conditions and policy landscape.

The text is divided in two main parts. The first part is an inventory of agricultural policy tools available to governments. Given that the great majority of governments in the Baltic Sea region (coastal states as well as catchment area) are European Union members, the EU Common Agricultural Policy (CAP) plays a central role here. But it should be noted that the perspective is that of national governments and their total range of policy options, CAP-related or otherwise.

The second part reviews a number of examples where agricultural policy tools have been or could be used in ways supportive of ERA. It is by no means a complete review, but it illustrates the range of possibilities, and also discusses some possible near-term improvements to exisiting policies.

The analysis has not been limited to policy interventions which can support ERA in the narrow sense – farms which fulfil the complete definition as presented above. On the contrary, it tries to identify the broadest possible range of measures which may be used to promote steps in the direction of ERA, from any starting point a farm may have, be it average conventional agriculture or a relatively advanced stage of organic farming. Likewise, it looks both at measures which can reward steps in the direction of improved recycling, and measures which can sanction anti-recycling practices.

Some other limitations apply, however. Only public policy measures are covered. There is a whole range of other actors who influence the development of agriculture: consumers and the market actors linking them to farmers, NGOs such as environmental and consumers' organizations, farmers' unions, research institutions, organic certification bodies, to mention just a few. All of these are necessary partners if a recycling farming model is to succeed. They have been excluded here only to keep the task manageable.

The paper mainly looks at near- and mid-term options, available immediately or in a perspective of a few years, without a need to wait for international policy changes to happen.

[4] Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Russia, and Sweden.

[5] The coastline states plus Belarus, the Czech Republic, Norway, Slovakia, and the Ukraine.

Available agricultural policy tools

This chapter will provide an overview of the main agricultural policy tools available to governments that wish to promote a transition toward ecological recycling agriculture. Next chapter will give examples of how these tools have been or could be used.

Two major international frameworks define the limits for national agricultural policy in the Baltic Sea region: the WTO Agreement on Agriculture (AoA), and the EU Common Agricultural Policy (CAP). Both, as we shall see, provide ample flexibility for national initiatives.

THE WTO AGREEMENT ON AGRICULTURE

Until 1995, agriculture was almost entirely excluded from the multilateral trade agreements negotiated through GATT (the General Agreement on Tariffs and Trade). This changed completely with the conclusion of the Uruguay Round and the establishment of the new World Trade Organization.

The WTO Agreement on Agriculture (AoA) is very broad in scope. It regulates not only traditional trade issues related to market access and tariff levels. It also establishes a detailed set of rules for the design of national agricultural policies, which lays down specific conditions for how various forms of government support may be used, and prohibits some kinds altogether.

The key principle in the AoA is that agricultural support as far as possible should be "decoupled" from what and how much farmers produce – on the assumption that this will reduce the impact of the support schemes on international markets.

In practice, this has led to a situation where virtually all new agricultural policies in WTO member states are designed to comply with the conditions of the WTO Green Box – the category of agricultural support which is regarded as having "no, or at most minimal, trade-distorting effects" (WTO 1994). All other forms of support have various forms of restrictions under the AoA, but Green Box measures can continue indefinitely without any time or budget limits.

Of the 14 states with territories in the Baltic Sea catchment area, all except Belarus are WTO members, and Belarus holds observer status and aspires to membership. Consequently, the conditions of the Green Box can be regarded as a de facto limit for the policy space available to the governments in the region.

The Green Box – Annex 2 to the AoA – allows eleven different types of agricultural support. Three of these are directly relevant in the context of ERA.

- *General services.* Assistance that a government provides to farmers in a range of areas, including research, training and advice, and infrastructure.
- *Decoupled income support.* Direct payments to farmers which must not be related to production in any way, but which can be subject to, for example, environmental conditions.
- *Government environmental programmes.* Direct payments to farmers covering the costs of specific environmental measures.

THE EU COMMON AGRICULTURAL POLICY

Most of the states in the Baltic Sea region are also European Union members. The only non-member with a Baltic coastline is Russia. Three additional non-members have territory in the catchment area: Norway, Belarus, and the Ukraine. As part of the European Economic Area (EEA), Norway adheres to most EU policies, but the agricultural policy is one of the few exceptions.

The Common Agricultural Policy (CAP) is one of only a handful policy areas in the EU which are completely harmonized. This means that all long-term and framework

decisions are taken jointly by EU member states in the Council – and since 2010 in a co-decision procedure with the European Parliament. Most budgetary support to agriculture is also on EU level, and external relations, for example negotiations on agriculture in the WTO, are co-ordinated by the European Commission.

The CAP goes back to the founding of the European Community in 1957. Until the 1980s it was a traditional production support policy based on market regulation and price support through tariffs, variable import levies, and export refunds. Since the early 1990s a number of reforms have been implemented to bring the CAP in line with the requirements of the WTO AoA.

Today, the bulk of CAP expenditure is direct payments to farmers (around 70 %), and most of the remainder is spent on rural development and environment programmes (around 23 %). Almost all of this qualifies for Green Box status. Although most of the market regulation and price support mechanisms still exist, they are little used and in most years only account for 5-10 % of the total budget (the figure varies considerably over time depending on market conditions).

AVAILABLE POLICY TOOLS

Because the CAP is the policy environment for the overwhelming majority of governments in the Baltic Sea region, the following inventory of available policy tools will be done from the perspective of an EU member state. The non-members in the region are in principle free to use additional or different policy tools. But given that they also strive to stay within the limits of the WTO Green Box, their policy choices tend to be very similar.

A new reform of the CAP is under negotiation at the time of this writing. A first draft of the legislative texts was published by the EU Commission 12 October 2011 (European Commission 2011c). Final political decisions are expected late 2012 or early 2013, and the changes will go into effect from 2014. Although the exact final outcome cannot be predicted yet, the broad lines are already established. Probable changes from 2014 will be flagged in the following where applicable.

EU Second Pillar

In the CAP, policy tools relevant to ERA are found primarily in the so-called Second Pillar, the European Agricultural Fund for Rural Development (EAFRD). This is the newest component of the CAP. It started on a very small scale in the 1970s with investment support to farm modernization and regional support to mountain farmers. The first agri-environment payments were added in the mid-1980s. With the major reforms from 1992 onwards these “accompanying measures” have been turned into a substantial part of the policy.

Each reform has shifted a little more of the budget from the First Pillar (market regulation and income support), bringing the rural development measures to their present level of almost one quarter of total CAP spending. The impact on farm level is even greater, because all Second Pillar payments must be co-financed by member state budgets. In most cases the member state share is 50 % (one euro from the member state for each euro from the EU). In economically weaker regions, the member state share is reduced to 25 %.

All Second Pillar spending is Green Box compliant under the WTO AoA. Although the whole policy is now referred to as “rural development”, agri-environment measures remain an important part, about one quarter of total Second Pillar spending, or about 6 % of total CAP spending.

Reform proposal

The current reform proposal however indicates a major policy shift. For the first time since the creation of the Second Pillar, no further budget transfer from the First Pillar is foreseen. Instead, the proposed budget indicates a slow decrease of funding to both pillars of about 13 % over the 7-year period 2014-2020 (European Commission 2011b, 2011c).

However, it is also proposed that member states should be allowed to voluntarily transfer up to 10 % of their allocated First Pillar funds to the Second Pillar. On the other hand, there would also be an option for member states with low First Pillar payments to increase them by transferring funds from the Second Pillar (up to 5 %). In the Baltic Sea region, this option would be available to Estonia, Finland, Latvia, Lithuania, Poland, and Sweden.

Something which may also change considerably in 2014 is the distribution of Second Pillar funds among member states. This distribution is now very uneven, reflecting various political decisions in the past. For example, certain financing levels have often been granted as part of accession agreements. There is also a practice of rewarding member states which spend their whole funding allocations with increased funding, and vice versa. There has been much discussion about basing the distribution instead on more objective criteria, but on this point there are still no concrete proposals from the Commission.

The combination of a shrinking total budget for the Second Pillar and a more equal distribution between member states could have considerable impact on the possibilities to promote ERA in the Baltic Sea region, where most of the EU member states currently have larger Second Pillar budgets than the EU average (all except Denmark and Germany). In five countries, Second Pillar payments to farmers are actually larger than First Pillar payments (Estonia, Finland, Latvia, Lithuania, and Poland).

National flexibility

The Second Pillar allows member states a high degree of flexibility. The EU Rural Development Regulation (EU 2010a) only provides a skeleton framework based on three very broad objectives: improving the competitiveness of agriculture and forestry, improving the environment and the countryside, and improving the quality of life in rural areas. Based on these, there is a smorgasbord of 45 measures to choose from, many of which are also very broadly formulated, such as "vocational training and information", "agri-environmental commitments" or "modernisation of agricultural holdings".

There are relatively detailed rules about the administrative aspects – programming, approval, reporting, maximum levels of payments – but very few restrictions on the actual content of the measures. Member states (or regions in the case of federal states) design a multi-year programme proposal, where they select the mix of measures they prefer, and as long as they can plausibly show that their programmes contribute to the objectives, they are approved. Only one measure – agri-environment – is compulsory to include in every programme but member states are free to make it large or small.

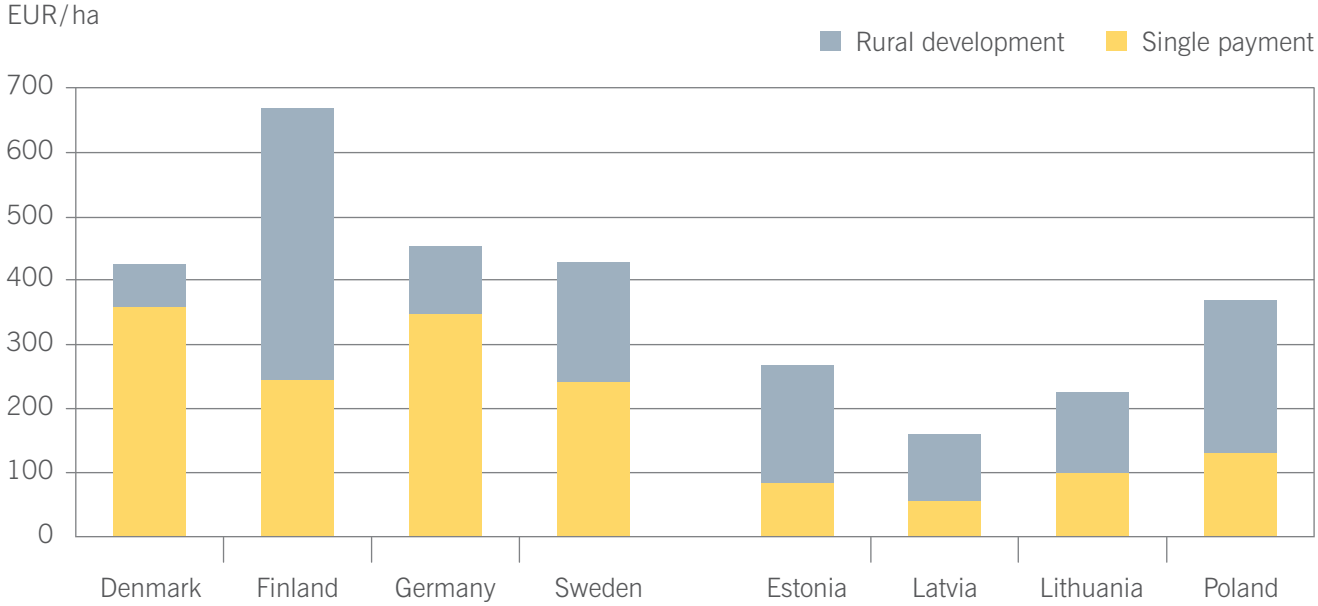
As a result, both the mix of measures and the design of individual payments differ widely between member states. Some regional patterns can be observed, for example that agri-environment measures have a greater role in a band across Northern Europe from Ireland to Finland, while competitiveness measures dominate in most otherplaces (Copus 2010).[6]

Agri-environment measures are obviously very relevant to the promotion of ERA, but because programme design is so flexible, a number of other measures can be of interest as well. Training and information measures, for example, are more or less necessary as complements if agri-environment measures are to be successful, as are advisory services. The relevance of competitiveness measures is perhaps less obvious, but measures such as investment support to modernisation of farms or infrastructure can also be designed to support investments necessary for the transition towards ERA. Quality and marketing measures can give priority to ERA products. Natural handicap payments can be differentiated on the basis of animal density or crop mixture to create incentives for ERA.

[6] An excellent entry point to further information about the Second Pillar is the web portal of the European Network for Rural Development at http://enrd.ec.europa.eu/

ANNUAL CAP PAYMENTS 2007–2013 BALTIC REGION

EUR/ha



Source: Author's calculations based on data from EU Commission DG Agri and Eurostat

EU First Pillar

The First Pillar support systems, which still account for more than 2/3 of the total budget, are the descendants of the historical CAP. They still include some market regulation tools which remain practically unchanged since the 1950s, such as intervention buying, storage systems, and export refunds, but most of the First Pillar budget has been moved into direct payments. A small portion of these remain coupled, which means that they are paid to specific crops or products. But the bulk of the direct payments are now decoupled – paid per hectare of farmland without any requirement for a specific production, or indeed any production at all. This is called the single payment scheme, and it is WTO Green Box compliant, while the coupled payments are not.

Although the single payment has been decoupled from production requirements, the distribution of the payments between farmers still to a large extent reflects the historical production support. Before decoupling was introduced in 2005, direct payments were based on crop yields and number of animals, so that a farm with good soils and high yields, or high animal density, was additionally rewarded with higher payments. This seemingly backward logic has historical reasons. The original CAP promoted production by guaranteed farm prices, and when the price guarantees were reduced from 1992 onwards, direct payments were designed to compensate for the income loss – which was greater where production was higher.

When decoupling was introduced, these disparities were mainly left unchanged, both between member states, and between farms and regions in each member state. In their implementation of decoupling, member states could opt for a more equal distribution of payments inside their borders, and some did, but between member states there was no redistribution at all. Disparities were further increased in the

most recent enlargement (2004 and 2007), when the 12 new member states were mostly allocated very low payment levels (based on a historical record of low-input and low-yield production) and even those levels will not be reached until after a long phase-in ending in 2013 (2016 for Bulgaria and Romania).

In contrast to the Second Pillar, there is no member state co-financing in the First Pillar. All payments are covered by the EU budget to 100 %. Another important difference is that while direct payments under the Second Pillar must always be justified by a specific commitment made by the farmer, and can never exceed the cost or income loss associated with this, the decoupled First Pillar payments do not need any justification at all. This follows from their status as income support under the WTO Green Box.

National flexibility

Even though member states have no part in the financing of the First Pillar payments, they now have considerable influence over their national implementation. Historically, this has not been the case. The old price support system was strictly an affair between the EU and the farmer, and it was very uniform across all member states. The current situation, with a whole array of different options for national governments, is a result of the reform process of the past 20 years, where increased flexibility has been one of the tools used by the Commission to gain member state acceptance for the often controversial changes.

Several of these national options are of interest for governments that wish to promote a transition toward ERA. Even though the flexibilities are limited, the potential effects can be considerable because the First Pillar is such a large part of the CAP. The fact that no national co-financing is required can also be important, especially for member states with limited budgets.

- *Basic conditions for support (cross-compliance).* While First Pillar payments are not tied to specific commitments like Second Pillar support, there is a set of baseline conditions which must be fulfilled by the farmer in order to qualify, referred to as *cross-compliance*. These conditions include a number of EU regulations and directives, but also relevant national environmental legislation to ensure what is referred to as "good agricultural and environmental condition" (EU 2009a).

While there are thus no requirements that go beyond what is already in EU or national law, the link to the payments adds a new level of sanctions to that legislation. The potential reduction in First Pillar support for breaking the rules is usually much more substantial than any possible fines under the national legal system.

Because any change that a government makes to the relevant legislation automatically becomes part of the cross-compliance conditions, this in fact provides a route for member states to use the weight of the First Pillar payments to achieve environmental improvements in their own territory. The legislation must stay within the framework specified in the EU direct support regulation, but just like the framework for Second Pillar support, it leaves great flexibility to member states.

- *Distribution of EU funds.* When decoupling was introduced, each member state was allocated a ceiling for their total use of EU funds. The default alternative was to distribute the money – or to be exact, the *payment entitlements* – to each farm on the basis of historical records. But member states were free to choose several different options, or even combinations of these.

For example, the pre-decoupling hectare payments were only granted to annual crops such as cereals and oilseeds, not to grass/clover grown for hay, silage or grazing on arable land, and not to permanent pasture. Member states could now choose to include such areas.

There was also an option to distribute the payments on the basis of regional or national averages, instead of to each farm according to its own historical record. Under this option, member states could also define different payment levels for annual crops, grassland, and pasture.

In addition, there remained a limited possibility to retain some coupled payments, for example to suckler cows and a few specific crops.

Given all the possible combinations, and the additional option of a stepwise change over a period of years, this created a complex but very flexible system, and member states made very different choices.

- *"Specific support" under Article 68.* Another option allowed member states to reduce their budget ceiling for direct payments by up to 10 %, and instead use those funds for nationally designed support schemes. The mechanism was originally called *national envelopes.* Since 2009, when it was expanded and made more flexible, the official name is *specific support,* but it is most often referred to as Article 68 support (while the original version was known as Article 69 support).

Article 68 support schemes must be designed for a limited number of objectives, including environmental benefits, animal welfare, quality and marketing of products, disadvantaged areas or sectors, and crop or animal insurance – objectives which by and large overlap with those of the rural development measures under the Second Pillar.

The support can be of two kinds. It can be a coupled payment linked to a specific sector or type of production. In this case, a maximum of 3.5 % of the direct payment ceiling may be used. Or it can be a decoupled payment fulfilling the same conditions as the agri-environment programmes in the Second Pillar. In this case, up to 10 % of the ceiling may be used. In effect, this amounts to an extra agri-environment programme, but located in the First Pillar and with 100 % EU financing instead of 50-75 %.

The original Article 69 scheme was little used by member states, mainly because various cumbersome conditions reduced its usefulness (IEEP 2008). The current Article 68 scheme has proven much more attractive, and almost all member states have used it to some extent, and for a great variety of different purposes (European Commission 2011a).

However, under the new reform proposals tabled by the Commission in October 2011, some of the national flexibility in Article 68 would be removed again. In particular, the possibility to have national schemes with decoupled support would be eliminated. Only coupled payments would be allowed.

Reform proposal

The two major changes to the direct payments in the current reform proposal may not directly influence the policy options relevant to ERA, but they will alter the fundamentals of the system so much that they will have indirect effects.

- *Convergence.* One main objective of the coming reform is to get in place a new and more equal basis for the distribution of direct payments, and reduce the historically motivated differences both between and within member states – a process which is now called *convergence.* This is highly controversial as it involves redistribution of EU funds from richer to poorer agricultural regions. The Commission is now proposing a model with a very long phase-in period for convergence within member states (to 2019), and only a minor redistribution between member states in 2014, with no further changes until after 2020. Nevertheless, reaching agreement on the principle would be a major achievement, as it would at long last close the door on the conception of direct payments as compensation for the removal of price guarantees, and make it clear that tax money to agriculture henceforth has to be motivated by the provision of public goods to society as a whole.

"Greening". Another major change proposed is what is informally referred to as a "greening" component. In the formal proposal it is called "Payment for agricultural practises beneficial for the climate and the environment". It is proposed that 30 % of the direct payments should be reserved for such payments, and they will only be made to farms which fulfil three additional criteria on top of the baseline "cross-compliance" conditions. The three criteria proposed are:

- Crop diversification. A minimum of three crops must be grown, none on less than 5 % of the land or on more than 70 %. Farms entirely under grass would be exempt from this requirement.
- Permanent grassland present on farms when the reform is implemented in 2014 must be maintained as such.
- Ecological focus area. At least 7 % of the farm area must be left uncultivated. Fallow, landscape features, buffer strips and afforested areas are mentioned as examples of land which would count as ecological focus area.

Several other criteria have been under discussion and might still come back during the negotiations. Among those are a minimum percentage of green cover during winter, and an animal density limit – both more relevant to ERA than the three now chosen.

A specific exemption is proposed for organic farmers. All farmland under certified organic management would automatically qualify for the "greening" payment, regardless of the three criteria.

The basic idea of introducing environmental conditionality in the First Pillar is something that has been suggested for a long time, primarily by environmental and organic farming organizations, as a way of moving direct payments to a more legitimate public goods basis (see for example IFOAM-EU 2002, IFOAM-EU 2010, Birdlife et al 2010). In the present proposal however, these provisions are introduced as an alternative to continued expansion of the Second Pillar, not as a complement, which has drawn criticism from the original proponents (Birdlife et al 2011). Against this can be argued that by moving some environmental conditions into the First Pillar, budget space is liberated for new measures in the Second Pillar.

National environmental legislation

Environmental law is a straightforward policy tool available to all governments with no or very few limitations.

For EU member states and also for Norway under the EEA, some baseline legislation on plant nutrient management is required by two directives, the Water Framework Directive (EU 2009b) and the Nitrates Directive (EU 2008a).

The Water Framework Directive (WFD) requires river basin management plans addressing all kinds of pollution of both groundwater and surface water.

The Nitrates Directive specifically addresses nitrate pollution from agricultural sources and lists some measures which must be regulated in national law. In designated "vulnerable zones", member states must prohibit fertilizer application during certain periods (winter), require sufficient storage facilities for manure so that those periods can be respected, and limit the total manure application per hectare to 170 kg N (in principle, but with possible derogations). For N application via artificial fertilizers, the directive does not contain any specific limit, only a general principle that total supply of N from all sources should not exceed "the foreseeable nitrogen requirements of the crops".

However, as with all EU environmental law, member states are free to introduce "more stringent protective measures" (Art 193 TFEU; see EU 2010b). Notification to the EU Commission is required, to ensure that there is no conflict with other provisions of the EU treaties, and in particular that there is equal treatment of national subjects and those from other parts of the Union. In practice, this is seldom a problem in the context of legislation targeting agricultural

land management. The target is national territory only, with no effect on the territories of other EU member states. The situation is similar with regard to the WTO.

In fact, what usually limits the ability or willingness of governments to use this option is the opposite – that stricter national legislation typically puts their own farmers at a disadvantage, increasing costs for domestic production but not for competing imported goods. This effect is particularly strong between EU member states, which share a common market and cannot counter increased imports in any way.

As already noted above, national legislation in EU member states now also gains added weight through the link to the direct payment system via cross-compliance conditions.

EU organic agriculture legislation

Organic agriculture started out with self-regulated private certification systems, loosely coordinated by the International Federation of Organic Agriculture Movements (IFOAM) through its Basic Standards (IFOAM 2007).

But since 1992, the EU has taken over the standard-setting role in its territory through a regulation (for the current version, see EU 2008b). It allows organic production to be certified by private or public bodies, which can have additional requirements for certification and use their own logos or seals, but must always comply with the EU baseline requirements and use the EU logo. Only products certified under these rules can be marketed in the EU as organic (or with the corresponding terms in other Union languages). Because of the EU's position as a major food importer, the regulation also has considerable influence on how organic agriculture is defined and regulated in many food exporting countries outside the EU.

The EU's role as standard-setter provides an opportunity for member states to influence the development of organic farming practices, including aspects relevant to ERA. Larger revisions of the regulation are decided by member states in the Council, jointly with the EU Parliament. Smaller adjustments are formally decided by the Commission, but in practice with considerable member state influence through the Standing Committee on Organic Farming (SCOF), an advisory body of government representatives consulted by the Commission on all organic farming matters.

National taxes

With a few exceptions, taxation is not harmonized in the European Union, so member states are basically free to use this instrument in relation to ERA. There will sometimes be a requirement to notify new taxation proposals to the Commission. This is if the proposed tax measure can be regarded as *state aid*, which can be the case if it gives selective advantages to specific companies or regions. However, measures intended to protect the environment are covered by a general exception, and do not count as state aid even if there are such effects. (For an accessible introduction to this very tricky field, see European Commission 2004a.)

Measures which could be relevant for the promotion of ERA include taxes on agricultural inputs and taxes on polluting management practices. There is also the possibility to use tax credits for recycling practices – or to remove tax credits now sometimes given for agricultural inputs.

This chapter will provide examples of how governments have

Examples of agricultural policy interventions

used or could use various policy tools in ways that promote ecological recycling agriculture (ERA). It is by no means a exhaustive survey. The intention has been to give an indication of the range of measures available, not a complete inventory. Examples are collected primarily from the Baltic Sea region, occasionally also from other parts of Europe.

Although there are virtually no examples of policy interventions explicitly designed for ERA, there are quite a few examples of measures which have been beneficial in an incidental way. Many of these could also easily be adjusted to more directly support ERA farmers, as will be noted when appropriate.

The discussion in this chapter is limited to measures which are possible to implement immediately or within a few years on national initiative, without any need for changes to EU or other international legislation. Some reflections on broader and more long-term change will be offered in the concluding chapter.

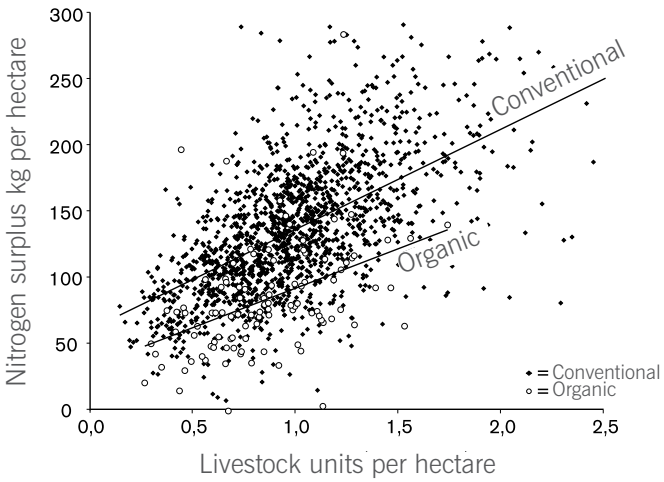
A primary source of information for this chapter have been the rural development programs of the eight EU member states in the Baltic Sea region, and the relevant German Länder. These can all be found in the reference list under RDP, but to avoid tedious repetition, individual references will not be given in the text below when it is obvious that facts are drawn from rural development programmes.

ORGANIC AGRICULTURE

Without any doubt, various measures in support of organic agriculture have been the most important policy interventions to date in terms of preparing the way for ERA. Although the baseline of standard organic production is quite far removed from the strict self-sufficiency and crop-animal integration of full-fledged ERA, any version of organic farming is an important step above and beyond conventional, non-organic agriculture. While the 85 % feed self-sufficiency of ERA compares to a minimum of 50 % in certified organic farming, conventional farms have no self-sufficiency requirement at all. Likewise with animal density. Many conventional farms stay close to the maximum legal stocking rates, which are typically around twice the 0.75 LU/ha maximum of ERA, while certified organic farms rarely exceed 1 LU/ha.

It should also be pointed out that there is a broad range of

LIVESTOCK DENSITY AND NITROGEN SURPLUS ON SWEDISH DAIRY FARMS



Source: Wivstad et al 2009

different production models in certified organic agriculture. The baseline defined in the EU organic regulation and other standards should not be confused with typical performance. The proportion of organic farms which stay close the baseline is not very large. The average organic farm shows a considerably higher self-sufficiency level, and although animal densities and nutrient balances satisfying the ERA standard are still rare, a significant number of organic farms come relatively close. This can be seen for example in a recent Swedish study analysing nutrient balances from over 300 organic farms (Wivstad et al 2009).

In addition, standard organic agriculture has an important function as a stepping stone from conventional production. Large-scale conversion of average conventional farms directly to ERA is not a realistic proposal, but the step up to the EU organic regulation baseline has proved possible to achieve for relatively large numbers of farmers in all sectors of European agriculture.

Financial support

All EU member states now provide financial support per hectare of organic farmland, both during the conversion period and maintenance payments as long as the land is kept in organic production (Schwarz et al 2010). Payment levels vary widely, and other conditions as well. Some countries differentiate between crops, others do not. Some have payments for permanent pasture, some only for arable land. A few have different payment rates for land where there are organic animals as well, and several have maximum and/or minimum stocking rates.

Almost all member states use the Second Pillar agri-environment funding for the organic payments, but France now uses Article 68 support under the First Pillar. A few countries have additional support mechanisms as well. France provides a substantial tax credit of up to EUR 4 000 for organic farms (Agence Bio 2011). Sweden uses Article 68 support under the First Pillar to pay part of the certification cost, and the education and information measure in the Second Pillar to provide advice and training free of charge (RDP Sweden 2008).

However, few if any countries seem to have used the opportunity to differentiate support between organic producers based on criteria such as animal density, feed self-sufficiency or crop rotations. This would be a simple way to create incentives for farmers to take further steps toward ERA. Most of the data needed for this differentiation (areas and crops, numbers of animals) is already collected by agricultural authorities.

Organic agriculture legislation

The EU organic regulation and similar legislation in non-member countries is an important underpinning for the organic food market, as it serves to protect bona fide organic producers against fraudulent competition. This benefits all organic producers, ERA farmers included.

At the same time, the organic legislation defines the baseline organic standard, and can be used to periodically raise that standard in various respects, to promote development in the sector. This is another possible means to move the organic farming sector in the direction of ERA.

One proposal aiming in this direction was recently tabled by the European Commission and discussed with member states in SCOF, the advisory committee on organic farming. The proposal was to increase the feed self-sufficiency requirement from 50 to 70 % (SCOF 2011).

Gradually raising the standard is a well-established modus operandi in the organic sector since its beginnings, but there is a possible downside. The entry threshold for conversion becomes higher, and this can reduce the number of conventional farmers willing or able to convert – and over time also the number continuing toward ERA. By instead using differentiated payments to achieve the same effect, as

suggested above, this risk is avoided. Alternatively, or in combination, differentiated marketing can be used.

Other changes to the EU organic standard may be better motivated. One example concerns the recycling of human waste, which is now prohibited in any form, even from specially designed systems which separate and recycle only urine and/or excrement and avoids the chemical and biological pollution which makes the sludge from conventional sewage systems unfit for use in agriculture.

Official targets and action plans

Many EU member states, and also the EU itself, have used official targets and action plans as a means of promoting organic farming. In the Baltic Sea region, Denmark, Estonia, Germany and Sweden have or have had national action plans (European Commission 2004b, European Commission 2004c, Schmid et al 2008, ORGAP 2008). The method can also be used in countries with limited resources and/or a young organic sector, recently for example in the Ukraine (Milovanov 2008).

Although action plans often include a funding component, typically directed to market development, research or other supporting activities, their most important effect may be psychological. They send the political signal that expansion of organic agriculture is a government priority, not only a private interest. Inside government institutions, this creates a new sense of "our project", and externally it adds legitimacy.

NUTRIENT MANAGEMENT

The large majority of states in the Baltic Sea catchment have a range of measures in place to address nutrient management in agriculture. Some mandatory legislated measures as baseline, and in addition advisory systems and/or financial support for various technical measures or agri-environment commitments.

Environmental legislation

The baseline legislation is very similar in all EU member states in the region, based mainly on the mandatory components of the Nitrates Directive (see previous chapter). The national flexibility to include stricter measures is little used, with Denmark as the only clear exception (see below).

The weaknesses of the EU directive are thus reproduced in the national legislations, in particular its focus only on nutrients from manure, rather then on total nutrient input, and its use of the economically optimal nutrient application as the norm, rather than an ecological optimum.

However, on the positive side it can be noted that substantial improvements can be implemented very fast. The legislation is in place and can be strengthened through a simple national decision and a normally uncomplicated EU notification.

By moving from regulating only the nutrient application via manure to a limit on total application of N and P, relatively large reductions in leaching could be achieved at little cost in crop yield. It is well known that N applications give diminishing marginal yield increases, so that reducing N by 20-30 % below the economic optimum will result in far less yield reduction (see DEFRA 2010, Appendix 11, which explains the basics and introduces the concept of socially optimal nitrogen level). Much of this small yield loss can in turn be compensated by better manure handling routines, further reducing leaching. Add some changes to crop rotations, in the direction of organic farming and ERA, and yields can probably be maintained despite substantially reduced inputs.

A reduction of maximum legal stocking rates could achieve similar rapid improvements, as the farms with highest animal density generate much of the leaching. The cost in terms of lower production might be slightly higher, but the cost-benefit ratio similarly excellent.

Financial support

While most governments have been reluctant to legislate regarding plant nutrients, they have been more willing to provide financial support for various technical measures and management changes. Usually this is done under the agri-environment schemes of the Second Pillar.

The supported measures are of two different types, which are seldom well distinguished, but should be. While both types have potential to reduce nutrient leaching, one does so by improving recycling, the other by passively parking nutrients in the environment or sending N back into the atmosphere. The difference is crucial, since only improved recycling creates the possibility to actually reduce inputs and move toward a better nutrient balance.

Common measures of the passive type are

- buffer strips of permanent grass along water courses
- creation of artificial wetlands
- controlled drainage, periodic flooding
- turning arable land into permanent grassland.

Common measures of the recycling type are

- catch crops, winter plant cover
- spring ploughing (instead of autumn ploughing)
- reduced tilling, direct seeding in stubble
- manure application with direct incorporation in soil.

Although measures of the passive type may be valuable in some situations, especially as a mitigation option in areas with very high local nutrient loads, priority should be given to the recycling type whenever possible. Passive measures should also more often be regarded as a baseline requirement, rather than a service to be paid for. Buffer strips along watercourses is an obvious example, and this has now been realized by the EU, where buffer strips will be a mandatory cross-compliance requirement as of 2012 (EU 2009a).

Bookkeeping systems

Only three EU member states have chosen to implement full-fledged bookkeeping systems for plant nutrients in national legislation. Not surprisingly, these are all countries with very intensive arable farming and high animal densities. In the Baltic Sea region, only Denmark has taken this route, and further south the Netherlands and the French-speaking part of Belgium (Netherlands 2010, Nitrawal 2010).

All three areas have severe problems with nitrate pollution of drinking water and other local effects of heavy N loads. This is probably an important explanation why it has been possible to gather the necessary political support for nutrient bookkeeping, which is a very substantial step up from the soft baseline legislation required by the Nitrates Directive.

In the case of Denmark, pollution of freshwater sources is in fact the dominant environmental issue in the agriculture sector. All of Denmark is classified as a "vulnerable zone" under the Nitrates Directive. Since 1987, a politically negotiated Action Plan for the Aquatic Environment, now in its third incarnation, provides guidance for both national legislation and Denmark's use of EU Second Pillar funds (DK Action Plan 2004).

The nutrient bookkeeping system is regulated by its own legislation (Fødevareministeriet 2004). It contains detailed rules for how balance sheets should be prepared, what nutrient values to use for various forms of manure and other organic fertilizers, as well as reporting requirements and fines for overuse (in the range of EUR 1-2 per kg N, plus cross-compliance sanctions reducing EU direct payments). As the government has the right to check any relevant documentation on-farm at any time, the risk of sanctions is very real.

A nitrogen quota is set for each farm each year, calculated on basis of what crops the farm plans to grow, numbers and

kinds of animals, soil characteristics and several other factors. The quota is set to correspond to 90 % of the economically optimal N application, which under Danish conditions is quite high. The quota can reach up to 230 kg N/ha (under a derogation from the normal maximum of 170 kg/N in the Nitrates Directive). There are also some mandatory technical measures, including catch crops on 6-10 % of farm area, and winter crop cover on at least 2/3 of the land.

The Danish system has been quite successful in reducing N surpluses. According to the Mid-term evaluation of the third Action Plan, surpluses were reduced by around 1/3 in the 20 years from 1988 to 2007, while N use efficiency (kg N in products per kg N applied) was up from 27 to 37 % (Olsen & Vinther 2008).

It is notable that this surplus reduction has been achieved virtually without any effect on production levels – meaning that all that has really been done is to eliminate overuse.

One important factor in the success of the Danish system is its policy of allocating high nutrient values to manure. Values are set on a level that presupposes that the farmer uses best available technology to minimize handling and spreading losses. For example, it is assumed that 75 % of the N content in pig slurry is available to the crop (25 % losses). This policy has driven a complete shift to modern spreading equipment, so that no slurry is applied with old-style broad-spreading machinery (Bæk Jensen 2005).

As of 2008 however, according to the mid-term evaluation, the N surplus is no longer decreasing (DMU 2008).

Advice and training

Expert advice and training is an important but sometimes less visible factor in nutrient management schemes. It seems to be implemented in many different ways. Sometimes, nutrient management measures in rural development programmes are designed as integrated packages, where advice and/or mandatory participation in courses is one component. Estonia and Finland both have variants of this model, where also soil and manure analyses are mandatory.

The Danish nutrient bookkeeping system calls for a mandatory fertilizer plan, which almost invariably is left to an outside consultant to produce. This has created a massive advisory system, producing some 35 000 plans covering 80 % of Danish farmland.

Sweden has chosen an unusual model, relying almost completely on advisory services, provided free of charge. Despite a very large RDP, there is only one measure directly relevant to nutrient management, a per hectare support for planting of catch crops and/or shifting ploughing from autumn to spring. Instead, Greppa Näringen (Focus on Nutrients) was set up as a joint advisory programme between agricultural authorities and farmers' organizations. It has now been running for 10 years and provided individual advice to several thousand farmers, centered on repeated nutrient balance calculations for the farm (Focus on Nutrients 2011).

REDUCED NUTRIENT INPUTS

It is impossible to draw a clear line between measures on nutrient management and measures aiming to reduce nutrient inputs. In fact, when nutrient management measures are successful in reducing nutrient surpluses, input reductions are usually also involved. This is not surprising. If a farm implements a measure that improves recycling, it can reduce nutrient input with the corresponding amount.

For example, the Swedish advisory programme mentioned above estimates it has reduced N surpluses on its participating farms with in total around 1 500 tons, and this corresponds to around 1 200 tons in reduced N input to the farms, in the form of fertilizer and animal feed (Greppa Näringen 2010). Likewise, the mid-term evaluation of the Danish action plan shows that the large surplus reduction of around 175 000 tons N almost exactly corresponds to the reduction in N fertilizer applied (Olsen & Vinther 2008).

However, this section will look at a few options to more directly address input reduction.

Bookkeeping systems

It can perhaps be argued that the Danish bookkeeping system is already a reduction programme, since a large reduction has taken place, and since the quotas are calculated to match 90 % of the economic optimum. On the other hand, the bulk of the reduction so far is clearly only of over-application.

Should the Danish government so wish, however, the system provides a very efficient instrument to implement more substantial reductions. The reporting system generates a dataset which makes it possible to follow the effects of the process in great detail.

As has already been seen, the mechanism of setting a maximum quota also seems to stimulate farmers to meet the challenge with better technology and management, so as to maintain production as well as possible despite lower nutrient levels.

Financial support

Some EU member states have implemented nutrient reduction measures in their Second Pillar agri-environment programmes. In the Baltic Sea region, Estonia and Finland offer payments for reduced N inputs.

However, there are several issues with this type of support. One is that unless there is a reporting system approaching the Danish level of detail, monitoring and enforcement is difficult. Another – which may or may not be seen as a problem – is that the payment tends to attract primarily those farmers who already were on a low-input track, so that little change is achieved. A third is that the cost becomes quite high if every farmer under a certain input level qualifies for the support. On the other hand, only offering the support to farmers who start out with high input and commit to lower it – an option favoured by many economists – would be rightly seen as unfair, in addition to being even more difficult to design and enforce.

Organic agriculture

An existing option which is often not thought of as a nutrient reduction measure is conversion to organic farming. But as every farm which converts to organic reduces its artificial fertilizer use with 100 %, the effect is substantial even though the proportion of organic farms is only 5-15 %.

A recent Swedish study trying to estimate the effect of organic conversion on climate gas emissions also generated some data on nutrient reduction. It was estimated that from 1990 to 2006 conversion to organic farming had reduced total N inputs with 29 000 tons or 61 kg per hectare converted (Cederberg 2009). These are very large figures compared to for example total N fertilizer use in Sweden (160 000 tons in 2006) or to Swedish reduction commitments under the BSAP (20 780 tons reaching the Baltic Sea). They dwarf any other N reduction measure undertaken in Sweden.

Figures from the mid-term evaluation of the Danish action plan confirm the Swedish data. In a comparison between conventional and organic dairy farms, total N input, including biological N fixation, is 66 kg larger per hectare on the conventional farms, and the N surplus 63 kg larger (Waagepetersen 2008)[7].

Taxes

In the past, a few European countries have had fertilizer taxes in the past, including Finland, Norway and Sweden in the Baltic Sea region (ECOTEC 2001). Presently, Denmark

[7] It should be noted that Waagepetersen makes the comparison in a different and rather twisted manner. He recalculates N figures for the conventional farms as if they had the same (lower) animal density as the organic farms – arriving at a much smaller difference. Which perhaps proves that conventional farms could improve considerably by reducing animal density, but not much else.

is the only country in Europe and likely in the world to still have a tax on N fertilizer (OECD 2011). However, there is a general exemption for farmers, so the only ones who pay the tax are Danish homeowners using N fertilizer in their gardens. Sweden until recently had taxes both on N fertilizer and on the cadmium content in P fertilizer, but both were repealed in 2010.

One often cited problem with fertilizer taxes is that the price elasticity of the product is low, around -0.3 according to several estimates (Söderholm & Christiernsson 2008). In plain English, this means that a price increase of 10 % will only reduce sales by 3 %. In other words, a fertilizer tax will have to be very substantial in order to have more than a marginal effect on consumption. The reason for this is simply that fertilizers are inexpensive in relation to existing alternatives.

There is however a solution to this dilemma, which was elaborated in some detail by the Dutch Centre for Agriculture and Environment already 10 years ago (CLM 2001). If the tax revenues are reimbursed to the farming sector, the net effect for agriculture as a whole is zero. Depending on the method of reimbursement, effects on individual farms can vary. With a simple flat rate reimbursement, the effect is simply a redistribution. Every farmer gets an equal amount per hectare, but only fertilizer users pay.

Another model is to use the revenue as financing for some form of agri-environmental programmes. This model was used in Sweden with the recently repealed taxes. Revenues were earmarked for several collective services in the agricultural sector, including agricultural research, the nutrient advisory programme mentioned above, and agri-environmental measures in the RDP.

Several variations on the fertilizer tax have been discussed. One is to widen it to include N in commercial feedstuffs, something which would give an incentive to increased feed self-sufficiency.

A different idea is to tax on-farm N surplus, rather than N inputs. This however requires a nutrient bookkeeping system of the Danish kind, while input taxes have the advantage of being very simple to implement and administer.

Yet another idea is to let the tax target all inputs of new N, including biological N-fixation. In principle, this would more clearly point to the roots of the problem: too much N regardless of source. In practical experience however, the shift from fertilizer to N-fixing plants is usually linked to a substantial reduction in total N input. Conversion to organic production typically involves at least a doubling of N-fixation on-farm, yet total N input decreases greatly. A tax on biological N-fixation might thus prove counterproductive.

CROP ROTATIONS

Better crop rotations are an important component of ERA systems. A well-balanced sequence with a sufficient proportion of N-fixing crops (grass/clover and other legumes such as peas, field beans, vetches and lupins) can supply enough nitrogen for all other crops in the rotation, while the regular shifting of crops helps keep plant pests under control.

Some governments acknowledge the importance of crop rotations in various policy measures, but provisions are rarely specific enough to have a useful effect.

Environmental legislation

A few countries have legislated some very basic crop rotation requirements – in the Baltic Sea region only Estonia and Poland, which both prohibit growing a single crop more than three years in a row.

Financial support

A larger group of governments support improved crop rotations as agri-environment measures, most often with Second Pillar funding, but in some cases with First Pillar funds under Article 68 (Italy, Spain).

In the Baltic Sea region, Estonia, Finland, Germany, and Poland offer crop rotation payments. In most cases, the requirement is only to rotate between a minimum number of crops (3-5), with each occupying at least a specified percentage of the farm area. Any mix of crops will fulfil the conditions.

The "crop diversification" component now proposed as part of the "greening" measures in the CAP First Pillar (see above) follows the same model.

This type of rotation payment is of limited value in terms of nutrient recycling, although it may be beneficial to biodiversity and reduce plant pest problems. For a crop rotation to provide nutrient-related benefits, it must as a minimum include some N-fixing plants, and preferably multiannual grass/clover mixtures which additionally provide the benefits of building soil structure and reducing ploughing/cultivation.

Estonia has included a condition of this type in both its "environmentally friendly management" scheme and in the organic agriculture payment. Both payments require that a crop rotation plan is made – and followed – and this plan must include a minimum of 15 % legume crops or grass/clover.

Several European countries provide a specific support to protein crops – usually to annual legume crops, in a few cases also to multiannual legumes such as lucerne, or to oilseed crops. While the main rationale is to promote increased protein production, replacing soy and other protein feed imports, there is also a positive effect on crop rotations, which may in fact be more important than that of explicit crop rotation payments.

Some of the protein crop payments trace back to the general protein payment which was part of the CAP direct payments until the 2005 reform. This payment could be retained under national flexibility, financed by a reduction in the single payment. In the Baltic Sea region, only Germany has used this option.

Alternatively or as a top-up, protein crop payments can be made under Article 68, an option that both Finland and Poland are using.

Crop rotation payments could probably be developed into a much more useful tool, although it must be noted that they can be complicated to design and enforce. Only specifying percentages for crops is too blunt. Estonia's model with individual crop rotation plans for each farm, plus explicit requirement for legume crops, provides a better starting point, even though it involves more administration.

Present protein crop support schemes could easily be integrated into crop rotation payments, which would bring the additional benefit of making them Green Box compliant.

Organic agriculture

In contrast to the dedicated crop rotation payments, the organic agriculture payments have a very substantial effect on actual crop rotations. This can appear paradoxical, especially as there are usually no explicit crop rotation conditions for organic farming payments (Estonia is the exception). While the EU organic regulation, which provides the baseline for support payments, does require an organic farm to have a "multiannual crop rotation including legumes and other green manure crops", it does not give any more specific indications such as percentages.

In practice however, there is ample data to show that organic conversion leads to great improvements in rotations. This is unsurprising, as it is a well-known fact that a well-designed crop rotation is a prerequisite for achieving good production results under organic management. In other words, the organic system has built-in economic incentives for good rotations.

GRAZING AND PASTURE

Support to pasture and other forms of permanent grassland forms an important part of agri-environment payments in many countries, but these are usually motivated only as biodiversity or cultural heritage measures. The value of grazing on permanent grassland as a resource-efficient animal husbandry system – producing valuable protein with very low inputs and without competing with human food crops for limited arable land – is rarely acknowledged. Nevertheless, existing biodiversity-motivated support systems probably contribute substantially to increasing resource-efficiency as an inadvertent bonus.

The possibility to create support systems which more explicitly combine the two rationales could be further explored. Some attempts in this direction have been made in the past. One example is a scheme proposed in Sweden by one environmental and one organic farmers' organization, which involved using Article 68 to support farms with grazing animals, a high degree of feed self-sufficiency, and a minimum of 30 % grass-clover in the crop rotation (Ekologiska Lantbrukarna & Naturskyddsföreningen 2009).

On a much more basic level, it is important that First Pillar payments are designed to promote a sustainable use of pastures. In the past, national governments have had almost complete flexibility to choose whether to include permanent grassland in direct payments or not (see above). Under the new CAP reform proposals, grassland must be included on equal terms with arable land, but a long transition period will be possible. One of the proposed new "greening" conditions is that existing permanent grasslands must be retained, but this is not clearly linked to inclusion in payments. There are also problems regarding the eligibility of traditional wooded pastures, which under current interpretations are often classified as forest and excluded from the support (EFNCP 2011).

Concluding remarks

A number of specific observations and suggestions have been made in the previous chapter. These will not be repeated or summarized here. Instead, a few more general or more long-term conclusions and reflections will be offered.

POLICY TOOLS ARE AVAILABLE

It is clear from the inventory performed that there is no lack of immediately available policy tools for governments that wish to support a transition toward ERA. Although both WTO and EU memberships come with certain policy restrictions, the national flexibility is in most cases sufficient, and often virtually unlimited.

Many governments already use some of these policy tools, so there is also practical experience with their implementation in national administration – as well as familiarity and wide acceptance among farmers.

COHERENT STRATEGY IS MISSING

What is missing is a coherent strategy to systematically link the various policy tools and extract the many possible synergies. The haphazard implementation of a seemingly random selection of available policy instruments, with frequent inconsistencies between different laws and schemes, reduce the impact and may largely explain why little change has been achieved.

The recent European Nitrogen Assessment makes the exact same observation, although based on a broad review of all N-related policies in Europe, not only those related to agriculture. It notes that most of the N-related environmental targets have not been achieved, and attributes this to the fragmented way N policies have been established (ENA 2011).

One likely reason why this is the case is a lack of understanding of the systemic nature of nutrient-related problems. Most measures and actions are targeted to symptoms, not to causes – probably because causal relationships are not clear to policymakers. A typical example is the focus on manure, rather than on the inputs of new N to the farming system. The link between manure and eutrophication problems is immediately obvious, while the structural link to artificial fertilizer use in a distant region without eutrophication problems is not.

Another likely reason is that the magnitude of the problem – "the greatest single experiment in global geoengineering", according to the ENA – is still underestimated. The fact that N compounds are rapidly accumulating in land ecosystems, much in the same way as greenhouse gases are accumulating in the atmosphere, has not yet been assimilated by policymakers, despite repeated scientific warnings that we may already be outside the "safe operating space" of humanity (Rockström et al 2009).

A third reason why N policies remain largely ineffective is that current agricultural technologies are not fundamentally questioned. Even where nutrient pollution is rampant and large-scale mitigation policies implemented, as in Denmark, the concept of economically optimal fertilization – i e the maximum application which will extract any additional economic return from a field – is the standard from which all calculations start.

As suggested in a recent policy paper from the Greens in the European Parliament, it is time to switch to the opposite principle and instead use the best available technology as the reference point (Greens 2010). This has been standard practice

in many other parts of environmental policy for decades, for example in the elimination of industrial pollutants such as freons or chlorine bleach in paper production. Had industry instead been given payments in return for 10 % reductions of those pollutants, they would no doubt still be around.

It should immediately be added that agriculture differs in many respects from industry, and that structural changes of the kind involved in a transition to ERA are much more complex and fundamental than substituting one chemical for another. This implies that lead times must be much longer, probably on the order of a generation, and that financial support is probably needed, especially to help with major investments. But it does not invalidate the principle.

INCENTIVES TO REDUCE NUTRIENT INPUTS ARE NEEDED

There is a scientific consensus that anthropogenic N and P inputs to ecosystems must be substantially reduced, and that N reductions are the most urgent. Estimates of the reductions necessary vary from a low around 30 %, corresponding to the calculated direct costs of N pollution in Europe, to a high at 75 %, based more on ecosystem science (ENA 2011, Rockström et al 2009). Most of this must happen in agriculture, which is responsible for around 3/4 of anthropogenic N.

This means that direct incentives to reduce nutrient inputs are urgently needed. Present legislation and agri-environment programmes come nowhere near the necessary reduction figures.

The two major policy tools that could be used to achieve this are nutrient accounting systems of the Danish kind, and taxes on nutrient inputs. Accounting systems have the advantage of giving very detailed control over the process, all the way down to individual farm level, but this is also their main disadvantage, since it generates a heavy administrative overhead. For most countries, taxes would probably be the preferred option.

Whether the tax targets fertilizer only, or other nutrient inputs as well, it should be combined with reimbursement, full or partial, to the farming sector. This requires the tax to be higher in order to have effect, but makes it economically neutral for the sector as a whole.

Input taxes are sometimes seen as an alternative to advisory systems or financial support schemes for technical improvements or recycling practices. This is a misconception. The two work very well in common. In fact, economic incentives such as environmental taxes create an increased need for assistance, because they generate more interest in changing behaviour. A tax of the reimbursing model also helps by generating the funds necessary to pay for technical or financial assistance, either by increasing the income of the individual farmer, or the tax money available for agri-environment programmes, or a combination.

ORGANIC FARMING A PROVEN ALTERNATIVE

As this review has illustrated, organic farming is by now a proven alternative model to conventional agriculture, showing better recycling performance by a large margin. It is also the natural stepping stone for farms aspiring to the more ambitious ERA status.

Yet, it is somewhat surprising to see that organic conversion also achieves so much better results in terms of nutrient surpluses and improved crop rotations than support schemes specifically designed for those purposes.

Add to this that supporting organic farming is very cost-effective, because well-developed organic markets pay a large part of the farmer's added cost. Then also consider the various benefits not directly related to nutrient recycling, such as improved animal welfare and complete elimination of chemical herbicides and pesticides.

The obvious conclusion is that no matter what other policy measures are chosen, they should be always be combined with increased efforts to expand organic agriculture.

At the same time, the possibilities to differentiate organic support systems to reward improved recycling practices, above the baseline organic standard, should be explored.

MEMBER STATE CONSENSUS FORMS THE CAP

Each time a new CAP reform is approaching, there is a flurry of lobby activity focused on Brussels. Although understandable, this reveals a basic misunderstanding of how European policy development works. Although the CAP is a top-heavy, centralized structure, its governance is not top-down but bottom-up. It is member state consensus that forms the CAP.

EU Commissioners, like ministers in national governments, have their own agendas and try to further those by creating the necessary alliances with different actors in their field. But for a Commissioner, there is a definite limit to what can be achieved, and that is the 27 national governments forming the EU Council. No Commissioner will ever table a proposal unless it can be expected to have a reasonable chance of attracting a majority in Council. These dynamics have changed to some extent since Parliament was granted co-decision rights, but not much, as EU parlamentarians now are increasingly linked to their national governments and reflect their priorities, tending to make Parliament into a mirror of Council.

When it comes to CAP reform, environmental aspects included, Agriculture Commissioners almost invariably have higher ambitions than the Council majority. This means that the limiting factor is not what the Commissioner would like to propose, but what she judges will have a chance of passing Council.

Influencing CAP decisions is thus much more a matter of influencing national governments than of influencing the Commission. It is also a much more long-term task than usually realized. Governments start discussing a reform with the Commission long before the first Communication is issued, because once that is tabled, the broad outline of a reform is already locked down. The rest of the process is about details, and that is where the current reform stands as this is written in January 2012.

This is not to say that details are unimportant, but that expectations should be realistic. In terms of environmental improvements, this reform proposal is probably the least ambitious one of the past 20 years. There is every reason to try and influence the outcome so that at least the flexibility for member states to have higher national ambitions is preserved.

For more substantial changes however, it is the member state consensus that needs to be shifted, and that will not happen through short-term lobby campaigns, only through sustained dialogue over long periods.

The power of example is important here. Very often, new elements in the CAP are first tried out on a voluntary basis by one or a few member states, and later made into mandatory policy. Two recent examples are the extension of the single payment to grassland – voluntary now, mandatory in the new proposal – and the protective buffer strips along watercourses, previously an option in agri-environment schemes, from 2012 a compulsory part of cross-compliance.

BALTIC SEA REGION CAN LEAD THE WAY

Although EU member states have considerable flexibility to promote environmental measures in agriculture through legislation or financial support, governments are often reluctant to introduce measures which put additional demands or financial burdens on domestic farmers, not present in neighbouring states. The EU market for farm products is completely integrated, and any additional requirement on domestic farmers translates into a corresponding advantage for imported goods.

The best way to avoid this problem is that the measure is introduced on EU level, so that the impact is equal in all parts of the common market. But as noted above, this is not always easy to achieve.

There is also a middle alternative, and that is to introduce

the measure in national legislation, but coordinate with some neighbouring EU members so that the same measure is introduced in a block of countries, rather then just in one. This is easier to organize, and often provides a reasonable measure of market protection, as much of food trade is in fact between neighbouring countries.

When it comes to introducing measures in support of recycling agriculture, the Baltic Sea region is in a very good position to lead the way and take common action along those lines. There is already a strong political agreement to substantially reduce nutrient losses from agriculture to the Baltic (BSAP). The agreed reductions are not happening, so there is also an urgent need for additional action. Furthermore, agriculture in the Baltic Sea region is reasonably homogenous in terms of climate, crops and products, so that it would be possible to find a set of measures which could be implemented in the same or similar ways in all participating countries.

Ideally, an agreement should involve all HELCOM members, Russia included, and possibly some of the other governments in the catchment area as well. But it would be quite possible to start with a smaller group. Since there is already a well developed cooperation mechanism, a programme should be possible to negotiate within 2-3 years.

If such an initiative is successfully launched, it will also be an excellent basis for influencing the next CAP reform. Being able to show a working concept, and acting jointly as an EU subregion, the Baltic Sea states would then be in a position to exercise leadership and extend their policies to the EU as a whole.

RESOURCE SCARCITIES DEFINE LONG-TERM PROSPECT

Although the remit of this paper was to look at policy measures possible to implement within a 5-10 year time-frame, it seems appropriate to end with a reminder of the broader perspective.

Over the past few years, several international studies have reviewed the future prospects of world agriculture and arrived at remarkably similar conclusions. In short, they tell us that present agricultural technologies depend on resources which will become increasingly scarce, such as fossil energy and phosphate rock, but also that the environmental effects of business-as-usual agriculture are destabilizing the very ecosystem services that form the basis for agriculture as a biological support system.

Most of these studies have had a global focus. This was true for the World Bank-sponsored International Assessment of Agricultural Knowledge, Science, and Technology for Development, the Millennium Ecosystem Assessment, and the report from the UN Environment Programme called *The Environmental Food Crisis* (IAASTD 2009, Millennium Ecosystem Assessment 2005, UNEP 2009).

A recent study however covers the same ground for the first time from a European perspective. Called *Sustainable food consumption and production in a resource-constrained world*, it was commissioned by one of the advisory committees of the EU Commission, the Standing Committee on Agricultural Research (SCAR 2011a).

If anything, the SCAR report is more outspoken than any of the previous ones. While nominally concerned with agricultural research priorities for the EU, what it in fact does is argue for a complete change of perspective in European agriculture, from what it calls the “productivity narrative” to a new “sufficiency narrative”. As resource scarcities will define the future of agriculture, further increasing productivity is not a possible response. What is needed is “drastic change” in both food production and consumption, to move away from the resource-consuming Western diet and create agro-food systems where “efficiency and resilience are the new priorities over production levels”. This, in very short summary, is what the study recommends as the future focus for EU agricultural research.

While this is remarkable in itself, even more remarkable is that the full SCAR committee, consisting of government officials from the 27 EU member states, by and large endorses the study conclusions, including the recommendation that "research into agro-ecological approaches, nutrient and water management, and replacement of energy intensive inputs are priorities" (SCAR 2011b).

It would be naive to interpret this as evidence of an impending complete turnaround in EU agricultural policy. But what it does indicate is that the political landscape is shifting very fast, and that something which 5-10 years ago was regarded as an extreme minority opinion is now well on its way to becoming the mainstream worldview.

Acronyms and abbreviations

AoA	The WTO Agreement on Agriculture
BSAP	The HELCOM Baltic Sea Action Plan
CAP	The Common Agricultural Policy of the European Union
EAFRD	The European Agricultural Fund for Rural Development (funds the Second Pillar of the EU CAP)
EAGF	The European Agricultural Guarantee Fund (funds the First Pillar of the EU CAP)
EEA	The European Economic Area (the EU plus Iceland, Liechtenstein, and Norway)
ERA	Ecological Recycling Agriculture
EU	The European Union
EU12	The 12 post-2004 EU member states (Bulgaria, Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia)
EU15	The 15 pre-2004 EU member states (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxemburg, Netherlands, Portugal, Spain, Sweden, United Kingdom)
EU27	The 27 current EU member states
GATT	The General Agreement on Tariffs and Trade
HELCOM	The Helsinki Commission (governing body of the Helsinki Convention on protection of the marine environment of the Baltic Sea)
N	Nitrogen
P	Phosphorus
RDP	Rural Development Programme (part of the EU CAP)
SCAR	Standing Committee on Agricultural Research (an advisory committee to the European Commission DG Research)
SCOF	Standing Committee on Organic Farming (an advisory committee to the European Commission DG Agriculture)
UN	United Nations
UNEP	United Nations Environment Programme
WFD	The EU Water Framework Directive
WTO	The World Trade Organization

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