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Agenda 21 for the Baltic Sea Region

SUSTAINABLE DEVELOPMENT OF THE AGRICULTURAL SECTOR IN THE BALTIC SEA REGION

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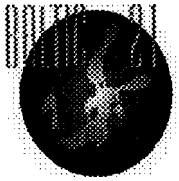

Agenda 21 for the Baltic Sea Region
Sector report - Agriculture

Contents

Foreword

The mandate to develop an Agenda 21 for the Baltic Sea Region (Baltic 21), with the objective Sustainable Development, stems from the Heads of Government of the region and the meeting of Ministers for Foreign Affairs of the Baltic Sea Region, within the framework of the Council of the Baltic Sea States (CBSS), including the European Union. Because of this, Baltic 21 comprises all Nordic countries and all other countries around the Baltic Sea. For the Russian Federation only the north-western part is included. The European Union is also a participant in the elaboration of Baltic 21.

Baltic 21 was officially launched by the Ministers of Environment in October 1996 in Saltsjöbaden and the Saltsjöbaden Declaration provides the terms of reference for the Baltic 21 set-up and process. In their back-to back meeting, the Ministers responsible for spatial planning in the BSR also decided to concentrate work on sustainable development, and in particular to integrate relevant activities with the Baltic 21 process.

Baltic 21 is a democratic, open and transparent process. It is steered by the Senior Officials Group (SOG), with members from the Governments of CBSS and the European Commission, NGOs, intergovernmental organisations like HELCOM, VASAB, International Baltic Sea Fishery Commission (IBSFC), Nordic Council of Ministers and the international development banks (World Bank, EBRD, EIB, NIB, NEFCO). Ail Baltic 21 documentation; back ground documents, SOG meeting reports, workshop reports, draft texts, are published on the Baltic 21 website (http://www.ee/baltic21).

The emphasis of Baltic 21 is on regional co-operation and on the environment and its bearing on economic and social aspects of sustainable development. The work focuses on seven sectors of crucial economic and environmental importance in the region. For each sector, goals and scenarios for sustainable development have been elaborated, as well as action programmes including time frames, actors and financing. The responsibility for the sector work is distributed among the SOG members. The seven sectors and their lead parties are: Agriculture (HELCOM and Sweden), Energy (Denmark and Estonia), Fisheries (IBSFC), Forestry (Finland and Lithuania), Industry (Russia and Sweden), Tourism (Estonia, Finland and Baltic Sea Tourism Commission) and Transport (Germany and Latvia). Work on the Baltic 21 initiative has involved some 300 persons in the region.

All sectors have presented their work in a sector report. This report is a result of the work carried out in the agriculture sector. All Baltic 21 countries, Belarus and the following organisations; Central Union of Agricultural Producers and Forest Owners, Finland, Coalition Clean Baltic, European Commission, Federation of the Swedish Farmers, HELCOM, Nordic Council of Ministers, and VASAB have participated in this work. The sector reports, and other working papers produced by, i.a., VASAB, IFIs, the European Commission and Baltic Local Agenda 21 Forum constitute the background for the integrated and comprehensive Agenda 21 for the Baltic Sea Region. These reports are, however, not an integral part of the Agenda 21 for the Baltic Sea Region. The Agenda has been adopted by the Council of the Baltic Sea States and will be reported to the Prime Ministers of the region at their next summit.

7. Summary of the Baltic 2 I-Agricultural Sector Report

Introduction

The agricultural sector is vital for all the countries in the Baltic Sea Region. One of the most important issues for the state of the Baltic Sea is high contents of nutrients, such as nitrogen and phosphorus. Algal blooming during the summer, areas with no or low levels of oxygen and negative effects on fish, seals and other species have been reported. Agriculture is the largest anthropogenic source of nutrient input to the Baltic Sea. In average, agriculture is estimated to account for 30-35 % of the nitrogen load and IO-I 5 % of the phosphorus load. Agriculture affects the environment both by diffuse and point pollution and is one of the most important sources to pesticide residues in the environment.

Background (Chap. 21

Heads of the governments of the Baltic Sea States met in Visby on 3-4 May, 1996 to affirm their support for the process of co-operation within the framework of sustainable development, sustainable management of natural resources and protection of the environment in the Baltic Sea Region. The prime ministers invited the Baltic Sea States to elaborate an Agenda 21 for the Baltic Sea Region (Baltic 21).

The Action Programmes concerning i.a. strengthening of the environmental protection were adopted by the Ministers of Foreign Affairs in Kalmar on 2-3 July, 1996. These Action Programmes call inter alia for urgent action in order to reduce nutrient emissions and leakage to a level consistent with the goal to restore the ecological balance of the Baltic Sea.

During the informal meeting at Saltsjbbaden on 20-21 October, 1996, the work concerning the elaboration of an Agenda 21 for the Baltic Sea Region, the Baltic 21 was launched by the Ministers of Environment of the Baltic Sea States. Agriculture was one of the seven relevant sectors (Agriculture, Energy, Fishery, Forestry, Industry, Tourism, Transport) where a path towards sustainable development should be identified. First proposals were presented concerning the organisation of the Agenda 21 for the Baltic Sea Region (BSR). A Senior Officials Group (SOG) was formed to closely monitor, contribute to and steer the process of developing the Agenda 21 for the BSR. All countries and other actors were invited to contribute to the work.

The results of the work within the sectors will be presented as a sector report containing a definition of goals for achieving sustainable development, an evaluation of activities relevant to sustainable development undertaken so far and identification of obstacles and gaps, scenarios for the key sectors indicating a path to sustainable development and associated policy changes implied. An action programme for sustainable development, including targets, monitoring methods, time frames, actors and financing should also be a part of the sector report

At the HELCOM 18 Meeting it was decided that HELCOM will take the lead for the agricultural sector in co-operation with a Lead Country. In May 1997 Sweden decided to share the responsibility with HELCOM as the Lead Country for the agricultural sector.

The countries that are involved in the Action Programme are almost the same countries that are included in HELCOM's area (but are not necessarily Contracting Parties to the Convention): namely Belarus, Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Sweden and the Russian Federation with the Leningrad region, the Kaliningrad region and the oblasts of Pskov, Karelia, Murmansk and Arkangelsk. The Czech Republic, the Slovak Republic as well as Ukraine have non been involved in the Action Programme.

Agriculture in the Baltic Sea *Region (Chap. 3)*

The agricultural sector is vital for all the countries in the Baltic Sea Region. Especially in the countries in transition and Poland, the population is to a large extent involved in agriculture, living in rural areas and the population is an important base for rural development. Agriculture comprises many different types of activities, such as animal and plant production, as well as local processing, distribution and combinations with e.g. forestry, tourism and other sectors. Farming is not sustainable if the farmers can not make their living in rural areas.

The climatic and soil conditions for agriculture within the Baltic Sea Region vary greatly from a mild climate and high production potentials in e.g. parts of Denmark, Germany and Poland to very harsh arctic conditions and low production potentials in northern Finland, Russia and Sweden. A viable agricultural sector is an essential part of the sustainable society by guaranteeing a basic food supply, sheltering many of the terrestrial species and by being a base for sustainable development for the future through e.g. recirculation of plant nutrients and organic matter between urban and rural areas.

On-going activities (Chap. 4)

In the agricultural sector there are certain elements that have a great influence on the sector. For the EU countries the most important are EU's legislation and policy including the Common Agricultural Policy, the 5th Environmental Programme etc. These are to some extent already of importance even for the EU-applicant countries in the preparations for membership. Bilateral action programmes and agreements, as well as binding conventions, such as the Convention on the Protection of the Marine Environment of the Baltic Sea Area, the Helsinki Convention, also influence the sector. In 1988 the Ministerial Declaration of HELCOM launched inter alia a 50% reduction target of the total nutrient input to the Baltic Sea by 1995. Measurements have so far shown that the 500/6 reduction target was most likely not met by the EU countries in 1995. Difficulties in assessing the effects of implemented measures exist, due to a significant time lag that affects the soil and sea systems depending on the mineralisation of stored nitrogen in the soil, erosion of soil including phosphorus and many other processes in these systems. In the area different countries are involved in many bilateral projects of importance for sustainable agriculture. The projects exist at varied levels. Several countries have programmes to promote organic agriculture, as one way of achieving a more sustainable agriculture.

Problems for the agricultural sector (Chap. 6, 7 and 8)

Regions and farms with a high livestock density and/or high inputs of fertilisers, as well as inappropriate agricultural management, can often be a serious environmental threat. The main challenges are to reduce the negative effects of agriculture on the Baltic Sea, by reducing the pollution by nutrients which to a large extent originates from animal production and improper use of fertilisers and by reducing the risks in connection with the use of plant protection products, as well as developing and maintaining bio-diversity. Great differences exist between the countries that are members in the EU and the countries in transition and Poland. In the EU countries point sources in connection with manure handling have been in focus for environmental action programmes for a couple of decades, as well

as more recently also diffuse sources. On the other hand, in the countries in transition and Poland, an immediate problem today is nutrient point sources, due to insufficient or non-existing manure storages and often large animal holdings. Even here diffuse pollution is a problem.

Nitrogen losses are basically correlated to the total turnover of nitrogen in the system and different corrective measures in crop production practices have so far not been proven enough to reduce the nitrate losses to acceptable levels for the water environment. Efficient tools to effectuate the reduction are important.

Modern agriculture also relies on imported feed and non-renewable fossil fuel and finite phosphorus resources. The specialisation of agriculture has greatly increased the transportation of commodities and agricultural products. Also large differences exist between countries and regions in economic conditions and infra-structure in rural areas. This means that measures necessary for sustainable development are not always the same within the entire Baltic Sea Region. As there is a large lack of education and knowledge on sustainable agriculture, it is necessary with education, advisory service and training in the whole region, but particularly for the new family farms in the countries in transition and Poland. Throughout the whole Baltic Sea Region, there is a need of developing and demonstrating more sustainable agricultural systems. Appropriate monitoring systems and the proposed indicators of sustainable development are indispensable tools to evaluate the progress towards the set-up goals of sustainable agriculture.

NON-SUSTAINABLE ISSUES

The most urgent non-sustainable issues for sustainable agriculture are:

Production

- **Contaminants and residues in food**
- **Unfavourable market conditions for agricultural production**
- **Excessive livestock density**

Natural resources

- **Dependence on fossil energy**
- **Low efficiency of energy use in agricultural production**
- **Dependence on non-renewable phosphorus deposits**
- **Lack of water and of high water quality**
- **Nutrient losses (N and P) to the environment**
- **Decrease in soil fertility (acidification, carbon content, nutrient status, structure, compaction, salinisation)**
- **Erosion**
- **Pesticide residues in soil, water and non-target organisms**
- **Accumulation of heavy metals and nuclides**
- **Soil contamination with persistent organic and inorganic substances**
- **Loss of biodiversity and genetic resources**
- **Air pollution (NH_3, CH_4, N_2O, pesticides)**

Human and animal welfare

- **Occupational threats to farmers and consumers health**
- **Dependence on growth promoters and antibiotics in animal production**
- **Unfavourable animal welfare and threats to animal health**

Socio-Economic criteria

- **Unfavourable economical profitability of farming**
- **Lack of food security and food production security**

- **Unfavourable social infra-structure in rural areas**
- **Lack of preservation of nature and historical values**
- **Urbanisation**

Competence - Education

- **Lack of education, information and management skill**

Definition and goals of sustainable agriculture (Chap. 6)

Agriculture contributes significantly to the society of the future. Sustainable agriculture is the production of high quality food and other agricultural products/services in the long run with consideration taken to economy and social structure, in such a way that the resource base of non-renewable and renewable resources is maintained. Important sub-goals are:

1. **the farmers income should be sufficient to provide a fair standard of living in the agricultural community**
2. **the farmers should practise production methods which do not threaten human or animal health or degrade the environment including biodiversity and at the same time minimise our environmental problems that future generations must assume responsibilities for**
3. **non-renewable resources have to gradually be replaced by renewable resources and recirculation of non-renewable resources maximised**
4. **sustainable agriculture will meet societies needs of food and recreation and preserve the landscape, cultural values and the historical heritage of rural areas and contribute to create stable well developed and secure rural communities**
5. **the ethical aspects of agricultural production are secured.**

BASIC CRITERIA FOR ANALYSIS OF SUSTAINABILITY

The term "criteria" is defined as values or services that are of fundamental importance for the economy and a long lasting and healthy society with respect to agricultural production and natural resource conservation. The following criteria are in focus:

Production

- **Food and biomass supply**
- **Food quality**

Natural resources

- **Arable soils: quality, productivity and fertility, erosion**
- **Landscape: biodiversity, agrodiversity, cultural values, recreational values**
- **Water: quantity and quality**
- **Air: quality**
- **Use of non-renewable resources**

Human and animal welfare

- **Health of producers and consumers**
- **Animal welfare**
- **Recreational values for society**

Socio-Economic criteria

- **Economy of the farmer**
- **Social infra-structure in rural areas e.g. education, health care, shops, transport**

Competence - Education

- **Farmers education**
- **Consumers education**

INDICATORS FOR MEASURING SUSTAINABILITY

An indicator can be defined as a parameter or a value derived from parameters, which provides information about a phenomenon. Indicators can provide information, assist policy makers and contribute to monitoring and evaluation of the efficiency of policies in promoting sustainable agriculture.

Driving Force - State - Response Framework

The framework for analysing agri-environmental linkages and developing agri-environmnetal indicators (AEIs) is called the Driving Force-State-Response (DSR) framework (OECD Environmental Indicators for Agriculture, 1997). This framework takes into account the specific characteristics of agriculture and its relation to the environment, as well as the consideration of agriculture in the broader context of sustainable development.

Driving forces are those elements which cause changes in the state of the environment and can be both beneficial and harmful. The state or condition of the environment in agriculture, refers to changes in environmental conditions that may arise from various driving forces. The impact of agriculture on the environment can occur both on and off the farm. Responses refer to the reaction by groups in society and policy makers to the actual and perceived changes in the state of the environment in agriculture, the sustainability of agriculture and to market signals.

Many different indicators are proposed in the agricultural sector report. Some indicating the status of several criteria. Other indicators can be regarded as efficiency indicators. Examples are ratio-indicators such as input of nutrients versus output via nutrients removed and similar ratios for the use of pesticides and energy. The proposed indicators should be further elaborated in the implementation phase of Baltic 21 and measurable goals defined for specific years, e.g. 2010 and 2030.

Scenarios and consequences (Chap. 7 and 8)

It was decided that the scenario was mainly to be based on a summary of existing knowledge, from earlier studies, literature and professional experience as well as to a minor degree on an explanatory and guiding model analysis regarding nitrogen and phosphorus. A strict scenario approach for all 10 involved countries, with mathematical analysis of consequences, was not considered to be possible within the framework of this project. Within the model analysis it was only possible to go into depth regarding the environmental issues of sustainable development, although the social and economical issues are just as important and are a prerequisite for sustainable agriculture. As the nitrogen and phosphorus load from agriculture to the Baltic Sea including ammonia emissions to the atmosphere are some of the most important non-sustainable issues for agriculture, the model was run against the sustainability goal of 50% reduction of nitrogen, phosphorus and ammonia losses and gave the maximum production of food and fodder possible without exceeding the goals. Business as usual was also modelled.

Measures were identified in three areas, sustainable agricultural structure, sustainable farm management concerning nutrient losses and additional measures. The scenario shows that less arable land and fewer animals will be needed in the future to provide the needed amounts of food and feed, due to greater efficiency in production, improved management and more sustainable technology. Opportunities to increase agricultural production of energy- and industrial crops, other types of bio-energy, etc. on excess arable land will be

obvious. This will also be of great importance to develop the infra-structure and employment in rural areas. The changes are bound to be larger in the countries in transition and Poland than in the rest of the Baltic Sea Region. The implementing of action programmes with efficient measures is an important component to reach sustainable agriculture for the entire Baltic Sea Region.

Action programme (Chap. 9)

The action programme for the agricultural sector consists of nine different Programmes supported by seven Actions. In all the programmes legislation, information, education, research and development, as well as instruments of control could be included. The Programmes should have clear goals that continuously should be monitored and evaluated. The Programmes below have not been ranked and no consideration has been taken to the relative importance of each programme when listing them. The Actions are used to implement the Programmes. In the Agricultural sector report the most important elements in all of the proposed programmes are described.

Programmes for the Agricultural sector

1. **Programmes to reduce the nutrient losses from agriculture**
2. **Programmes to reduce the risks connected with the use of plant protection products**
3. **Programmes to protect ground and surface water for drinking water purposes in agricultural areas**
4. **Programmes to preserve agricultural productivity for production of high quality food and feed**
5. **Programmes to maintain and develop biodiversity and rural landscapes**
6. **Programmes to reduce the usage of growth promoters and antibiotics in agriculture and to promote animal health**
7. **Programmes to develop rural infra-structure and to promote a high quality of life in rural areas and the economic conditions of sustainable agricultural production**
8. **Programmes to promote the development of new production alternatives for arable land**
9. **Other measures for sustainable development in agriculture (measures regarding transport logistics, markets for sustainable produce, genetically modified organisms, the greenhouse effect)**

Actions for the Agricultural sector

The agricultural sector proposes seven actions for the implementation of the programmes. The actions are ranked according to the following and are general throughout the entire Baltic Sea Region, no consideration has been taken to the fact that there is a larger need of some of the actions in specific countries. The actions are ranked into three groups, where the first priority is the most important and in this case the difference between first and second priority was minor.

Priority 1.

Action *1: Education and training*

This action relates to all sub-goals. Education, training and information is one of the most important actions in the action programme and both farmers and consumers are important target groups. The farmers in all countries are dependant on adequate education and training to be able to practice production methods that will lead to sustainable agriculture. Especially in the countries in transition and Poland, where the tradition of family farming is recent, a great need of educating the farmers has become evident. To be able to do this, institutional strengthening, applied research, demonstration trials and a well functioning extension service and funding for all of these mentioned components, as well as investments in education and training are necessary. Even the consumers should be

informed to be able to make decisions that will promote sustainable development in their everyday life.

The main actors will be the agricultural schools, the extension services, universities and research institutes, as well as governmental Ministries and possibly the EU. Industries, the market, the farmers' organisations and non-governmental organisations, NGO's have interests here. Education and training could be financed with EU's funds (CAP, environmental, TACIS, PHARE, structural funds). Governmental sources should also be of importance. International financing institutions, IFI's could also be interested in the demonstration watersheds. In the EU countries education programmes financed by the EU's agri-environmental programmes within the CAP are currently running. In the countries in transition and Poland, some education and training has been included in bilateral projects. Much larger efforts, as a large general investment on education on sustainable agriculture, will be needed in the countries in transition and Poland for the next 10 years. Education and training must be a necessary part of the entire time span of the Baltic 21 programme and all countries must be involved. For monitoring the proposed indicators should be elaborated further and implemented.

PRIORITY 2.

Action *2: Create demonstration watersheds with demonstration farms in a network in the different countries.*

This action can relate to all sub-goals. It is of utmost importance to demonstrate to the farmers and public what sustainable agriculture is and how it can be performed under different conditions. At least one demonstration watershed should be established in every country, in larger countries with varying conditions the demonstration watersheds should be able to show sustainable agriculture in the most important agricultural regions of the country.

The most important actor will be the farmer. A national team of experts in each country is recommended to implement the work in the country on the demonstration watersheds. The team will consist of experts from agricultural schools (education and training, demonstrations), advisory service (education and training, demonstrations, applied research), research institutes and universities (monitoring, applied research, education), as well as ministries (legislation, agro-environmental policy, support). The co-ordinating function will co-ordinate the activities taking place in the demonstration watersheds, as well as transferring knowledge.

Potential interested parties for financing are the World Bank and the Nordic Environment Finance Corporation. NGO's, such as UN Volunteers are also interested. Governmental funding as well as intergovernmental funding is possible. EU's agricultural funds, such as funding for demonstration farms mentioned in EU's regulation 2078/92 and the EU's structural funds could be used. Bilateral support will be important for the countries in transition and Poland.

The time frames will of necessity differ between the western countries and the countries in transition and Poland and the development will take place according to every country's abilities. In all countries the first step will concern the choosing of suitable watersheds with demonstration farms. Necessary investments in the watersheds and on the farms, such as the building of sufficient manure storage, investments in water monitoring equipment and facilities, possible investments in environmentally friendly technology, as well as the building of an education room should also be performed during the first two years. In the

countries in transition and Poland one of the most important issues to be taken care of during the first years, is the livestock density of all areas, as there now exists a one time chance for adjustments, as the transition to family farms is taking place at the same time. Building manure storage, teaching proper soil tillage, improving feed utilisation in animal production and transferring knowledge on sustainable agriculture should continuously take place during the time span of the Baltic 21, with a larger investment during the first 10 years. Some of these actions are included in the HELCOM Annex III "Prevention of pollution from agriculture" and a preliminary date has been set for the implementation but it is likely to be changed. This date differs between the EU countries (at the latest on the 1 January 2002) and the countries in transition and Poland (before the 1 January 201 1). Education and training should start as soon as possible for the farmers and monitoring of environmental quality as well. Demonstrations and research should also be started in the near future.

A major task in the demonstration watersheds will be to monitor the changes in water quality in the catchment area and also to monitor other agro-environmental parameters. The proposed indicators could be used after further development.

PRIORITY 3.

The remaining four actions were found to be equally important and are therefore not ranked. Details on actors, financing, time frames and monitoring methods can be found in the sector report.

Action *3: Establish a Co-ordinating Function for Sustainable Agriculture in the Baltic Sea Ca tchmen t Area.*

This action ensures that the action programme will be carried out and will encompass the entire span of different programmes, projects and other actions that are proposed, as well as all the sub-goals. The co-ordinating function will be able to provide the initiative and knowledge to start, develop, support, assist, implement and monitor the actions and programmes. The responsibility of running the programmes and demonstration watersheds will lie within the countries. At the same time, the co-ordinating function will provide possibilities of co-ordinating the work in the different countries, co-ordinating the monitoring and also of adapting the programmes and projects according to the progress that will be reached within sustainable development in agriculture. The co-ordinating function should be placed with some other suitable institute within the Baltic Sea Area, such as HELCOM, a research institute, university or some part of the EU commission. This function could also be located together with similar groups from other Baltic 21 sectors, e.g. forestry. The participating countries are invited to together promote and share the responsibilities and assets of the establishment of a co-ordinating function for sustainable agriculture.

Action *4. Develop a "Virtual Research Institute" for sustainable agriculture based on the already existing NOVABOVA in the Baltic Sea Region.*

A network of research institutes and universities in the form of a "virtual research institute" should be established to be able to promote and co-ordinate research concerning sustainable agriculture. This action could be linked to the already existing NOVABOVA (NOVA - the Nordic Forestry, Veterinary and Agricultural University and BOVA - the Baltic Forestry, Veterinary and Agricultural University). Relevant research programmes to further develop the concept of sustainable agriculture, monitoring and indicators should be elaborated and implemented.

Action *5. Elaborate and implement agro-environmental legislation and policies*

The elaborating and implementation of agro-environmental legislation and policy is a part of the entire action programme for sustainable agriculture, both at the intergovernmental and governmental level and relates to the entire goal of sustainable agriculture. The legislation and policies in all countries must be adapted and improved towards sustainable development to be able to achieve sustainable agriculture.

Action 6. *Institutional strengthening for sustainable agriculture*

Institutional strengthening is a prerequisite for education and training for sustainable agriculture and applies mainly to sub-goals 2 to 5. The target group is all organisations involved in the education and training of farmers, agricultural students and advisory specialists, such as research institutes, universities, advisory service centres and agricultural schools etc.

Action 7. *Develop support (knowledge, financial) to the countries in transition and Poland*

The countries in transition and Poland need support to be able to improve their agriculture towards sustainable development. This action relates to the whole goal of sustainable development. Support, both as transferring of knowledge and financial, will be needed for the building of manure stores, to purchase environmentally friendly technology, to implement agri-environmental legislation, to implement the Code of Good Agricultural Practice etc.

On top of the agricultural actions and programmes, three actions are proposed that are not specific for the agricultural sector.

TRANS-SECTORIAL ACTION

The recirculation of nutrients and organic matter in urban bio-wastes to the production of biomass on arable land should be promoted.

A plan on how this goal can be achieved should be elaborated by the participating countries, the Union of the Baltic Cities and other interested parties.

CROSS-SECTORIAL ACTIONS

Promote the development and production of energy crops and bio-energ y production.

A programme to increase the production of energy crops and of bio-energy to replace fossil fuel and create new employment in rural areas should be elaborated. This action will also involve the forestry and energy sectors.

Elaborate diversification and rural development programmes.

Diversification and rural development programmes to create employment, conditions to improve rural infra-structure and to stabilise the economy base in rural areas should be elaborated by the participating countries. This action could involve the tourism, fishery, energy and forestry sectors.

2. The Task - An Introduction

Background

One of the most important issues for the state of the Baltic Sea is high contents of nutrients, mainly nitrogen and phosphorus. Algal blooming during the summer, areas with no or low levels of oxygen and negative effects on fish, seals and other species have been reported. In this aspect agriculture is one of the most important sources to nutrient losses and also to pesticides in the environment. Agriculture affects the environment both by diffuse and point pollution. Point sources from agriculture are usually connected to animal production and regard nitrogen and phosphorus from animal housing, manure handling and storage, ammonia emissions and milking parlours, as well as from rural habitations. Point pollution in connection with plant protection products exists i.e. when filling or cleaning sprayers, with careless handling of pesticides. Diffuse pollution is mainly connected with loss of nitrogen and phosphorus from arable land, as leaching or surface run-off, erosion or as wind driven dispersion or leaching of pesticides.

President y declaration in Visb y

The heads of the governments of the Baltic Sea States met in Visby on 3-4 May, 1996 in the presence of the President of the European Council and the President of the European Commission. They affirmed their support for the process of co-operation in the Baltic Sea Region. One of the main areas of discussion was strengthened environmental co-operation, which should be implemented through special action programmes to be elaborated by the Council of the Baltic Sea States (CBSS). They confirmed that the essential objective of the Baltic Sea co-operation is the constant improvement of the living and working conditions of their peoples within the framework of sustainable development, sustainable management of natural resources and protection of the environment. The prime ministers also invited the Baltic Sea States to elaborate an Agenda 21 for the Baltic Sea Region (Baltic 2 1).

Council of the Battic Sea States, 5* Ministerial Session in Kalmar

The Action Programmes concerning i.a. strengthening of the environmental protection were adopted by the Ministers of Foreign Affairs in Kalmar on 2-3 July, 1996. These Action Programmes call inter alia for urgent action in order to reduce nutrient emissions and leakage to a level consistent with the goal to restore the ecological balance of the Baltic Sea. Environmental protection should be an integral part of agricultural policies and priority will be given to the implementation of HELCOM 15 Ministerial decisions as well as other relevant decisions and recommendations on measures to limit the environmentally adverse impact of agriculture on the Baltic sea. The introduction of good agricultural practices as well as the elaboration of an Annex on agriculture to the Helsinki Convention has been proposed.

Saltq3baden declaration

During the informal meeting in Saltsjijbaden on 20-21 October, 1996, the work concerning the elaboration of the Baltic 21 was launched by the Ministers of Environment of the Baltic Sea States. The provisions and modalities of the task were laid down in the Ministerial Declaration of the meeting. Agriculture was one of the relevant sectors where the development should go towards sustainable development. In total, seven sectors were selected:

- **Agriculture**
- **Energy**
- **Fishery**

- Forestry
- Industry
- Tourism
- Transport

First proposals were presented concerning the organisation of the Agenda 21 for the Baltic Sea Region (BSR). It was stated that the Agenda 21 document could cover i.a. the following elements:

- **Definition of goals for achieving sustainable development, taking into account existing mechanisms**
- **Evaluation of activities relevant to sustainable development undertaken so far and identification of obstacles and gaps**
- **Scenarios for the key sectors indicating a path to sustainable development and associated policy changes implied**
- **Action programme for sustainable development, including targets, monitoring methods, time frames, actors and financing**

A c tom

A Senior Officials Group (SOG) was formed to closely monitor, contribute to and steer the process of developing the Agenda 21 for the BSR. All countries and other actors were invited to contribute to the work.

At the HELCOM 18 Meeting it was decided that HELCOM will take the lead for the agricultural sector in co-operation with a Lead Country. In May 1997 Sweden decided to share the responsibility with HELCOM as the Lead Country for the agricultural sector. In Sweden the Ministry of Agriculture was appointed contact organisation.

involved Countries

The countries that are involved in the Action Programme are the same countries that are included in HELCOM's area: Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Norway, Poland, Sweden and in the Russian Federation the Leningrad region, the Kaliningrad region and the oblasts of Pskov, Karelia, Murmansk and Arkangelsk, as well as Belarus. As effects from agriculture mainly follow the water dividers, it is the catchment area and not the countries political boundaries, that are of the greatest interest for this task. Problems can arise when only considering the watershed level, as statistics commonly only are available at the country level.

3. Agricultural Production in the Baltic Sea Region - - a Brief Review

3.1 Introduction

The former importance of agriculture in the national economies of the countries in the Baltic Sea Region has been reduced, but a sustainable food production is still of regional interest. The natural prerequisites are good with fertile soils, humid climate and moderate damage from insects. Cultivated areas provide an environment for human settlement and recreation. Agricultural areas also provide habitats for many other species of animals and plants. Agriculture is a source of enrichment for the future society as well as a source of pollution.

In this brief review we are looking for the differences, characteristics and trends in agriculture in the Baltic Sea Region during the time period 1990-l 995. Ten countries with major shares of arable land in the Baltic Sea Drainage Basin are included in the overview. These countries are Poland, Lithuania, Russia, Belarus, Finland, Sweden, Denmark, Latvia, Germany and Estonia. Information from Russia has been difficult to obtain and statistics from Russia are not included in some of the tables as well as in the text on agricultural policies.

Agriculture in the EU countries has become more specialised and concentrated with increased risks of negative impacts on the environment. The negative impacts are counteracted by legislation, improved management and new technology.

In Poland, Estonia, Latvia and Lithuania the technology used is old and the legislation is infrequently implemented. From the environmental point of view, this situation is counteracted by the low intensity and small scale structure of agriculture, which has developed since 1990. However, in some areas large joint-stock companies are still an environmental problem.

The socio-economic conditions for farmers in the countries in transition are poor with difficulties to invest in sustainable technology. The farmers are also exposed to several threats to their health. In Russia and Belarus agricultural production is still concentrated in large agro-industrial complexes.

3.2 Land use

Agriculture is the largest anthropogenic source of nutrient input to the Baltic Sea. In average, agriculture is estimated to account for 30-35 % of the nitrogen load and 10-l 5 % of the phosphorus load. Riverine export of nutrients is 25 times higher in the south of the Baltic Sea than in the northern part. Riverine export is especially high in the south-western part of the Baltic Sea.

Arable land leaches more nutrients than forested land. Even if the best agricultural management practices are applied, arable land can leach more than 5-10 times as much nutrients to surface- and groundwater as forested areas. Agriculture as such always has leached, and will continue to leach nutrients to the surrounding environment.

Agricultural land including arable land and permanent pastures constitutes 26 % (table 1) of the Baltic Sea drainage basin. Poland is the country in the drainage basin with the largest area of arable land. The Polish share of arable land in the drainage basin is 41 %

followed by Lithuania, 9 % and Russia, 8 %. Belarus has in spite of its distance from the Baltic Sea surprisingly about the same share, 7 O/b, of arable land in the drainage basin as Sweden. The basic agricultural data are shown in table 2.

An interesting observation is the large areas of permanent pastures in the countries in transition and Poland as shown in table 2.

Table 1 . ***Land cover in square kitometres of the Baltic Sea drainage basin (19961***

Land cover	km*	% of total area
Forest	835 936	48
Agricultural land	456966	26
Non-productive open land	**298 121**	17
Unclassified land	33 633	2
Urban area	13 105	**< 1**
Inland water	106 849	6
Glacier	526	**< I**
Total area	**1 745 136**	100

iource: Sweiher et al., 1996

Table 2. ***Land use and basic agricultural data by country (1994)***

Countries	Total area of country ha x 1000	Agri-cultural area ha x 1000	Agri-cultural area % of total area	Agri-cultural area ha/capita	Arable land ha x 1000	Permanent pastures % of agricult-ural area	Share of arable land of the Baltic sea drainage basin %
Belarus	20760	9 391	45	0,89	6 225	33	7
Estonia	4 510	1 454	32	0,96	1 144	21	3
Latvia	6 460	2 540	39	0,99	1 740	32	5
Lithuania	6 520	3 513	54	0,94	3017	14	9
Russia L-grad . K-grad	19 800 1510	2 353 580	i i	0.29 0,63			8
Poland	32 325	18 707	58	0,49	14 652	22	41
Germany	35 698	17 308	48	0,21	12 037	30	4
Denmark	4 309	2 691	62	0.52	2 374	12	6
Finland	33 815	2 703	8	0,53	2 593	4	7
Sweden	44 996	3 356	7	0.38	2 780	17	7

• *L-grad includes Leningrad obl, Novgorod obl and Pskov obl.; Source, FAOSTAT, 1994 and J. Sweitzer et al., 1996.*

3.3 The structure of agriculture

Size of farms

Agriculture in the EU countries; Germany, Denmark, Sweden and Finland is characterised by private family farms. During the last decades the EU farms have become larger and more specialised with an increased share of monocultures in plant production and animal husbandry. In Sweden the number of farms has been reduced by three times since 1950.

Today, the majority of farmers are part-time farmers and the average farm is still rather small as shown in table 3.

Table 3. ***Average size of farms (19951 and trend in change of average size***
(- reduced average size, + increased average size)

Countries	Average size of farms > 2 hectare. Hectare/farm	Trend 1990-1995	Trend 1995-1997
Estonia	22	-	+
Latvia	14	-	+
Lithuania	9	-	+
Russia L-grad K-grad	 9* 16*		
Poland	8	+	+
Germany	18	+	+
Denmark	40	+	+
Finland	22	+	+
Sweden	31	+	+

**** Figures orfly include private family farms; Source: Country reports and Yearbook of Agricultural Statistics, SSweden 1996.***

In the former Soviet Union agriculture consisted mainly of large state and collective farms with 2000 - 5000 hectares of agricultural land. Most of them were formed during 1960-1980. Besides agricultural production, their function was also that of a municipality with responsibility for education, health-care and other social services. Since independence, the large state and collective farms have been privatised and a mixture of remaining large scale joint-stock companies and small family farms dominate the structure. Some of the large joint stock companies have had difficulties on the new markets and abandoned farm buildings are common.

The average size of a family farm in Latvia is 14 hectares and in Lithuania 9 hectares. Family farms in Estonia are larger and the average size is 22 hectares (table 3). These figures do not include the very large numbers of small homelands and subsidiary plots. The size of a homeland or subsidiary plot is l-3 hectares and if they were included in the statistics, the average size of farms would be substantially lowered. The homelands and subsidiary plots are very important for family food supply.

In Estonia, Latvia and Lithuania most of the food is produced at family farms and homelands. In Latvia 76 % of the total agricultural output originates from the same type of farms and in Estonia the corresponding figure is 50 %.

In Poland the process of collectivisation was never completed and most of the farms were and are still managed as small private farms. The average size is 7 hectares and the present structural trend is towards a split into very small farms < 2 hectares and medium sized farms > 10 hectares. Private farms dominate the centre, the south and, in particular, the east of the country with an estimated share of the agricultural land of approximately *85* % in 1995.

In Belarus and Russia family farms are few and production is dominated by large collective farms turned into joint-stock companies. In Russia agricultural output from private farms

increases but it is still only 2-4 % of the total production. However, small homelands are common also in Russia and Belarus.

Average livestock density has been reduced in the countries in transition and Poland as a result of the drastic change of production level. In Latvia there is an average of two cows per dairy farm and 80 % of the dairy cows can be found on farms with less than 10 cows. In the EU countries the number of cows per dairy farm is higher and for example in Sweden the average dairy farm has 27 cows. Large production units are however still common in the countries in transition and Poland and they are substantial point sources of pollution. In Latvia there are 58 share-holding companies with an average of 460 cows each. In the small Matsalu Bay drainage area of Estonia, there are 7 share-holding companies with more than 500 cows each.

The large joint-stock companies and newly formed family farms in the transition countries are using old and often heavy and unsuitable technology. This technology combined with unsuitable management promotes soil compaction and nutrient run-off. The introduction of new more environmentally sustainable technology and improved management is important as the crop yields, in the EU countries, have increased due to an improved management skill in farming and the adaptation of new technology to biology.

Food export

Denmark is today the only country in the region with a major net export of food and grain. With the exception of Denmark, the production of food corresponds to the national needs of the other countries in the Baltic Sea Region. The size of the agricultural production in Estonia, Latvia and Lithuania has also been adapted to their national demand. However, export of food to Russia is recovering and Lithuania now exports about 20 % of the agricultural production (dairy products) to Russia. Before World War II, Estonia, Latvia and Lithuania were successful exporters of dairy products to West European countries and during the Soviet period they supplied Leningrad and Moscow with meat and milk products and more than 50 % of the production was sold there. Today, food from the EU countries are often seen in the food stores of Latvia, Lithuania and especially Estonia.

Land ownership

The legal framework for protecting the ownership of land or the tenancy, is a key issue for developing sustainable agriculture. Focus of this issue must be raised towards the countries in transition. The speed of the process of privatisation in some of the countries in transition limits the actual possibilities to make long-term investments in agriculture. Many farmers can not get credits as they are still not the formal owners of their land. An additional problem is the low economical value of arable land. In the EU countries and in Poland the legal framework for protecting ownership and the tenant is quite good.

3.4 Trends in agricultural land use and production

The sown area decreases in most countries in the Baltic Sea Region. Set-aside arable land is usually forested. In the countries in transition large areas of arable land have been set aside since 1990 as the demand for milk and meat production has dropped by 50 %. Large areas of natural grasslands are not grazed and i.e. in Estonia 20-30 % of the arable land was not sown in 1996. Unused agricultural land becomes rapidly overgrown with bushes and trees and special programmes are being developed for afforestation of former agricultural land.

Animal produce

Milk, meat and eggs was the important agricultural production in the Baltic countries during the Soviet period. Arable land was mainly used for growing grain, grass and potatoes to feed pigs and dairy cows. Crop rotations included 50% of perennial crops as grass. In the western countries crop rotations are to a greater degree based on annual crops and cereal production. In Sweden 36 % of the arable land is used for perennial crops. The share of perennial crops decreases in the countries in transition and Poland which increases the risks of leaching but at the same time, the total area of arable land decreases which reduces leaching.

Production of beef is slowly altered to production of pork and chicken in the EU countries. In the countries in transition and Poland the production of all kinds of meat has been greatly reduced. Production of beef has been reduced at a much faster pace than pork and chicken. The changes in meat consumption pattern within the whole region will have environmental impacts. Pork and poultry production is connected to cereal production, with special risks for nutrient losses to surface and groundwater and beef production increases ammonia emissions to the air. The production of meat and milk is shown in tables 4 and *5.*

Table 4. ***Production of meat in 1995 and trends of production in 1992- 1995***

Country	*Total meat production Tonnes/year*	*Total meat production Kg/ha of agricultural area*	*Total meat production Kg/capita*	*Trem*
Belarus	*657 100*	71	167	-
Estonia	*67 816*	47	45	▪▪
Latvia	*122 924*	48	47	- - -
Lithuania	*208 200*	**59**	54	- - -
Poland	*2 758 500*	147	72	
Germany	*5 742 749*	333	70	
Finland	*322 990*	120	63	-/+
Denmark	1855000	**690**	357	-/+
Sweden	552577	165	64	-/+

tource: Calculations from F, OSTA T

Table ***5. Production of milk in 1995 and trends of production in 1992-1995.***

Country	Total milk production Tonnes/year	Total milk production Kg/ha of agricultural area	Total milk production Kg/capita	Trend
Belarus	5 070000	551	491	
Estonia	700 534	485	465	- -
Latvia	943 900	371	363	- -
Lithuania	1 818 900	517	478	-
Poland	11 826 680	632	307	-
Germany	28 645 670	1 655	351	-/+
Finland	2 472 486	915	484	-/+
Denmark	4 476 200	1 663	860	-/+
Sweden	3 304 000	984	384	-/+

Source: Calc,ulations from FA OSTA T

Cereal production

During the period 1990-1995 there was a clear trend of a reduced production of cereals in Russia, Estonia, Latvia, Lithuania and Belarus and at the same time an increased cereal production in Poland and the EU countries. The downward trend in the countries in transition has ended during the last year (1997) and shows stabilisation or a slight increase. Instead of barley, mixed grain, oats and rye, farmers tend to grow more wheat. The total increase of cereal production in the EU and in Poland is related to increased yields per hectare.

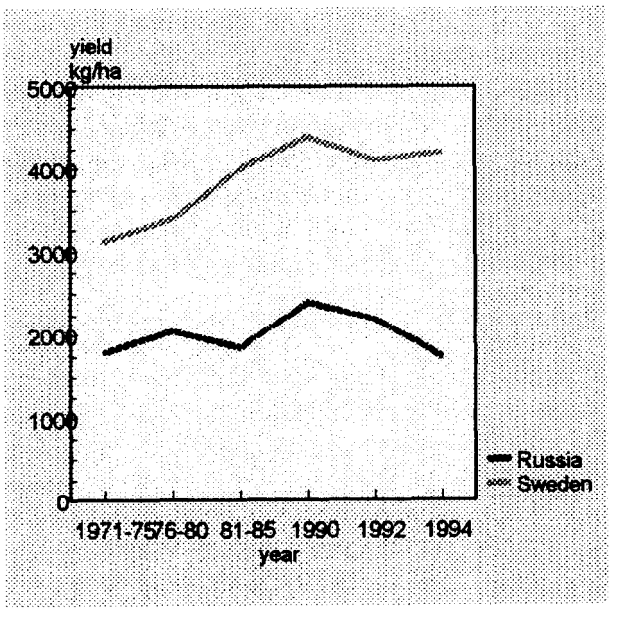

Figure 1. Yield of barley in kg per hectare in Russia and Sweden in 1971- 1994

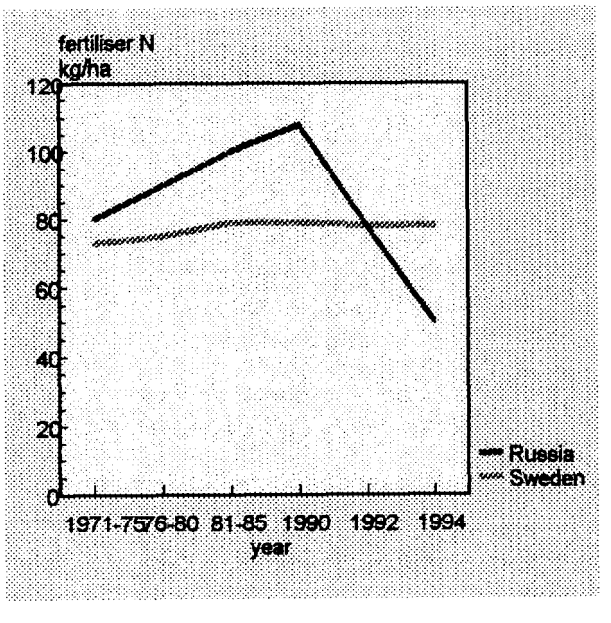

Figure ***2. Usage of nitrogen fertilisers in kg per hectare in Russia and Sweden in 1971-1994***

Yields per hectare of barley in Russia (figure 1), do not show any remarkable increases following the increased input of nitrogen fertilisers for 20 years and the drop in yield is very moderate from the more than halved input of nitrogen in 1994 (figure 2). The steady increase in barley yields in Sweden during the same period is not caused by increased applications of nitrogen fertilisers. It is instead caused by an increased nitrogen efficiency following improved skill in farming and the adaptation of new technology to biology. Most of the increase in harvest yield is due to improved soil tillage and the farmers ability to handle and maintain his new and adapted farm machinery. The Swedish farmer has also been able to buy soil tillage equipment and fertiliser spreaders increasing his precision in crop growing operations. An improved strategy for sowing, harvesting, plant protection product treatment and improved seed varieties has in combination with the farmers increasing knowledge of plant rotations made yields of barley and other crops increase with time. In Sweden nitrogen dressings per hectare are the same throughout the period 1971 to 1994 but yields are increased by 50 %.

The use of mineral fertilisers is very low in the countries in transition (table 8). However, during the last two years a slight increase of amounts used has been observed. Problems connected with the handling of plant protection products can be found in all countries in the Baltic Sea region. In the EU countries several programmes have been launched to reduce the risks and the amounts applied. In the countries in transition and Poland plant protection products are expensive for the farmers to purchase and there is a lack of good spraying equipment. As a result, the applied amounts have been sharply reduced since 1990. Awareness of the dangers connected with handling of plant protection products has gradually developed but plant protection products are still handled with great risks to human health and the environment in the countries in transition and Poland.

Table 6. *Production of crops in 1995 expressed as kg per capita and trends in production (1990 - 1995).*

Country	*Cereals Kg/capita*	*Trend*	*Vegetables Kg/capita*	*Trend*	*Potatoes Kg/capita*	*Trend*
Belarus	*506*		*103*	*+ +*	*924*	*+/-*
Estonia	*342*	*-*	*38*	*-*	*358*	*-*
Latvia	*264*		*88*		*332*	*–*
Lithuania	*490*		*99*	*+ +*	*419*	*+*
Poland	*672*	*+*	*156*	*+/-*	*646*	*+/-*
Germany	*514*	*+*	*42*	*+/-*	*166*	*+/-*
Denmark	*1 739*	*+ +*	*56*	*-*	*277*	*--*
Finland	*653*	*+*	*46*	*+/-*	*156*	*+*
Sweden	*560*	*+*	*27*	*+/-*	*160*	*+/-*

Source: Calculations from FAOSTAT

Table 7. ***Production of cereals expressed as yields in kg per hectare in 1995***

Country	Wheat kg/ha	Barley kg/ha	Rye kg/ha	Oats kg/ha
Belarus	2 480	1 900	2 210	1 890
Estonia	2000	1 500	1 820	2 080
Latvia	2 220	1 400	1 770	1 610
Lithuania	2 440	1 640	1 780	1 410
Poland	3 600	3 130	2 570	2 510
Germany	6 890	5 640	5 230	4 520
Denmark	7 350	5 450	5 160	5 100
Finland	3 770	3 420	2 770	3 330
Sweden	6 050	4 040	5 310	3 470

Source: Calculations from FA OS TA T

Table ***8. Consumption of total nitrogen in mineral fertilisers in 1993/94, in metric tonnes (MT) and in kg nitrogen used per hectare of arable land***

Country	Nitrogen MT	Nitrogen/ha arable land kg N /ha
Belarus	227 000	36
Estonia	30 000	26
Latvia	40 000	23
Lithuania	30 000	10
t Poland -	757 700	52
Germany	1612000	134
Denmark	326 000	137
1 Finland	171 000	66
Sweden	226 000	81

Source: FA 0, Fertilizer Yearbook

There are large differences in yields per hectare of crops between the countries in the Baltic Region as shown in table 7. In the EU countries and especially in Denmark and Germany, the yields of cereals are more than twice the size of the yields in the countries in transition and Poland. The differences are of the same magnitude in milk and meat production (tables 4 and 5) where a poor efficiency regarding the utilisation of fodder for animals is common. The low yields are mainly the result of insufficient management and not only the decreased use of fertilisers or plant protection products.

Organic farming

Organic farming increases in the Baltic Sea region. Most EU countries have developed programmes to support organic farming. In Denmark for example 40 million DEK are used annually to support organic farming. But still organic farming covers only some few percent of arable land in the EU countries. Organic farming is also developing in the countries in transition and Poland. In Lithuania a special organisation (GAIA) co-operates with national authorities to develop organic production and market organisations.

3.5 Agricultural Policies

Common Agricultural Policy (CAP)

Agricultural production depends, in addition to the natural factor of location, to a high degree on governmental policy. This means that future land use will depend on the frameworks provided by agricultural policy-making. Agreements like the Common Agricultural Policy (CAP) and the General Agreement on Tariffs and Trade (GATT) are important means. The average Producer Subsidy Equivalent (PSE) calculated by the OECD was 49 % for farmers in the EU countries in 1995.

The objectives of the CAP were set out in the Treaty of Rome: to increase productivity; to ensure a fair standard of living for the agricultural community; to stabilise markets; to assure food supplies and to provide consumers with food at reasonable prices. The 1992 CAP reform was aimed primarily at restructuring agricultural markets. One of the elements of the CAP reform was the encouragement of farmers to use less intensive production methods, thereby reducing the impact of farming on the environment and cutting the production of unwanted surpluses.

As part of the CAP reform, the community also has agreed on a set of complementary agri-environment and afforestation measures, that are explained in chapter 4. The reforms of CAP in 1992 also enabled the EU to comply with its obligations under the Uruguay Round GATT Agreement which was signed on 15 April 1994. This is a multilateral agreement which also covered all farm products. This agreement requires a 20% reduction in domestic support for agriculture over a six-year period, a reduction of 36% in budget spending on export subsidies and a 21% cut in the quantity of subsidised exports.

In the document “Sustainable Germany, 1996” the potential trends in EU agriculture are outlined as follows: The reformed CAP in the EU will be maintained and continued towards deregulation and market; current market regulations (limited agricultural exports in accordance with the GATT/WTO agreements) define the economic framework; agriculture will continue to display high rates of technological progress; yields will continue to rise, although less rapidly than to date; the trend towards substitution of labour by capital will continue; the demand for agricultural products within EU will stagnate; the growth in food supply within EU will be higher than the rise in demand; an accession of central and eastern European countries to EU will take place step by step; world trade will be liberalised further.

Environmental effects of CAP

With regard to the environmental effects, some positive elements can be identified as a result of the 1992 CAP reform; the more rational use of fertilisers and plant protection products, the possible environmental benefits of set-aside land (if well managed), incentives for a long-term improvement in the regional distribution of animal production. However, there are also negative elements, mainly the encouragement given to irrigated crops through direct payments to cereals, oilseed and protein crops, as well as the relative advantage given to intensive animal production through lower feed prices. The scale of support still provided through prices and crop specific payments, may also discourage farmers from committing themselves to more extensive practices or dedicating land to environmental purposes.

Agricultural policies of Estonia, Latvia, Lithuania and Poland

Estonia has until now followed a very liberal policy towards agriculture. Despite the fact **that** several laws to support farmers have been adopted by the parliament, they have

been implemented to a limited extent and total budgetary spending on agriculture remains rather low. Programmes are mainly aimed at improving seed and breeding quality, registration and training. The main instrument used to provide financial support to the agricultural sector is the Agricultural and Rural Life Credit Fund (ARLCF), which provides credits for farms and processing industry. The Producer Subsidy Equivalent, PSE, calculated by the OECO was 3 % in 1995.

In Latvia support is given to family farming and to establish new agricultural markets. Price support policies are mainly limited to border protection, as the artificially set prices had to be abolished after privatisation. The support policies include export subsidies and credit support. Direct payments exist in the form of diesel fuel subsidies and promotion of high quality breeds and seed. Rural development policies are receiving an increasing attention. The Latvian Government is in the process of implementing a rural diversification programme which includes financial assistance to investments in rural areas. Land reform and privatisation is almost complete. The PSE calculated by the OECD was 8 % in 1995.

In Lithuania the objective of agricultural policies is to support the development of a competitive agricultural sector. The Lithuanian Government introduced market regulation measures in 1995 with minimum marginal purchase prices as well as price subsidies for farm produce within the quantities determined by the Government. In 1997 the Rural Development Fund was created to support farm incomes by application of support prices for main agricultural products, direct payments and investment support. Increasing attention is given to rural and structural development policies and farming in less favourable areas is supported. Support to less favourable areas is allocated according to soil quality (must be one quarter below average productivity). The PSE calculated by the OECD was 3 % in 1995.

Policy instruments in Poland include guarantied minimum prices, as well as import and export mechanisms for key commodities, cereals, milk products, pork and beef similar to EU market policy instruments. If market prices fall below minimum prices, intervention purchases are carried out by the Agricultural Market Agency under the supervision of the Ministry of Agriculture and Food Economy. By far, the biggest share of the agricultural budget (72 % in 1994) is designated for the farmers social security system. Currently a wide range of activities relating to rural, structural and environmental development are being undertaken; integrated rural development; technical infrastructure projects in rural areas; farming in less favourable areas, early retirements have been or are being implemented. These measures are generally similar to EU measures. The PSE calculated by OECD was 21 % in 1995.

3.6 From agricultural policy to rural policy

Transformation from agricultural policy towards a rural policy is on the agenda in the EU countries as well as in the countries in transition and Poland. However the starting points are different. In the western countries significant structural changes of agriculture have been made during the last decades and quite a proportion of the rural population already has other complementary sources of income beside agriculture. Since the mid-1980s, the European Union has been focusing to an increasing extent on the development of rural areas, over and above the agricultural economy. The aim is to meet the challenges posed by the depopulation of rural areas.

The principal objective is to maintain viable rural communities. A competitive agriculture is essential to this process. In addition, however, diversification of the rural economy is *a* key element. In this context, the ED is concentrating on developing small and medium-sized enterprises, exploiting new technology favouring rural areas, rural tourism etc. Access to services, the protection of the environment and appropriate training are further important priorities. For the 1994-1999 period, the scope of EU measures in favour of rural development was broadened to include provisions for encouragement for tourist and craft investments, the renovation and development of villages, and the protection and conservation of the rural heritage.

The Treaty on the European Union, which came into force in 1993, mentions rural areas specifically in the context of economic and social cohesion, i.e. the Union policy of assisting peripheral, lesser-developed regions to catch up with the central, more highly-developed regions of the Community. In the period 1994-1999, one third of the Community budget - ECU 141 billion (at 1992 prices) - is being devoted to this policy of economic and social cohesion.

In the countries in transition and Poland agriculture has until now, been the major source of income in rural areas. The number of people working in the agricultural sector will be further reduced and unemployment rates will increase in rural areas. In the city of Riga the unemployment is about ten percent but in rural areas in Latvia unemployment is up to 30%. Similar problems exist in the other countries in transition and Poland with 50-70 % of the rural population engaged in agriculture (table 9). In the western countries 20-30 % of the rural population is engaged in farming.

Table 9. *Agricultural population by country in 1995*

Country	Agricultural population, % of total population	Agricultural population, % of rural population
Belarus	18	62
Estonia	13	50
Latvia	14	52
Lithuania	18	64
Poland	23	65
Germany	3	19
Denmark	4	30
Finland	7	20
Sweden	4	25

Source: FAOSTAT

It is likely that changes in the agricultural sector in the countries in transition and Poland to future higher production levels and improved management will take place relatively quickly. The change in the countries in transition and Poland will have a large impact on rural life and the success of diversification programmes will be crucial to avoid unemployment in rural and urban areas.

In the EU countries the change has also been rapid and is still going on with a steadily reduced number of people working in the agricultural sector. As an example, 24 % of the German population was employed in agriculture in 1950. Forty years later, in 1990, only 3 % of the population was employed in agriculture. The number of farmers still

decreases in the EU countries. In Sweden another 50 % reduction of the farmers is predicted for the next 25 years.

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4. Ongoing Activities on Sustainable Agriculture in the Baltic Sea Region

Identifying the ongoing activities one has to realise the differences in time available to implement activities in the EU countries and the countries in transition and Poland in the Baltic Sea Region. In the EU countries the time span has been more than 40 years of educational and legislative work while the countries in transition and Poland only have had a few years time to find new paths towards sustainability. However, Estonia, Latvia, Lithuania, Poland and Russia have during the last years adopted several acts for the protection of the environment.

Most of the activities on sustainable agriculture are programmes which only include parts or components of sustainable agricultural concepts. Such as activities to reduce agricultural pollution, preservation and improvement of biodiversity. There are few programmes covering the whole ecological dimension and even less taking the social or economic dimension into consideration. The concept of organic farming or bio-dynamic farming are maybe the types of activities reaching closest to a holistic view of farming and rural life on farm level. Policy programmes aiming to support the development of organic farming are launched in several countries around the Baltic Sea.

BALTIC 21 has brought the different dimensions of sustainability in agriculture closer to one another and we hope this could be the start of activities reaching further in that context. If experiences from applied pilot projects representing the ecological, social and economic dimension of agriculture where brought together valuable information and knowledge would be added.

The Baftic Sea Joint Comprehensive Environmen tat Action Programme

In 1988 the Ministerial Declaration of HELCOM launched inter alia a 50 % reduction target of nutrient input, to the Baltic Sea by 1995. The 50 % reduction target was not met by the EU countries in 1995. However, some reductions of 20 - 30 % have been achieved. In the countries in transition and Poland, the decreased production has lead to reductions in nutrient losses but not to the expected extent.

To reach the target, national programmes have been adopted in all countries and bilateral programmes have also been started. Denmark, for example, has adopted a special Action Plan for Sustainable Agriculture and in Finland most farmers have joined the Agro-Environmental Programme. In Sweden, two major programmes have been adopted: Action programme to reduce nutrient losses from agriculture and Action programme to reduce the risks in connection with the use of pesticides.

The importance of agriculture as a source of pollution to the Baltic Sea is additionally stressed by the fact that an **Annex on Prevention of Pollution from Agriculture** has been elaborated and added to the Helsinki Convention. The contracting parties shall apply measures on animal density, manure storage and application, winter crop cover, water protection and plant protection products. Codes of Good Agricultural Practice (GAP codes) are also being elaborated within the framework of the Helsinki Convention.

Common Agricultural Policy of EU (CAP)

The objectives of the CAP were set out in the Treaty of Rome: to increase productivity; to ensure a fair standard of living for the agricultural community; to stabilise markets; to assure food supplies and to provide consumers with food at reasonable prices.

An important element of the CAP reform in 1992 was the accompanying measures, which cover agri-environment, afforestation and early retirement. The aim of the agri-environment accompanying measure is to grant aid to farmers for the introduction or maintenance of production techniques, which encourage the protection of the environment, the landscape and natural resources. More than 160 programmes have been approved under this measure, on the basis of proposals submitted by the Member States and regions of the Union. The measures should encourage the farmer to view his role not only as the producer of food but also as guardian of the environment and heritage of EU citizens.

Aid for afforestation under the CAP reform is intended to provide an alternative use for agricultural land and to encourage the development of farm forestry. The aim is to create a well-balanced afforestation of farmland, as part of the policy to restore equilibrium to agricultural markets and to develop the forests so that they can contribute to the economic development of the countryside.

Below are three directives and regulations mentioned as examples which together with the Common Agricultural Policy (CAP) affects the environment and structure of agriculture.

In the **Council directive on the environment, and in particular of the soil, when sewage sludge** is **used in agriculture** (86/278/EEC) the use of sewage sludge in agriculture is regulated in such a way as to prevent harmful effects on soil, vegetation, animals and man. In the directive, limit values are given for the concentration of heavy metals in soil as well as limit values for concentration of heavy metals in sludge. Member states shall regulate the use of sludge in such a way that accumulation of heavy metals in the soil does not exceed the limit values.

The Council directive on the protection of waters against pollution caused by nitrates from agricultural sources (91/676/EEC) is probably the most well known directive in agricultural circles. The nitrate directive from 1991 aims to control and reduce water pollution resulting from spreading or discharge of livestock effluents and the excessive use of fertilisers. Member states shall identify especially vulnerable zones and waters which require special protection. Within the vulnerable zones, action programmes should be implemented including measures to limit the land-application of all nitrogen-containing fertilisers and in particular to set specific limits for the application of livestock manure. Furthermore, environmental monitoring should be introduced in the countries **as** well as a more frequent programme in the nitrogen vulnerable zones. Codes of Good Agricultural Practice should also be elaborated and implemented.

In the **Council regulation on agricultural production methods compatible with the requirements of the protection of the environment** and the maintenance of the **countryside** (92/2078/EEC) an aid scheme is launched with the purpose to contribute to the achievement of the policy objectives regarding agriculture and the environment.

The aim is to reach an improved market balance by reducing production and still provide an adequate income for farmers. The aid scheme includes a number of grant possibilities, such as the number of livestock per hectare can be reduced, perennial crops can be used instead of annual crops, organic farming, set aside of arable land etc. Grants can also be given if endangered breeds are reared. This is the regulation behind the environmental subsidiary system of agriculture in the EU. However, environmental support within the Common Agricultural Policy in EU (CAP) is limited and only 2 % of the total CAP budget is used for agro-environmental activities.

In July 1997 the EU Commission presented its view **"For a Stronger and Wider Europe".** The document is named b and outlines the development of the European Union and its policies beyond year 2000, taking into account the prospect of an enlargement of the Union also including the central and eastern European countries which would potentially double the farm population and increase its agricultural area by more than 40%.

In the Agenda 2000 the reform of CAP in 1992 is deepened and measures are proposed to take further steps towards world market prices coupled with direct income support. There are several reasons in favour of such an approach mentioned by EU: the risks of new market unbalances, the aspirations towards a more environmentally friendly and quality oriented agriculture, and last but not least the perspective of an enlargement of the European Union.

0 ther multilateral and bilateral agri-environmental co-operation projects

The co-operation between the countries in transition and Poland and the EU countries has been growing during the last years, also in the field of agriculture and environment. Assistance programmes have been developed i.e. to improve productivity in agriculture and support the establishment of advisory services. One of the most important factors in the bilateral programmes is that they have contributed to increase the awareness of sustainable issues at a local level. There are several projects in the countries in transition and Poland with a direct linkage to agri-environmental issues. The projects have proved to be important means of showing good management practices and providing a frame for the Baltic Sea region co-operation. Legislative and institutional support has also become an increasingly important part of the projects. In many of the projects farmers from the EU countries, co-operate with their colleagues in the countries in transition and Poland.

The Baltic Agricultural Run-off Action Programme (BAAP) is a Swedish contribution comprising education and demonstration activities with legislative measures, as well as institutional strengthening. The aim of the programme is to reduce run-off from agriculture to local surface water and groundwater. Demonstration watersheds equipped with monitoring stations, education rooms, field trials and demonstration farms have been built in Estonia, Latvia and Lithuania. In Poland and Russia demonstration farms have been established. The demonstration activities are linked to the national monitoring programmes and educational activities of farmers federations and advisory service.

Denmark has supported the development of the advisory service in Estonia, Latvia and Lithuania with special emphasis on **agri-environmental education of farmers and advisors.** Denmark will also continue to support the integration of legislation in the countries in transition into the EU framework. Denmark will also within the framework of HELCOM continue to assist Poland and some of the countries in transition to develop national codes of good agricultural practice.

Finland has implemented agricultural projects in Estonia, Latvia and Lithuania and in the Leningrad region mainly dealing with manure, slurry and waste water treatment.

The Nordic Council of Ministers (NCM) has supported the development of **integrated monitoring stations** and harmonisation of measuring methods and analytical procedures in Estonia, Latvia and Lithuania.

NCM has also financed the **Gulf of Riga Project** aiming to study the environmental problems in the Gulf of Riga and its drainage basin, and to determine the environmental impact on the rest of the Baltic Sea and the Baltic Proper in particular. One of the sub-projects deals specifically with agricultural run-off. Measuring programmes have been

established in several small agricultural catchments in Estonia and Latvia, using the same methods as similar Norwegian programmes. The project is also supported by the Research Council of Norway. Assessments of the riverborne load of nitrogen and phosphorus show no major decrease in the concentration of nutrients reaching the Gulf. It is a widely recognised fact that the diffuse emissions and discharges from agriculture is a much more complicated issue to handle than abatement of point source pollution.

NCM also supports the development of national programmes for conservation of genetic resources in the Baltic countries as well as an institutional evaluation of the Vavilov Institute in St Petersburg, holding one of the worlds largest collection of plant genetic resources. Further, the co-operation between Nordic, Estonian, Latvian and Lithuanian universities of agriculture, veterinary and forestry is partly supported by the NCM within the network of NOVABA (NOVA - the Nordic Forestry, Veterinary and Agricultural Universities and BOVA - the Baltic Forestry, Veterinary and Agricultural Universities).

In the Nordic-Baltic research project "New **strategies in the use of Environmental Policy Instruments"** the political- and administrative policy is studied and compared between countries in relation to achieving nutrient loading goals from diffuse sources in agriculture and forestry in Norway, Finland, Sweden, Denmark, Estonia, Latvia and Lithuania. The study aims broadly at producing results applicable to further political and administrative reforms and for implementing future environmental programmes. The project is supported by the Nordic Environmental Research Programme (1993-l 997) and national funding from the respective countries, initiated by NCM and co-ordinated by the University of UmeZi.

The World Bank is engaged in **Agricultural Watersheds and Environmental Management Projects** in the Matsalu Bay of Estonia and also in Lithuania. Similar projects are also being elaborated for Poland.

In the St Petersburg Region **a new demonstration farm** is being constructed as a co-operation between Russian and Swedish agricultural companies. Demonstration farms can also be found in the other countries in transition and in Poland, i.e. in the small demonstration catchments elaborated within the Baltic Agricultural Run-off Action Programme (BAAP).

In **1996** a **Royal Colloquium on Agriculture and Sustainability** was held in Stockholm. In the statement from the colloquium in 1996 it is mentioned that "a sustainable agriculture does not exist anywhere in the Region, fundamental changes will be needed in all countries. A thorough integration of environmental and agricultural policies and practices is indispensable in order to achieve such a shift". Papers presented at the colloquium were recently published in the Journal of Human Environment (AMBIO no. 7, 1997) and in the spring of 1998 a Royal Colloquium Scholarship will be given by H.M. King Carl Gustaf of Sweden to Mrs Angelija Buciene, Lithuanian Institute of Agriculture.

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5. Cross-sectorial Issues, Overlaps and Gaps with other Sectors

The Agenda 21 for the Baltic **Sea** Region is divided into seven sectors:

* agriculture
* energy
* industry
* transport
* forestry
* fishery
* tourism

Joint issues, overlaps and gaps will occur when transforming the sector approach to a more holistic approach of the region. To identify these areas a presentation of the contents of the different sectors is needed, which for agriculture is presented in table 1.

Table 1. Examples of areas that are included, resp. not included in the Agricultural ec tor.

hcluded	*Not included*
- the farm **- agriculture / horticulture** **- normal primary production** **- crops for energy or industrial purposes** **- forestry: energy crops grown on arable land, "islands" and "corridors" within the agricultural landscape for biodiversity, wooded pastures** **- industry: primary production of industrial crops** **- recirculation of nutrients between urban and rural areas** **- usage of sewage sludge in agriculture** **- the deposition of nutrients and pollutants to agriculture** - ozone and acidification **- energy: the usage of energy on the farm, for fuel, heating, production of fertilisers, production of energy/biogas on the farm, production of energy crops on arable land** **- the field, meadow and wooded pasture** **- occupational health of the farmer: quality of drinking water and food, exposure to pesticides, ammonia in animal housing** **- the transport of nutrients to the environment, the amounts to the air and water** **- access to water** **- agriculture and rural local development** **- transport: animal transpon, transports within the farm**	**- the food industry** **- commerce/trade** **- the production of commodities as fertilisers, pesticides, concentrates** **- transports to and from the farm such as fertilisers, fodder, milk etc.** **- forestry with some exceptions** **- tourism** **- hunting** **- fishing** **- occupational health of the farmer: accidents, mental health** **- the effects of losses of N and P from agriculture on the marine life in the Baltic sea**

As can be noticed in table 1 there are several areas where overlaps are possible. The areas that have been identified to be included in the agricultural sector have been:

- energy - the usage of energy on the farm, e.g. fuel, heating, production of fertilisers
  production of energy crops on arable land and of energy e.g. bioenergy within agriculture

- forestry - energy crops grown on arable land, such as ***Salix,*** energy grass
  forested areas growing as “islands” or as “corridors” for biodiversity within the agricultural landscape

- industry - the primary production of industrial crops

- transport - transports within the farm
  animal transport

- fishery - nutrient input into the Baltic Sea
  toxic effects of pesticide residues on the marine population

Environmental impacts from urban settlements can affect agriculture. Effects from ozone and acidification are not unusual on arable land and the quality of sewage sludge used as a fertiliser in agriculture, can also have a detrimental effect on arable land and crops, if the sewage sludge is of a poor quality and contains heavy metals or other contaminants. For these two areas it is not possible for the agricultural sector to take responsibility for these impacts. The agricultural sector can try to minimise these effects by using measures to reduce the negative effects from these areas and by using their influence to create changes in society that will reduce the problems in the future.

One possible gap could be nutrient pollution from sewage, sewage treatment plants and from single households. Pollution originating from urban settlements or industries is not included in the agricultural sector. Possibly could pollution from single households in rural areas be classified under agriculture. This type of pollution is very important for the general state of the Baltic Sea.

6. An Outline of Concept for analysing the Sus fainaMity of Agriculture - Goals, Criteria and Indica tors

6.1 The challenge - A vision of sustainable agriculture

The overall vision is to preserve Nature's ability to produce high amounts of healthy crops and animals without degrading the natural resources.

Agriculture contributes significantly to the society of the future. Sustainable agriculture is the production of high quality food and other agricultural products/services in the long run with consideration taken to economy and social structure, in such a way that the resource base of non-renewable and renewable resources is maintained. Important sub-goals are:

1. the farmers income should be sufficient to provide a fair standard of living in the agricultural community
2. the farmers should practise production methods which do not threaten human or animal health or degrade the environment including biodiversity and at the same time minimise our environmental problems that future generations must assume responsibilities for
3. non-renewable resources have to gradually be replaced by renewable resources and recirculation of non-renewable resources maximised
4. sustainable agriculture will meet societies needs of food and recreation and preserve the landscape, cultural values and the historical heritage of rural areas and contribute to create stable well developed and secure rural communities
5. the ethical aspects of agricultural production are secured.

6.7.1 Sustainability goals

Agriculture can only be regarded as sustainable if it can be continued for generations in an environmentally, economically and socially acceptable way.

Sustainable agriculture operates largely in cycles, conserving and preserving the natural resources upon which life depends, e.g. soil, water, air, species diversity as well as scarce natural resources. Prerequisites in this regard include the integration and adaptation of farming practices into the natural balance. The aim of agriculture must be to supply the population with healthy food products and raw materials, primarily on a regional basis. Agriculture also serves to preserve or restore a varied, diversely structured cultivated landscape abundant in species and biotopes as well as to safeguard and to develop rural areas. In the interest of achieving a circular flow economy, non-hazardous biogenic waste and residues should, wherever possible, be recycled and reused within the agricultural sector.

Sustainable Agriculture embraces the following goals:

- Securing the food supply on a long term basis
- Preserving soil fertility as a basis for life and economic activity for future generations
- Efficient use of renewable resources without exceeding their regeneration capacity
- Protection of non-renewable resources
- Preservation and development of biodiversity and rural landscape

- Securing animal welfare and species protection
- Increased public awareness on sustainable issues
- Equitable relations in trade of products at the local and international level
- Development of rural communities.

The definition of sustainable agriculture in AGENDA 21 also includes eradicating poverty and ensuring public participation. The criteria to be applied when shaping a conditional framework in the food sector involve not only responsibility towards farmers, consumers and the environment, but also towards less developed countries. Sustainable development cannot be achieved unless there are changes in demands, consumption habits, traditional patterns of behaviour and in the priorities pursued at the individual and social levels.

Sustainability should not be reduced to environmental soundness in the narrower sense, but needs instead a holistic view and the consideration of economic, social, cultural and ethical aspects. Sustainability is energy and resource extensive, but labour- and know-how-intensive. To this extent, sustainability requires a fundamental reorientation of entire sections of society and the economy.

To be able to define the main components of sustainable agriculture and to be able to measure changes and appropriate development for sustainable agriculture, a strict terminology, a common vision, well established criteria and useful indicators are essential prerequisites.

6.2 Non-sustainable issues of present day agriculture

We have now adopted a challenge in the form of an obligation to change our lives and activities towards increased sustainability within the Baltic Sea region, with mutual benefit for all of us in the long run. That means that we have to agree on what has to be done along our mutual road of sustainable development. But equally important is to agree on a list of the most essential non-sustainable issues to be addressed. A generally accepted statement regarding the main areas of problems is of fundamental importance, as a basis for constructive common work.

Environmental, social and economical impacts of modern agriculture have been on the research agenda for many years and the main problems are reasonably well known. We also know a lot about what has created the problems. To summarise, the most urgent non-sustainable issues to be considered are:

PRODUCTION

- Contaminants and residues in food
- Unfavourable market conditions for agricultural production
- Excessive livestock density

NATURAL RESOURCES

- Dependence on fossil energy
- Low efficiency of energy use in agricultural production
- Dependence on non-renewable phosphorus deposits

- Lack of water and of high water quality
- Nutrient losses (N and P) to the environment
- Decrease in soil fertility (acidification, carbon content, nutrient status, structure, compaction, salinisation)
- Erosion
- Pesticide residues in soil, water and non-target organisms
- Accumulation of heavy metals and nuclides
- **Soil** contamination with persistent organic and inorganic substances
- Loss of biodiversity **and genetic resources**
- Air pollution (NH^3, CH_4, N^2O, pesticides)

HUMAN AND ANIMAL WELFARE

- Occupational threats to farmers and consumers health
- Dependence on growth promoters and antibiotics in animal production
- Unfavourable animal welfare and threats to animal health

SOCIO-ECONOMIC CRITERIA

- Unfavourable economical profitability of farming
- Lack of food security and food production security
- Unfavourable social infra-structure in rural areas
- Lack of preservation of nature and historical values
- **Urbanisation**

COMPETENCE - EDUCATION

- **Lack of education, information and management skill**

On top of these problems, agriculture is also affected by atmospheric deposition, mainly **consisting of heavy metals, acidifying and eutrofying substances as well as toxic** organics.

6.3 Basic criteria for analysis of sustainability

The term “criteria” is defined as values or services that are of fundamental importance for the economy and a long lasting and healthy society with respect to agricultural production and natural resource conservation. The following criteria or values will be in focus:

PRODUCTION

- **Food and biomass supply**
- **Food quality**

NATURAL RESOURCES

- **Arable soils: quality, productivity and fertility, erosion**
- **Landscape: biodiversity, agrodiversity, cultural values, recreational values**

- Water: quantity and quality
- Air: quality
- Use of non-renewable resources

HUMAN AND ANIMAL WELFARE

- Health of producers and consumers
- Animal welfare
- Recreational values for society

SOCIO-ECONOMIC CRITERIA

- Economy of the farmer
- Social infra-structure in rural areas e.g. education, health care, shops, transport

COMPETENCE - EDUCATION

- Farmers education
- Consumers education

6.4 Indicators for measuring sustainability

An **indicator** can be defined as a parameter or a value derived from parameters, which provides information about a phenomenon.

The OECD is in the process of developing agri-environmental indicators (AEIs), within the overall context of agricultural policy reform and the need to ensure consistency between environmental and agricultural policies. The indicators will:

- **provide information** to policy makers and the wider public on the current state and changes in the conditions of the environment in agriculture
- **assist policy makers** to better understand the linkages between the causes and effects of the impact of agriculture and agricultural policy on the environment , and help to guide their responses to changes in environmental conditions
- **contribute to monitoring and evaluation** of the effectiveness of policies in promoting sustainable agriculture.

A major challenge is to provide a solid conceptual and methodological basis to support the empirical analysis of agri-environmental linkages, especially in terms of quantifying the impact of agricultural policies and policy changes on the environment in agriculture. In order to better understand agri-environmental linkages, and to identify and develop policy relevant indicators, particular consideration has been given to :

- recognising specific characteristics of the linkages between agriculture and the environment

- situating agriculture in the broader context of sustainable development, especially in terms of the relationships between the economic, social and environmental dimensions
- ensuring the framework to structure agri-environmental analysis is largely consistent with that commonly being used in other related work in the OECD and elsewhere.

Certain specific characteristics of agriculture in relation to the environment can distinguish the agricultural sector from the linkages between other sectors in the economy and environment:

1. Agricultural activities produce a diverse range of harmful and beneficial impacts on environmental quality.
2. The relationship between agricultural activities and the environment is frequently complex, site specific and non-linear. Agricultural activities can have impacts on the environment which are determined by different agro-ecological systems and physical attributes of the land, the prevailing conditions and production technology and farmers' management practices in relation to natural conditions.
3. The agricultural sectors in most OECD countries are characterised by policies delivering high levels of support and government intervention. Farmers behaviour can be affected by these policies. Also changes in environmental quality can trigger market and societal reactions which may in turn influence agricultural and environmental policy decisions.

The situation of agriculture needs to be considered in the broader context of sustainable development.

DRIVING FORCE - STATE - RESPONSE FRAMEWORK

The framework for analysing agri-environmental linkages and developing AEIs is a modified form of the Pressure-State-Response framework (PSR) and is called the Driving Force-State-Response (DSR) framework (OECD Environmental Indicators for Agriculture, 1997; OECD "Pressure-State-Response"-framework for classifying environmental indicators, 1993;). This framework takes into account the specific characteristics of agriculture and its relation to the environment; the consideration of agriculture in the broader context of sustainable development and the work already underway in OECD Member countries and other organisations to develop their work on indicators, e.g. the energy and transport sectors.

Driving forces are those elements which cause changes in the state of the environment and can be both beneficial and harmful. These include:

- **natural environmental processes and factors,** including the agro-ecological system, the physical attributes of the land, meteorological conditions, and random events such as earthquakes.
- **biophysical inputs and outputs at the farm level,** covering the use of chemical inputs, energy and water resources; farm management practices; and decisions taken in terms of the level and mix of agricultural commodities produced.
- **Economic and societal driving forces,** encompassing reactions to economic and policy signals received from markets and governments; variations in the level and composition of farm financial resources; changes in technology; cultural attitudes and public pressure; social structures and population growth.

The **state** or condition of the environment in agriculture, refers to changes in environmental conditions that may arise from various driving forces, The impact of agriculture on the environment can occur both on and off the farm. The state can be broadly categorised in the following sub-categories:

- **The state of the natural resources,** used in agricultural production - soil, water and air - covering their physical, chemical and biological condition.
- **The composition, structure and functioning of the ecosystem,** affected by agricultural activities, including biodiversity and natural habitats, while for some countries the inclusion of the man-made environment, such as agricultural landscape, is also an integral part of this sub-category.
- **The state of human health and environmentally related welfare,** including e.g. the risk to human health from pesticide spraying and the public nuisance caused by odours from intensive livestock production.

An important consideration when examining the "state" component is to identify the share of agriculture in the environmental media or issue concerned, and to assess its importance for policy purposes. Agriculture usually is one amongst many activities which has an impact on the economy which has an impact on the state of the environment. A further aspect in this context is that while agriculture can affect the state of the environment, changes in environmental conditions can also have an impact on agricultural production activities, such as by acid air emissions or ozone depletion.

Responses refer to the reaction by groups in society and policy makers to the actual and perceived changes in the state of the environment in agriculture, the sustainability of agriculture and to market signals. The responses include:

- **farmer behaviour,** by changes in input use, farm management practices, such as integrated pest management, and co-operative approaches between farmers and farmers and other stakeholders.
- **consumer reactions,** through altering food consumption patterns, including preferences for "organically" produced foods.
- **responses by the agro-food chain,** with changes in technology to produce less toxic plant protection products and the voluntary adoption of better safety and quality standards by the food industry.
- **government actions,** through changes in policy measures, including regulatory approaches, the use of economic instruments such as subsidies and taxes, training and information programmes, research and development and agricultural policies.

SELECTION CRITERIA FOR AGRI-ENVIRONMENTAL INDICATORS

There are potentially a large number of indicators that could be developed to help quantify the various components and linkages in the DSR framework. Each indicator should be examined against four general criteria:

- policy relevance
- analytical soundness
- measurability
- level of aggregation.

Some indicators shown below are indicating the status of several criteria. Other indicators can be regarded as efficiency indicators. Examples are ratio-indicators such as input of nutrients versus output via nutrients removed and similar ratios for the use of pesticides and energy.

Generally it can be argued that historical time-series are of great value for interpreting the degree of sustainability of a given system. Such data-sets will also give valuable references to future trend analysis. Indicators will to a great extent be used for analysing changes in **driving forces,** state and implementation of more sustainable methods and techniques. There is in fact little use of direct comparisons between countries on the basis of absolute data.

6.4.1 National indicators of production

Only criteria and indicators with relevance for evaluating sustainability are selected (Table 1).

Concerning “land use” it is most urgent to get information about the usage of the land. The risks of nutrient losses and the need for usage of pesticides in the production of crops are greatly influenced by the proportion of land used for perennial and other winter green crops. Other factors of importance are the amount of agricultural land, crop production, animal production, wetlands and buffer-zones. For maintaining biodiversity the amounts of permanent pastures and meadows are of special importance.

Regarding “livestock” different environmental consequences are related to ruminants versus pigs and poultry. Access to grazing animals are a prerequisite for maintaining biodiversity in pastures and meadows. On the other hand, ammonia emissions in relation to production are larger from grazing ruminants in comparison to pig and poultry production.

The average livestock (animal) density of a country is one useful indicator but the distribution pattern e.g. the degree of integration between crop and animal production is more important for sustainability. One alternative can be to state the proportion of farms by hectare and number and types of animals. A well integrated crop and animal production promotes minimised transportation and an efficient recycling of animal and human wastes. Another interesting indicator is also the amount of animal farms without any arable land, as well as the number of combined and purely crop farms.

The degree of domestic production of the national **food supply** consisting of the national food consumption and production can be expressed in MJ per capita. Nutrient losses are differing depending on the production methods used and the type of products produced.

Finally, there is also a need for some sort of **intensity indicators.** Use of fertilisers, pesticides and imported feeds related to crop yields are such examples, as well as yield levels by themselves. On the other hand, data on actual harvests versus a calculated national production potential would further indicate the degree of intensity in the use of natural resources, as well as figures on hectares of set-aside land.

6.4.2 Jndica tors of natural resources

There are a lot of possible indicators that can be used to describe natural resources and especially concerning their “state” according to OECD (1993). In table 2 we have

compiled a set of indicators, that according to our opinion give a good view of the degree of sustainability of a system. The indicators are primarily selected for the purpose of giving a good coverage of the identified criteria and to a lesser degree with respect to the actual data available for the Baltic region. This is discussed in chapters 6.4.6 and **6.5.**

There is generally little regard for the **quality of arable soils,** which also can be noticed in the fact that they are usually investigated to a lesser extent. This is true especially with respect to soil contaminants and soil compaction etc. In certain areas soil acidification, due to usage of acidifying fertilisers, acid rain and insufficient liming, depresses the crop yields and can exaggerate the heavy metal uptake. Soil acidification, can thus also affect nutrient uptake and leaching.

Meadows and pastures are the most valuable habitat for maintaining the wild flora and fauna in the agricultural landscape. Not only the amount of such land but also the quality of the **grazing areas** determine the biological response. Sufficient grazing is normally the most appropriate way to preserve the quality. Due to an intensive drainage of natural wetlands over decades, there is a shortage of open water in many landscapes. Therefore creating new wetlands becomes an urgent measure. There also exists a common idea that organic farming can be more favourable in promoting biodiversity than conventional farming using fertilisers and pesticides. It can also be in place to mention agro-diversity as well, as it is just as important to maintain the genetic resource base within agriculture and also to mention agriculture's positive effects on the landscape.

Despite the fact that the Baltic Sea region is situated in a humid climatic region, there may locally be a need for irrigation, which can lead to conflicts among different water user interests. Water quality refers to the quality of drinking, ground and surface water. However, changes in **water quality** and subsequent problems are definitely the main issue for concern. Indicators for monitoring and assessment of water quality can be found on all three levels: driving force, state and response. The usage of inputs, e.g. manure, fertilisers and pesticides, can be considered to be core indicators for the long time perspective. Furthermore, nutrient leakage very much depends on the amount of animals in livestock units per hectare, LU/ha, of a certain farm or catchment area. Among the response indicators, the storage capacity for manure, will determine when in the year the manure is to be spread and affect the risk of nutrient leaching and run-off. In a humid region the ground coverage by crops and also what types of crops are also important factors affecting nutrient losses, as well as the occurrence of bufferzones. The quality of the soil layer is also important for water quality as e.g. leaching occurs only to a minor degree on heavy clay soils in comparison to light soils, where leaching dominates and the pH of the soil can also affect water quality. Even the type of drainage system and maintenance can be of importance.

Within agriculture, little attention has up to now been paid to the usage of **fossil energy** and **phosphorus** from **finite deposits.** This is necessary for the future, depending on the greenhouse effect and in solicitude for future generations. The solution regarding phosphorus will be described by the term **recirculation** of nutrients in food and human effluents being returned to farming areas.

6.4.3 Indicators of human and animal health

A farming system is not sustainable if the farming methods and inputs used cause negative health effects to the farmer, other farm workers and consumers. Such possible health effects must be included in our work and are presented in table 3.

The question of animal care has recently been debated in some countries. An important goal must be to have healthy animals. The use of growth promoters and especially the use of antibiotics has been argued to cause bacterial resistance with a future likely impact on mankind. Furthermore, how we treat our animals in housing will be of increased consumer's concern in the future. Consequently, even these new issues deserve identification and development of useful indicators.

6.4.4 Indicators on economy and social issues

ECONOMY

Farming is not sustainable if the farmers can not make their living from the farm. A fair standard of living for the agricultural community is a prerequisite to sustainable agriculture. An attempt to list different economical indicators showing the economy of the farmer is presented in table 4. The possibility of earning ones income from different types of production from different sectors, such as is common in the Nordic countries with agriculture and forestry, or in the vicinity to urban settlements with part-time employment outside the farm, can also be different solutions to the economy of a farm. However, to be able to improve their economy, farmers must, just as other groups, adapt to new situations. Otherwise, in the worst case looking back historically, if sufficient employment and incomes can not be earned in rural areas, a migration to the cities has taken place. Furthermore, the farmers must **take consideration to the consumers preferences as well as to market prices** when producing food and other agricultural services.

SOCIAL

The social prerequisites for agriculture are many. If the farmers and their families do not have access to social services such as: schools, medical care, communication, culture, shops, libraries, public transport e t c they will eventually stop being farmers and move to urban areas in the long perspective. This can be shown as different indicators on infrastructure as in table 4. Another factor of importance is the structure of population, which the age distribution of a population shows (table 4).

It has also been discussed **how important agriculture is for a living rural landscape.** This varies depending upon how close to urban settlements the rural area is located. In the near vicinity of urban settlements, other employment outside agriculture can be found and agricultural land has other alternative values beside the production of food. The possibility of rearing, for example horses, can keep the landscape open in the future, by the production of fodder and grazing. No food production will be necessary in these areas. If the agricultural area is far from urban areas, farming is increasingly important. A paradox lies within this, as the large market for food exists in the urban areas and production of food in their vicinity would reduce transports and handling and could with proper measures taken, in the long run, lead to a production of higher quality at a lower price.

Another aspect which must be included for sustainable agriculture, is the necessary **recirculation of nutrients between urban settlements and rural areas.** This recirculation regards all nutrients from society that usually end in sewage sludge, sewage and garbage and must be returned to the production of food. This is, as already mentioned, most important for phosphorus, as the phosphorus deposits are limited. The consumers must be involved in the process of recirculation to ensure "clean, not contaminated, high quality waste". The consumers must learn how to use their drain, sewer and garbage disposal and to realise how important recirculation is for sustainable food

production. In this report we have chosen to use two criteria for indicators within this area, the education of consumers (table 4) and non-renewable resources (table 2).
In planning for the society of the future with sustainable development, consideration must be taken to the **distribution of rural areas and urban settlements, as** well as the protection of arable land for food production. Careful **spatial planning** is necessary. Areas for recreation and cultural and historical values must be preserved. In this case suitable indicators can be the age distribution of the rural community or the general economy or amount of unemployment or social service within a rural area compared to an urban area (table 4).

6.4.5 hdicators on competence

Competence is a precondition for sustainable development. **Good agricultural practice** concerns the **farmers** management skill and knowledge and takes into account measures to prevent negative effects on the environment from agriculture. Education makes it possible to improve the results of the farm, at the same time it often improves health and well-being. As mentioned above, it is just as important to educate the consumers as the farmers. The **consumers** must also be well informed, to be able to make the "right" sustainable choice and not only the cheapest choice when purchasing food and other agricultural services. Indicators can show the level of education or the type of education, such as agricultural or environmental education (table 4).

6.4.6 Comments on core indicators

The idea behind the presentation of a rather extensive set of indicators is to make it possible to analyse the degree of sustainability from the data that is available in the different countries. At present, we have to use the kind of information that exists in the individual countries and in the meanwhile develop common monitoring programmes on core indicators for the future. The analysis of sustainability will from the start be carried out in the form of a **cluster analysis** of preferably key ratios. An array of key ratios which illuminate a specific question is called a key ratio cluster (Bergstrom, 1997).

An attempt to list ten **core indicators** based on the gross presentation of indicators given in table 1 to 3, is presented in table 6. Such a list should be produced from identified core values and non-sustainable issues.

Agriculture substantially contributes to the eutrofication of the Baltic Sea. The use of indicators focusing both indirectly and directly on **nutrient losses** are urgent. Nitrate pollution of ground water often restricts the use for drinking purposes and has to be monitored. Similarly, the use of **plant protection products** might be connected with environmental and health hazards.

The general agricultural structure determines the farms ability to adjust to sustainable agriculture. An inappropriate livestock density and integration between crop and animal production within a country makes it difficult to establish an efficient recirculation of all kinds of animal wastes.

Biodiversity is no doubt, in many places, severely threatened and needs efficient indicators and immediate counter measures. As already mentioned, grazed permanent or old meadows and pastures are the most valuable habitats and thus chosen as one of the core areas for monitoring biodiversity. Also the amount of threatened or endangered species, both of animals and plants, are of importance.

In the future the use of **phosphorus and fossil energy** has to decrease and consequently indicators are needed both on the overall use and on the progress of phosphorus recirculation.
Finally, the consumption of **growth promoters and veterinary antibiotics in animal production** has been discussed as one of the core areas to be analysed.

6.5 Data availability and monitoring

"State indicators" collected within appropriate monitoring systems aiming at environmental quality aspects are scarce. Few soil monitoring programmes are in operation and water quality is similarly not studied frequently enough. Easier available are statistics on inputs, land use patterns and livestock, which can all be used as "driving force indicators". This suggests a need for common efforts aiming at efficient monitoring systems, to be able to follow the path towards increased sustainability within agriculture in the future.

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Table 1. ***National indicators of production***

Criteria	Indicators		
Food supply	**Driving force**	**State**	**Response**
Structure of agriculture	Economy Legislation	Agricultural land/total land Agricultural land use Livestock farms, % LU/ha on farm level Arable farms, % Farm number and size distribution Farms > 200 LU*	Environmentally certified farms, % Subsidies
Crop production	Economy Legislation	MJ/capita, Actual harvest/country potential	Subsidies
Animal production	Economy Legislation	MJ/capita Types of animals	Subsidies
Food quality	Economy Legislation	Nutrition, proteins, vitamins Flavour, freshness, pollutants	
Other crops	**Driving force**	**State**	**Response**
Energy crops	Economy	Hectares, %, of total arable land	Subsidies
Industrial crops	**Economy**	**Hectares, %, of total arable land**	New products and methods

LU = Livestock Unit

Table ***2. Indicators of natural resources***

Criteria	indicators		
	Driving force	**State**	**Response**
Arable soil quality	Cd input/output Acidifying fertilisers Total P input/removed P Plant prot.prod. input I harvest unit Cd in fertilisers Atm. Deposition of S, N, heavy **metals and** toxic organics Erosion Soil compaction, machinery weight	Cd, Hg, Pb, Cu in top soil P in top soil, root depth Bio-activity in top soil Cd ,ppm in W. Wheat Organic matter, % Tonnes soil eroded/ha/year	Use of low Cd fertilisers Lime, kg/ha Recirculation Soil-mapping of P, K, PH Crop rotation Green manure Cultivation methods Bufferzones
Landscape and biodiversity	Grazing area/total agric. Land Habitat alteration and natural land conversion Removal of landscape elements	Pastures and wooded pastures, ha Endangered species Natural wetlands, Size of connected arable land Traditional biotopes	Organic farming, % Created wetlands Bufferzones Payments for restoration & maintenance
Water quantity and quality	Water abstraction-irrigation **Total N input/removed N** Plant prot.prod. input / harvest unit Consumption of N-fertilisers Consumption of P-fertilisers Consumption of plant prot. products LU/ha on farm level Net-import/export of N and P Proportion of drained arable land	Nitrate leakage/arable land, **ha** P losses/arable land, ha Pesticide residues in water Nitrate in drinking water	Regulation on manure storage 81 handling Restriction of substances Disposal of pesticide residues Protected water supplies Wastewater treatment coverage Winter green cover, %
Air quality	LIJlha	NH, emissions CH, emissions	Covered storage, % Spreading & livestock density regulations
Non-**renewable resources**	Fossil energy, kwh/unit Fertilizer P, kg/ha	Renewable/total energy used Recycled P/total **P** used	Recycled urban P, % Environmental taxes

Table 3. ***Indicators of human health and animal welfare***

Criteria	Indicators		
	Driving force	**State**	**Response**
Health of the farmers and farm workers	Amount of chemicals in use Environmental safety of chemicals in use Indoor climate of animal housing and farm buildings Indoor climate of tractor cabin Number of heavy lifts and dangerous movements	Cases of respiratory diseases/total Cases of muscular-skeletal diseases/total Cases of infective diseases/total	Reduced degree of specialisation Improved ventilation in buildings Preventive medicine & care
Animal welfare	Economy Production methods Consumption of growth promoters and veterinary antibiotics / L.U	Pathological abnormalities, %	New housing, feeding and transportation systems Legislation on drugs

Table 4. ***Indicators of economy and social issues***

Criteria	Indicators		
	Driving force	**State**	**Response**
Economy of the farmer	Market price Market protection, tolls Agricultural policy Environmental policy Consumers preferences	Average income/farmer Agricultural workers wages Profitability Average income/crop or product Credit system	Subsidy programmes Tolls Increased productivity Complementary incomes Research and extension Processing of products
Social services in rural areas	Population density Burden of disease Political decisions I economy Regional policy	Population in rural areas Availability of medical care, schools, public transport, stores, libraries	Spatial planning Regional and rural policies Establishment of social services Local influence and democracy
Communication structure	Access to communication Price of communication	Distance Quantity and quality of roads Number of cars Public transport	Communication strategy IT*-education IT-projects
Structure of population	Employment /employers Housing Social services Economy of public sector	Age distribution of population(rural areas) Population density Income /family Number of commuters	Diversification programmes Subsidy programmes Establishing social services Education
Balance between rural and urban areas	Economy Employment Social services	Age distribution of population(rural areas) Rural land use e.g. forest, arable land, nature reservation	Spatial planning Exchange of services Recirculation

*IT = **Information technology**

Table 5. ***Indicators of competence issues***

Criteria	Indicators		
	Driving force	State	Response
Farmers competence	Economy Competition Democracy	% farmers with higher education % farmers with agricultural education	Education available Subsidies Training Advice and extension
Public awareness	Economy Information types 81 sources	% of population with higher education % of population with environmental education	Education available Environmental labelling Consumers choice

Table 6. ***Ten selected central core indicators***

Criteria	Indicator
Structure of agriculture	LU*/ha on farm level
Arable soil quality	Total P input/removed P
Landscape and biodiversity	Grazing area/total arable land
Water quantity and quality	Nitrate in water
Non-renewable resources	Recycled P/total P used
Health of the farmer and farm worker	Cases of respiratory diseases/total
Animal welfare	Consumption of growth promoters and veterinary antibiotics / L.U.
Economy of the farmer	Average income/farmer
Social services available in rural areas	Availability of rural social services
Competence	% of farmers with agricultural education

L U = livestock unit

7. Scenario of Sustainable Agriculture in the Baltic Sea Region

Aim

The aim of the scenario task is to illustrate one or more possible ways to improve present agricultural practices towards increased sustainability. Furthermore, an analysis should be made of the consequences from the proposed changes in agricultural structure and methods.

In the directives to the given task, it is stated that the work of HELCOM and EU-CAP should be considered.

The implementation horizon is proclaimed to be 2030 with a checkpoint at 2010. However, when searching for appropriate changes to present day agriculture, the focus has been to develop a long term sustainable situation, regardless of the time schedule.

Another presumption, is that there will be many alternative modifications to present day agriculture, all capable of contributing to sustainable development. To imagine that we will reach total agreement on “the only right way” is unrealistic. Our belief, is that we will be better off, if we focus on “a set of main changes” or in other words elaborate some sort of compass for the future.

The non-sustainable issues

Depending on the extremely short time frame for the scenario task most effort has been put on the environmental issues of sustainable development, although the social and economical issues are just as important. The social and economical aspects have been dealt with to a larger extent in other chapters of this report (chapter 6 and 9). Nevertheless, we want to point out that further analysis is necessary regarding the social and economical aspects of sustainable development of agriculture.

New solutions for agricultural production have the utmost goal to solve all present non-sustainability issues, but this analysis will start by searching for solutions for the two main environmental issues for the Baltic Sea Region; the nitrogen and phosphorus load on the Baltic Sea including ammonia emissions to the atmosphere. The following non-sustainable issues have been analysed with respect to the need of measures:

* Nitrogen and phosphorus load to the Baltic Sea
* Ammonia emissions; nitrogen load and acidification
* Inadequate use of plant protection products
* Loss of soil fertility and nutrient mining
* Loss of bio-diversity
* Unfavourable animal health and welfare
* Farming under less competitive conditions
* Dependence on non-renewable resources (P, fossil fuel)
* The greenhouse effect and damage to the atmosphere
* Insufficient education, information and skill
* Occupational health of the farmer
* Risks with genetically modified organisms
* Social and economic issues

Background of the proposed conclusions for Chapters 7 and 8

It was decided that the scenario was mainly to be based on a summary of existing knowledge, from earlier studies, literature and professional experience as well as to a minor degree on an explanatory and guiding model analysis regarding nitrogen and phosphorus. A strict scenario approach for all 10 involved countries, with mathematical analysis of consequences, was not considered to be possible within the framework of this project. Within the model analysis it was only possible to go into depth regarding the environmental issues of sustainable development, although the social and economical issues are just as important and are a prerequisite for sustainable agriculture.

Based on the judgement that the nitrogen and phosphorus load from agriculture to the Baltic Sea including ammonia emissions to the atmosphere is one of the most important non-sustainable issues for agriculture, an explanatory and guiding model analysis regarding nitrogen and phosphorus was performed. The model analysis only gave a minor input to the results from the scenarios in Chapters 7 and 8 and most of the conclusions were reached without the model analysis results as a base. Nevertheless, the results from the model were considered to be valuable to show in which direction the changes could possibly be and to show some of the consequences. A short description of the model task can be found below.

A sub-project based on a model task

The reasons for applying a model approach to the scenarios were that it was not possible to model the environmental impact and possible solutions for agriculture in the whole Baltic Sea Region within the time frame for this assignment. Instead a partial model approach, both with respect to the number of countries and to the numbers of non-sustainable issues was chosen. The high levels of nitrogen and phosphorus in the Baltic Sea were considered for the agricultural sector to be one of the main non-sustainable issues. At the same time the involved countries had not achieved the goal of 50% reduction to 1995 in the levels of nitrogen and phosphorus to the Baltic Sea. Thus, it was decided that the model would be run against the sustainability goal of 50% reduction of nitrogen, phosphorus and ammonia losses and that the model would give the maximum production of food and fodder possible without exceeding the goals, as well as modelling business as usual. The objective of this task was to compare and analyse the environmental impact from two hypothetical agricultural production systems, with the base year 1995, by the years 2010 and 2030. Details on the modelling task can be found in the report “Model analysis of environmental impact from two hypothetical agricultural production systems in Sweden, Denmark and Lithuania by the years 2010 and 2030” (Swedish Institute of Agricultural Engineering, report no. 243, 1998).

The three selected countries - Denmark, Sweden and Lithuania - represented a range of typical agricultural practices of present day Baltic Sea region agriculture. Denmark represents an important agricultural country, with relatively high production, that has a large export of agricultural products. Sweden represents countries with a lower degree of agricultural production and a minor export of agricultural produce. Lithuania, as a relatively large agricultural country, represents the countries in transition, with all of their specific conditions and problems. One difficulty that was recognised was that it is impossible to specify “business as usual” for the countries in transition and Poland, as the whole sector is in a process of changes after the liberation from the former Soviet Union. Relevant assumptions on “business as usual” are therefore extremely difficult to suPPlY-

A NP-flow model which originally was developed to provide an Agricultural Run-Off Management Study in the Republics of Estonia, Latvia and Lithuania was used (Swedish

Institute of Agricultural Engineering, 1993). In addition, information from the Swedish Environmental Protection Agency's report; "A sustainable Swedish agriculture the year 2021" (1997) was also used for relevant assumptions on production levels, fertiliser use, yields etc. Some assumptions are constant for the two scenarios but are different for the selected countries e.g. water discharge' (Sweden 250 mm, Denmark and Lithuania 200 mm).

The research group that created and used the NP-flow model in Estonia, Latvia and Lithuania was engaged for the task. To their help an expert group was appointed with representatives from the three selected countries. The expert group guided the work on designing the future sustainable agriculture for the model and helped the research group to find necessary data and other facts from the individual model countries.

The model analysis was performed on two scenarios;

- **Scenario 1. "Business as usual (BAU)".** A scenario with the more or less full use of today's available agricultural area, creating possibilities for increased export compared to today. For Lithuania, being a country in transition, this was not considered to be relevant (see the explanation above). Instead the export of milk was assumed to be 1 ***200*** 000 tonnes for the year 2030. Improved management and the technical development will increase the animal and crop production. The mineral fertiliser use was constant. No environmental legislation, besides the already existing, was implemented.

- **Scenario 2. "Sustainable agriculture - 50% nutrient loss reduction (NP50)". A** scenario which assumes a sustainable agriculture in the sense of a 50% reduction of the nitrogen run-off from agricultural land to surface waters. The reduction of ammonia emissions from agriculture and the phosphorus run-off was determined by the agricultural system when the N run-off target was reached. It is assumed that improved management and technical development increases the animal and crop production levels to a lesser extent than in the BAU model. The use of mineral fertiliser is reduced compared with today. The environmental legislation is improved, especially for manure handling. Set-aside land, not used for export will be utilised for energy crops, extensive grazing, wetlands or afforestation.

* The algorithms used to calculate the relation between water discharge and N&P-runoff are based on results gained by investigations on surface and drainage water from tile drained fields. The total surface water discharge due to inflow of deeper groundwater (low N&P concentrations) is often somewhat higher.

Table ***1. The most important assumptions for the scenarios "Business as usual' (BAU)*** *and "Sustainable agriculture - 50% nutrient loss reduction (NP50)".*

	1995	2010		2030	
		BAU	NP50	BAU	NP50
Human consumption	actual	as 1995	as 1995	as 1995	as 1995
Human population	actual	110%	110%	120%	120%
Crop yields					
Grass, kg DM/ha, y	actual	100%	50%	100%	50%
Wheat, kglha, y	actual	110%	105%	120%	110%
Barley, kg/ha, y	actual	110%	100%	120%	100%
Mineral fertilisers					
Grass, kg N/ha	actual	100%	0	IOO%	0
Wheat, kg N/ha	actual	110%	105%	120%	110%
Barley, kg N/ha	actual	110%	100%	120%	100%
Milk production					
Milk, kg/cow, y	actual	115%	115%	130%	130%
Fodder grass, kg DMlcow, y	actual	100%	100%	100%	100%
Fodder grain, kglcow. y	actual	100%	100%	100%	100%
Concentrates beside grain	Imported! No influence on the agricultural area!				
Milk export, 1000 t/y	actual	110%	Varied	120%	Varied
Milk production, 1 000 t/y	actual	Calculated!		Calculated!	
Beef production					
Beef meat export, 1000 t/y	actual	Determined by number of cows!			
Beef meat prod., 1000 t/y	actual	Determined by number of cows!			
Pig production					
Fodder grain, kg/kg pig	actual	95%%	95%	90%	90%
Pig meat export, 1000 t/y	actual	100%	Varied	100%	Varied
Pig meat prod., 1000 t/y	actual	Calculated!		Calculated!	
Poultrv production					
Fodder grain, kg/kg poultry	actual	100%	100%	100%	100%
Poultry meat export, 1000 t/y	actual	100%	Varied	100%	Varied
Poultry meat prod., 1000 t/y	actual	Calculated!		Calculated!	
Improved manure spreading technique					
N-runoff		100%	90%	100%	80%
NH,-emissions, % of N in manure		35%	30%	35%	25%
P- runoff		100%	85%	100%	70%

In both scenarios, it is assumed that the area of winter green land is 60% or more of the agricultural land. If less, catch crops (grass) are assumed to be sown on the areas missing up to 60%.

Some of the results from the modelling task are presented in table 2.

Table ***2. Some model results for Denmark, Sweden and Lithuania with the scenarios "%usiness as usual"(%AIJI and "Sustainable agriculture-50% nutrient loss reduction (NP50)". The results are in percent (%l of the vaIu'e in the base year '995 (official natibnal statistics***

Scenario Year / Country Parameter		BAU 2030	NP50BAU 201Q0I0	NP50 2030
Denmark				
Grassland		118	130103	113
Grain		87	85 91	74
Other crops		151	134155	282
Dairy cows		130	73110	65
Milk production		200	100150	100
Beef cattle		131	74111	65
Beef production		137	77116	68
Pork export		***96***	80 96	66
Pork production		***101***	87 99	78
N run-off		86	82 97	51
P run-off		101	86 99	68
NH,-emissions		113	67104	46
Sweden				
Grassland		130	105120	78
Grain		95	88 93	75
Other crops		71	108 84	152
Dairy cows		145	114131	87
Milk production		250	175200	150
Beef cattle		143	113130	86
Beef production		184	145166	110
Pork export		***0***	0 0	0
Pork production		major	changes	here
N run-off		100	69100	52
P run-off		118	90111	80
NH,-emissions		136	95123	64
Lithuania				
Grassland		19	22 22	19
Grain		25	27 27	25
Other crops		2338	2256250	2338
Dairy cows		45	52 52	45
Milk production		75	75 75	75
Beef cattle		47	53 53	47
Beef production		51	57 57	51
Pork export		***0***	0 0	0
Pork production		167	153153	167
N run-off		41	41 45	38
P run-off		57	57 57	55
NH^3-emissions		60	56 64	40

Some conclusion from the model task

BUSINESS **AS USUAL**

Denmark and Sweden

- The number of animals will increase, creating larger losses of ammonia both in absolute figures and expressed as kg nitrogen per hectare and year in 2030.
- The nitrogen run-off will be fairly constant, with slightly lower specific area losses in 2030, due to increased areas with grassland and smaller areas with grain.
- This slight area specific nitrogen run-off reduction and the more efficient meat production gives a positive effect on the amount of nitrogen lost per kg produced meat. It decreases from 34 to 28 g N/kg meat in Denmark and from 78 to 58 g N/kg meat in Sweden.
- Nitrogen losses expressed in kg per hectare and year is more environmentally relevant and shows that agriculture in Denmark has higher losses than Sweden.

Lithuania

- Lithuania would have preferred to have used the same assumptions as for Denmark and Sweden, with more or less full use of today's available agricultural area, creating possibilities for increased export when modelling business as usual. Instead, the previously discussed assumption that the export of milk, was at the same level as before independence in 1990 for the year 2030, was applied. To rerun the model on new assumptions was not possible to comply with, due to lack of time and possibilities.
- Agriculture in Lithuania largely reduces the emissions of both nitrogen and phosphorus and reaches the 50% nutrient reduction goal in the BAU scenario.
- The large nutrient reductions in 2030 are due to the productivity increase in crop yields, milk production per cow etc. The same amount of food can be produced by fewer animals and on smaller agricultural areas.
- Two thirds of the agricultural area may not be needed for food production in the future.
- Lithuania will be able to increase the milk export to the same level as in the late eighties.
- The larger efficiency in milk production per cow results in fewer calves, which means that the beef production may not reach the domestic demand.
- The nutrient losses will be low in absolute and area specific terms, but the nitrogen losses per kg produced meat will be almost as high as in Sweden.

NITROGEN PHOSPHORUS 50% REDUCTION - SUSTAINABLE AGRICULTURE

- Legislative measures are implemented to regulate storing and spreading of manure in such a way that the ammonia emissions are reduced from 35% to 25% of the ammonium nitrogen content in the manure.
- It is also, in combination with other regulation's on soil cultivation, bufferzones, catch crops etc., assumed to reduce the nitrogen and phosphorus run-off to 80% and 70%, respectively.
- Both Denmark and Sweden can reach the 50% nutrient reduction target.
- In Denmark, the substantial reduction of the pig and poultry meat export to 70% and 50% respectively of the 1995 level, seems to be enough to reach the 50% nitrogen reduction goal, beside the legislative measures.

- In Sweden, improved legislation and increased milk yields per cow are almost enough for reaching the 50% target. No other measures were therefore implemented in the scenario for Sweden.
- In Lithuania, the legislative measures will improve the environmental status even further and the nitrogen run-off will decrease from 29 000 tonnes 1995 to 11 000 tonnes in 2030.

There will be large areas of agricultural land not needed for food production in the NP50-scenario. If those areas were used for rape production (1 year rape and 2 years grass in the crop rotation) or if 2% of the surplus area was used for construction of wetlands, the nitrogen runoff would increase or decrease.

General conclusions

- Implementation of legislation that reduces the nutrient losses from manure seems to be an efficient way to reduce nutrient run-off and ammonia emissions from agriculture in all three countries
- The reduction of arable land for food and fodder production is an efficient way to reduce nutrient losses from agriculture in all three countries
- Positive expectations in excess to reality on quick response of the implemented measures are likely, as the model does not correctly take into account the long term nitrogen leakage caused by mineralisation of organic nitrogen in the soil.
- Too high expectations on fast phosphorus run-off reductions, due to unsuitable soil cultivation techniques and extreme climatic events causing high erosion, are to be expected.
- Today the agricultural production in Lithuania is at a very low productivity level and the nutrient losses are low compared to Sweden and Denmark.
- In Sweden and Denmark it is the high input of nutrients that causes problems. This does not necessarily mean that the nutrient run-off will be extraordinarily high as the nitrogen input can be balanced by increased yields, ammonia emissions and denitrification. In that case, only the ammonia emissions will be the problem.
- It is important to use environmentally relevant estimates on the nutrient utilisation efficiency in the agricultural production system. Low losses per produced amount of food can be obtained even though the total effect on the environment is much too high.

7.1 Proposed changes to meet the sustainability goals

Prophylactic solutions rather than corrective measures

Agriculture in the future will be managed in a way that enhances natural processes and nature's ability to produce healthy crops and animals rather than focussing on tools of control to deal with and combat the negative effects of inappropriate agricultural practices. Consequently, priority is given to research and development resulting in prophylactic solutions rather than in more effective corrective measures. New technical solutions in line with this development will be based on biological and environmental requirements, taking advantage of both existing and emerging new technologies.

Below is suggested changes with the ability to improve the sustainability of present day agriculture with respect to the use of natural resources /environmental sustainability, to economy and social aspects.

In many countries, agriculture has developed in a way that does not promote long term sustainability. This is discussed and measures are proposed to improve the overall agricultural structure. In the next part, nutrient losses are discussed and a set of possible corrective measures suggested. In the last section, other important non-sustainable issues are analysed and some urgent changes proposed.

The changes and actions proposed are of different relevance to each individual country, region and farm type. This issue is analysed in chapter 8. In the Action Programme, chapter 9, a set of selected measures from this chapter are proposed.

In more general terms it may be stated that structural issues deciding agricultural production levels, the extent of animal production etc. has to be put more in focus in the future. Implementation of good agricultural practice at farm level must continue, but seems not to be sufficient to reach the goal of a Baltic Sea in environmental balance with respect to the experiences now available.

7.1. I Agricultural structure sets the framework for the success of measures on farm level

The development towards sustainable agriculture is up to now mainly characterised by agricultural adjustments in terms of “good agricultural practice” at farm level. However, achieved results have not reached the set up goals. That is especially true about nutrient losses.

Issues such as production levels, total input of nutrients in crop production, total numbers of animals and the degree of net-export of agricultural products have to be further analysed with respect to sustainability concepts. Some fundamental prerequisites concerning the overall structure of the farm sector have to be fulfilled, if sustainability will improve through modifications of practices at farm level.

The distribution pattern of animal production sets very much the base level for nutrient losses to the water, as well as to the atmosphere. High **livestock density** in relation to available land for spreading of manure, often causes severe nitrate leaching and an inefficient recycling of phosphorus in manure. This is true on farms, as well as for regions. Animal production concentrated to certain regions creates heavy emissions and local negative impacts of ammonia per land unit.

Differences in environmental impact are also to be identified related to the **types of animals.** Grazing animals such as cattle, horses and sheep give opportunities to preserve old natural permanent grazing land and thus maintain biodiversity. The amount of permanent pastures is most likely one of the most important factors for biodiversity. The existence of grazing animals also has a positive effect on soil fertility, due to favourable crop rotations with a high proportion of perennial crops. Crop rotations with leys also require less pesticides than rotations consisting of annual crops only, which dominate on farms with pigs and poultry and on grain farms. On the contrary, animal products from ruminants cause greater losses of nutrients per produced unit, than products based on pigs and poultry, due to a less concentrated feed, roughage which needs greater areas for production than grain feeds.

Biodiversity, the characteristic of biological systems to be different from each other, is manifested at the level of genes, species and ecosystems. The main sources of threat are loss of landraces and old species, as well as destruction of habitats due to intensive, mechanical agriculture, land-use changes and abandonment of land as well as polluting

emissions. New niches for successor species can be created through adapted, extensive forms of land management, thus enhancing species diversity. Placing areas under protection within the framework of nature conservation treaties is an important but expensive instrument to preserve extensive areas as habitats and to protect the species that remain. Promotion of organic farming could also be a way to maintain biodiversity as no pesticides or artificial fertilisers are used.

Large farms are often regarded to be less favourable with respect to resource and environmental maintenance than small ones. Except for very large animal holdings, such a statement is not scientifically proven. Good opportunities of being able to afford better techniques on larger farms may even change the situation completely. Machinery rings will improve the farmers economy on all types of farms. The situation will be different on the extremely large animal complexes existing today in the countries in transition and Poland, where there usually is no balance between the amount of animals and arable land for spreading manure and a lack of techniques for correct manure storage and spreading.

Organic farming, meaning the use of no commercial fertilisers and pesticides, is in many aspects in agreement with a sustainable concept, but not in all aspects. Due to a widespread growing of nitrogen fixating crops and use of organic wastes, nitrate leaching can often be unacceptably high, although often not as high as in conventional agriculture. Furthermore, continuous phosphorus export from the farm with agricultural products, may lead to a phosphorus deficit in the soils, if not compensated in some way. This could be the case even with respect to other nutrients depending on the soil type and origin. Compared to conventional agriculture the yields are usually lower in organic farming systems. Organic farming with dual purpose milk/meat production, seems to have the best market competitiveness in comparison with other types of commercial farming.

During previous decades, people were more evenly integrated with agriculture and arable land. Animal feed was mainly produced on the farm and the amount of purchased necessities was small at that time. Today most people live in urban areas and the production of food relies heavily on purchases of necessities also from other countries. **Transportation** has thus increased to a large extent during the 20th century, as well as the environmental impact due to increased fossil fuel consumption and related pollution. The urban development and the increased dependency on the farm on necessities from other countries has exaggerated the **linear elemental flow.** Nutrients, as well as non-biotic elements e.g. heavy metals, accumulate in urban vicinities and on animal dense farms and regions. Large distances between food producers and consumers not only create long transport of food but also constitute an obstacle for the recirculation of nutrients.

Farming under less competitive conditions is prevalent for holdings on less fertile land, mainly situated on the outskirts of the agricultural plains and for enterprises remotely situated to urban districts. A lack of social infra-structure e.g. availability of services, such as education, health care, public transport and shops, may be a determining factor for the running of such farms. Lack of competitiveness may also be a consequence of insufficient funds for investments in appropriate farm equipment or for purchases of essential means of production. When valuable areas are threatened, such holdings and regions may need special policy actions to survive. This applies to farming in western countries and can be very important for farming in the countries in transition and Poland.

Conclusions for sustainable agricultural structure

Integration

- Crop and animal production should be more integrated in all countries.

- Very large non-sustainable animal holdings should reduce the number of livestock or be split up into smaller, more evenly distributed animal holdings

Biodiversity

- The number of ruminants should locally correspond to the amount of old permanent grazing land to preserve biodiversity. In some countries it may not be possible to retain all such land, selected valuable grazing areas may need special policies to maintain.
- Remains of natural biotopes such as wetlands, stone walls, islands in field etc. should preferably be saved.
- On-farm conservation of landraces and old species.

Transport

- Transport of feed, food and wastes should be minimised by promoting local alternatives before centralised ones wherever found profitable determined by life-cycle analysis.

Less competitive farming

- All countries in the Baltic Sea Region should support remote and less market competitive farming and the development of essential services and complementary employment, in order to preserve a viable countryside all around the Baltic Sea.

Co-operation within watersheds

- Co-operation between neighbouring farms should be promoted to overcome negative effects of extensive specialisation on individual farms by mutual care for the arable resources, such as permanent grazing land, exchange of feed and manure etc. This can be a way to reach sustainability for the total area without jeopardising the benefits of specialisation of individual farms.

Organic farming

- Society should promote organic farming wherever it is contributing to sustainable development.

7.1.2 Controlling factors and management changes to meet the goals for nutrient losses at farm level

FACTORS REGULATING NUTRIENT LOSSES FROM FARMS

Drainage and cultivation of wetlands and old grasslands may cause extensive nitrate leaching due to an increased mineralisation of stored organic matter. Nutrient losses may also occur as a consequence of wind and water erosion, due to inappropriate soil management. In all other cases of unacceptable nutrient losses from arable land, the losses are related to the **degree of fertiliser input** e.g. mineral fertilisers and manure. Heavy leaching of nitrogen can only occur in relation to intensive fertilisation but not necessarily as a result of the fertiliser input an individual year, but as a consequence of a long term use of high inputs. The purchase of feed and feed concentrates to the farm is often an underestimated or forgotten component of the farm nutrient balance. The ratio between total nutrient input and product output is a key factor directing the long term losses. A goal should be to have as efficient use as possible of the nutrients on the farms, which should in many cases lead to reduced fertiliser input.

As already mentioned the use of **animal manure in crop production** is often a main contributor to nutrient losses to the atmosphere as well as to the water. A lot of research

has been performed with the aim of improving the utilisation of nutrients in manure. Still there is more to be done in this field. If no other possible short term measures are applicable to prevent excessive negative effects on the environment for regions and individual farms with an excessive production of manure compared to available spreading land, it could be of interest to develop methods to concentrate the valuable nutrients in manure through some sort of technical manure processing. That would make it possible to transport the nutrients in manure over greater distances, but at the same time these types of processes have a high energy input. Such research is under way and may provide one possible solution to leaching problems in animal dense areas. This type of solution should only be used as an emergency measure during the time that it can take to implement other structural measures with a greater potential for long term sustainability, such as adjustments of the livestock density.

Ammonia emissions are strongly correlated to the **number of animals** and also to the housing and ventilation system used, **manure storing** practices and **spreading procedure.** A less protein rich **animal feed** diet decreases the amounts of ammonia in the manure that can be lost to the atmosphere. The same is true if the ventilation air is cleaned, the manure storage tank is covered and the manure is incorporated in the soil during spreading or immediately after application.

An efficient use of manure in crop production prerequisites **sufficient manure storage capacity** in relation to optimal timing of spreading.

Cropping practices such as soil tillage, choice of crop, crop rotation, timing and equipment for spreading manure, are all factors influencing the nutrient turnover and flow in the soil-crop-system. Except for a more appropriate total fertiliser use, these are the main tools for minimising the nutrient losses on the farm level. Nutrient leaching and surface run-off may be reduced in systems with direct sowing, high proportion of winter green fields and manure spreading mainly during spring. Liquid manure seems to give better opportunities for an efficient handling and nutrient recycling compared to solid manure systems, due to recent development in techniques. Slurry in western countries commonly has a dry matter content of 5-10%. The slurry that commonly exists in countries in transition and Poland, with a dry matter content of approx. 0,5%, will lead to large problems, as the amounts are so large that building suitable manure storage is economically impossible. Also problems with soil compaction are common, when spreading such large amounts of slurry.

Point pollution sources of urine or leakage from manure storage is not acceptable in a sustainable production system. Furthermore, waste water from households and farm buildings should be collected, stored and applied to farmland **as** a nutrient.

Conclusions for sustainable farm management concerning nutrient losses

Nitrogen input

- Application rates for nutrients should not exceed the crops nutrient requirements. National guidelines should be developed with fertilising recommendations and they should be referred to:
  a) soil conditions, soil nutrient content, soil type and slope
  b) climatic conditions, precipitation and irrigation
  c) land use and agricultural practices, including crop rotation systems
  d) all external potential nutrient sources.
- Nitrogen nutrient balances should be performed on the farm to show the size of the nitrogen surplus and be used when planning fertilisation.

Phosphorus input

- The available phosphorus content of arable topsoils should not exceed the requirements of an acceptable crop production.
- The annual phosphorus input should be calculated in relation to:
    - the phosphorus content in the field
    - the crop requirements.
- Good monitoring data on the phosphorus status of the arable land is needed in every country, as well as nutrient balances to show if the supply of phosphorus in the soils increases or is depleted.
- At farm level the phosphorus input should be of the same size as the phosphorus removed. Phosphorus nutrient balances should be performed on the farm to show the size of the phosphorus surplus and should be used when planning fertilisation.

Livestock density and manure handling

- In regions with high average livestock density, and preferably also on individual farms, the total number of animals should be reduced to a level consistent with an efficient recycling of nitrogen and phosphorus.
- The efficient circulation of nutrients on animal farms in combination with a high degree of self-supply of fodder is a prerequisite for limited losses of plant nutrients
- The utilisation rate for the nutrient content in animal manure should be improved as much as technically feasible. That can be implemented by:
    - building sufficient storage capacity for manure for optimal timing of spreading
    - covering slurry and urine stores to reduce the odour and the emissions of ammonia nitrogen
    - improving manure spreading techniques and maintenance of manure spreaders
    - incorporating slurry, urine and solid manure in the soil immediately after spreading on open soils to minimise ammonia nitrogen losses

Nutrient point sources

- Nutrient point sources on the farm, such as from manure storage, milking parlours, silage storage etc. should be taken care of and stopped

Crops and crop rotations

- Choose crops and crop rotations for a minimum need of soil cultivation and a high proportion of arable land covered by crops during autumn and winter.
- In areas with more than 50% annual crops, the proportion of perennial crops or green cover crops should increase. This is most urgent in areas with sandy soils and in areas that are used for drinking water purposes and also on land sensitive to erosion.

New technology

- Promote the development and implementation of new technology that can reduce the losses of nutrient, such as precision farming with site specific crop management by use of global positioning systems.

Criteria for surplus land

- The farmers should take environmental considerations when removing land from food production in a situation of surplus agricultural land for food production:
    * soils poor in phosphorus
    * organic soils from previously drained wetlands
    * soils sensitive to erosion
    * soils sensitive to nitrate leaching

Nutrient traps

- Create bufferzones and wetlands to reduce nutrient losses and increase biodiversity

7.1.3 Additional measures to meet other sustainable issues

Soil fertility is determined by chemical, physical and biological soil conditions. Mineral fertilisers may be contaminated with pollutants due to the process by which they are manufactured, or depending on the origin of the raw materials. Phosphate fertilisers, especially, display high levels of pollutant elements, above all cadmium. Depending on the system of land use and fertilisation methods, these pollutants enter agricultural soils by fertilisers. Cadmium and chromium are the main contaminants, with lesser quantities of lead, nickel and arsenic being deposited. Recycling of urban waste may also contribute to the input of heavy metals and persistent toxic substances to arable land. For most of the Baltic region the atmospheric deposition is however the main pollutant source.

Soil erosion in the strict sense refers to degradation processes exceeding natural dimensions. It is caused by water and wind and increased by intensive soil cultivation and bare soils. Soil erosion due to non-sustainable land management leads not only to loss of soil fertility, but also to water pollution through phosphates, plant protection products and nitrogen compounds deposited along with soil material.

Cropping methods in intensive farming, especially soil tillage and the use of heavy farming equipment, cause **structural damage to both the topsoil and subsoil,** especially compaction, with subsequent negative impacts on the regulatory functions and fertility of the soil. Structural damage leads to yield reductions. Topsoil compaction is repairable, but greater weights can lead to subsoil compaction, which is extremely serious, as subsoil compaction is irreparable. In recent years there has been a trend towards heavier farm machinery, better wheel equipment has become more common, but can not always solve the problems caused by the large weights. Consideration must be taken to total weight, wheel pressure and wheel equipment when developing or purchasing farm machinery for sustainable agriculture.

The inadequate **use of plant protection products** is always related to health and environmental risks. The utmost goal is to minimise those risks. To reach this goal it is necessary to improve the registration and handling and to reduce the overall use. Point pollution in connection with pesticides exists i.e. when filling or cleaning sprayers and with careless handling of plant protection products. Diffuse pollution is mainly connected with leaching or surface run-off, erosion or as wind driven dispersion of pesticides. Pesticide residues are found in products as well as in water. On the other hand, the introduction of pesticides in crop production some decades ago, led to a more reliable yield level and also to healthier harvests, with respect to naturally produced toxins. In most countries work is currently taking place on minimising the use of pesticides in agriculture and also replacing risky products with less toxic and easy degradable ones. Educating the farmers that handle pesticides and requiring a certificate or license for all those that handle pesticides and sprayers is important. The measures are well known and the work towards a minimal or even a zero-use has to continue. How close to zero we will come without jeopardising essential benefits from proper pesticide use, will be seen in the future.

The introduction of **genetically modified organisms (GMO)** is exponentially increasing in agriculture. Such new crops are often linked to the use of specific pesticides. The crop has through gene-techniques been made resistant to specific pesticides for combating weeds and fungi. The knowledge is still very restricted about the risks for genetic-

pollution of wild species. It seems now impossible to completely prohibit an introduction of these new seeds. Also in aqua-culture there is a risk of spreading modified genetic material to wild fish species. GMO used in animal husbandry is mainly a question of ethics. What can and has to be done, is to adopt a restrictive policy for accepting and introducing GMO.

An intensive and increasing use of **veterinary drugs** e.g. use of antibiotics for animal medication and as **growth promoters** creates a serious human and animal health problem for the future. A number of bacteria have become increasingly resistant to antibiotics, restricting future possibilities of combatting diseases. The use of antibiotics can be reduced if the breeding intensity, fodder and housing conditions are suitable for the biological production potential of the individual species.

An important step to achieve sustainability in agricultural production is to develop an efficient **recirculation of urban bio-waste/human effluents** into cropping systems. For that purpose, appropriate waste collecting urban systems have to be established, where contamination with non-biotic pollutants can be avoided. The main purpose is to keep phosphorus in human food in circular flows in the soil-crop-consumer-soil-system and also to stop urban pollution to waterbodies. In many places the need for urban investments are enormous to enable the development of circular elemental flow within the next decades.

Fossil energy has to be successively replaced, due to the greenhouse effect and air pollution as well as the fact that it is a non-renewable resource. Agriculture can produce **bio-energy.** Some possible crops are ***Salix,*** grass, oil-seed rape and wheat. Among these, ***Salix*** and grass seem to be the most favourable for the environment and also for soil fertility. Consequently, using environmentally sensitive land for production of energy can also improve the environment. To get the bio-energy sector to expand, bio-energy has to be efficiently and profitably produced and techniques for converting bio-energy to electricity and heat must be improved. Another way of producing energy can be through the production of bio-gas from e.g. manure and fermentation of some other waste products from agriculture.

In most countries the **farmers income** is often insufficient for necessary investments on the farm. **Lack of time and income restrains the farmers from finding and implementing** new production methods. On the other hand, implementation of sustainable farming systems could in the short run lead to economic losses for the farmers, in particular when the total output per land unit is reduced. To some extent, their income is linked to their degree of **education.** Extended education, demonstrations and advisory activities can no doubt improve the farmers economy and understanding of sustainable issues and the farmers willingness to change practices on the farm. Research and extension service can be of great importance.

The availability of **clean ground water** is rapidly decreasing in most countries. Agriculture plays a role in this development as nitrate and pesticide residues in water mainly originates from agriculture. Powerful measures have to be implemented, if the present **negative trends are to be broken** and the remaining waters of high quality are to be preserved.

Agriculture in the Baltic Sea region produces nitrous oxide (N^2O), methane (CH_4), and carbon dioxide ($CO_,$) that are of substantial importance for the greenhouse effect with global warming as the ultimate result. These emissions are mainly attributable to livestock farming and combustion from heating and agricultural machinery. About three quarters of the methane emissions from agriculture come from animal digestion.

Agricultural machinery and mineral fertilisers account for about 60% of the fossil fuel consumption on cash crop farms. It has been calculated that the global emissions of greenhouse gases could be balanced, if the soil organic matter content annually was increased by 0,01 % by implementing careful land use practices. This situation will not continue in the long run, but could be a solution during a transition period, while the emissions are measured.

Maintaining a **high degree of employment** is an essential component of a sustainable society. Employment is of fundamental importance to enhance social stability and the personal economy and health. However, in the future it will most likely be difficult to sustain employment in most countries. In that perspective a general commitment for the agricultural sector, as for all sectors, should be to develop new profitable services and products based on farm assets and produce. This is really a challenge. In Sweden it has been calculated that employment in Swedish agriculture will be reduced by approximately 40% up to year 2021 mainly due to the implementation of more efficient production methods and increased yields in both crop and animal production.

Conclusions on additional measures towards sustainability

Economy

- The farmers income should be sufficient to provide a fair standard of living and consist of a reasonable compensation for products and other services

Water quality

- Long term water quality should be secured by suitable land use within potential and existing pumping areas for high quality ground water. This usually corresponds to less intensive forms of land use.

Soil fertitit y

- Soil fertility should be maintained and improved with respect to soil organic matter, soil structure, nutrient status and contents of non-biotic elements and chemicals by use of only non-polluted means of production, non-compacting machinery and cultivation practices promoting increased soil organic matter.
- Nutrient balances, soil analysis and monitoring programmes should be established as a basis for appropriate use of the arable land.

Animal health and welfare

- To promote animal health and welfare, animals should:
  - be fed well balanced diets
  - not be subjected to long distance transportation
  - preferably have outdoor access and be kept in loose housing systems.
- The use of antibiotics in animal medication should decrease and the use of growth promoters terminate

Gene tically modified organisms, GMO

- The introduction of GMO in food production should be subjected to a very restrictive approval procedure and any increase in the use of plant protection products should not be allowed.

Bio-energ y

- Bio-energy production should be increased on excess arable land. Present land use must not jeopardise possibilities in the future to produce high quality food on the same land.

Recirculation

- Promote the recirculation of nutrients and organic matter in urban bio-waste to the production of biomass on arable land. Efficient administrative systems for waste quality assessment are necessary in every country.

Plant protection products

- Reduce the use and risks of plant production products in the future. This can be achieved by:
    - selecting crops and cropping systems with less need for plant protection products
    - improving spraying techniques and maintenance of sprayers
    - making certificates obligatory after participation in courses for safe handling of plant protection products for all farmers handling plant protection products and sprayers
- All plant protection products must be registered and approved by national or international authorities.

Greenhouse effect

- Promote cropping systems that increase the soil organic matter content e.g. increase permanent grassland, perennial crops and reduced soil tillage
- Promote farming with a reduced use of mineral fertilisers and imported fodder
- Introduce CO, energy taxes on non-renewable energy
- Reduce ruminant livestock numbers

Employment

- Emphasise a sector commitment to develop new profitable services and products based on farm assets and production.

Competence

- Implement action programmes for extended education, demonstrations and advisory activities for sustainable agriculture.

Literature

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8. Analysis of Consequences of Proposed Changes, Gaps and Obstacles

It has not been feasible to make a detailed analysis of the consequences of the proposed changes within the time frame for this task. The analysis is accordingly more of a macro analysis that points out the directions of the main consequences without quantifying them. The analysis is not detailed regarding results for individual countries.

Time frames

Some of the proposed measures concern structural changes. The time frame for structural changes, such as the adjustments of farm size and numbers of animals per holding, the integration of crop and animal production etc. is often decades.

Changes in agricultural practices on the individual farms may be fulfilled more rapidly if the right economic conditions or other convincing incentives can be offered to the farmers. The time schedule for implementation can be found in chapter 9.

Economy

Structural changes as well as measures on individual farms may need large investments. One principle that is applicable for agriculture is the polluter-pays principle. To be able to implement some measures for sustainable agriculture, good profitability in agriculture is a necessary prerequisite. Otherwise, the availability of subsidies or credits can make it possible for agriculture to achieve certain measures that society is willing to pay for. An important base on the way to sustainable agriculture is clear property rights.

Concerned areas

Finally, the analysis will be oriented towards the previously discussed non-sustainable issues. For each specific non-sustainable issue we will try to address the concerned countries, regions and farm types, where the most urgent actions should take place. This does not mean that other areas are not concerned at all.

8.1 Nutrient leaching

Concerned countries, regions and type of holdings

In the EU countries, the council directive concerning the protection of waters against pollution by nitrates from agricultural sources, “the nitrate directive” (91/676/EEC) regulates the status of ground and surface water, with special reference to drinking water. Nitrogen vulnerable zones must be designated, where action programmes should be established and implemented in order to reduce water pollution from nitrogen compounds. Measures to limit the land application of all nitrogen containing fertilisers and in particular to set specific limits for the application of livestock manure should be included. Even monitoring is included in the directive. All western countries have national legislation regarding manure storage and some for the spreading of manure. The countries in transition and Poland, which have applied for EU membership are starting to adapt their national legislation to the EU “nitrate directive”. Some groundwater reserves exceed the EU nitrate limit of 50 mg/l in Denmark, Germany and in the countries in transition and Poland. Problems with nitrate pollution of groundwater are on the other hand rare in Finland and Sweden.

POINT SOURCES

Nutrient point sources, such as outlets of waste effluents from manure storage, animal housing and households are today mainly a problem in the **countries in transition and Poland,** due to insufficient or non-existing manure storage and often large animal holdings. In the western countries point sources have been in focus for environmental action programmes for many years. The manure storage capacity and quality has been substantially improved and waste water treatments installed. However, problems on some individual farms can still exist.

DIFFUSE POLLUTION

Heavy nitrogen losses as diffuse pollution from arable land can occur in areas and on farms with high livestock density. Such large animal farms with several thousand heads per holding still exist in the **countries in transition including Poland and Russia.** High livestock density can be found at a regional level in western countries as well and contribute to unacceptable nitrate losses. The diffuse nitrate pollution problem is largest in areas consisting mainly of sandy soils, with a high precipitation, where a high livestock density is combined with a large proportion of annual crops.

Ploughing up old grasslands, rich in nitrogen in the countries in transition and Poland already has become and will most likely be an important source of nitrate pollution for the Baltic Sea in the future.

Phosphorus losses are more evenly distributed all over the arable land and are a function of both soil erosion sensitivity and the soil phosphorus content. Consequently, a high livestock density is a main pollution factor. Often larger problems with surface run-off, erosion and also with phosphorus losses can be found on clay soils.

Consequences of proposed changes, obstacles and gaps

IMPROVED UTILISATION OF NUTRIENTS

A more efficient use of fertilisers regarding available soil nutrient pools and crop demands may be reasonably easily effectuated by an extended education of the farmers. Knowledge exists among agricultural researchers, extension services and the majority of the farmers in most countries. The task is to distribute the concept of sustainable agriculture to all farmers and especially to those who still need to be educated. It is also important to promote applied research that will increase the efficiency and utilisation of nitrogen and phosphorus inputs.

LOWERING THE NITROGEN SURPLUS IN AGRICULTURE

In the scenarios it has been suggested that a goal should be to have as efficient use as possible of the nutrients on the farms, which should in many cases lead to reduced fertiliser input. It is also suggested to implement the paragraph on application rates for nutrients in the agricultural Annex to the Helsinki convention, as well as to use nitrogen nutrient balances on a regular basis at the farm to show the size of the nitrogen surplus and to be used when planning fertilisation. This is proposed as nitrogen losses are basically correlated to the total turnover of nitrogen in the system and different corrective measures in crop production practices have so far not been proven to be enough to reduce the nitrate losses to acceptable levels for the water environment. One complicating factor is that the nitrogen content of the soil has been built up during many years and consequently it will take many decades to see any reduction in the levels and any large change in nitrogen losses. These measures should lead to increased incentives to improve the utilisation of other nutrient sources on the farm, such as animal manure, plant residues, improved crop rotations etc., which would reduce the nitrate leaching.

Corrective measures such as **extended manure storage capacity, increased winter green cover, nutrient balances, crop production plans** for a more appropriate fertilisation and timing of manure spreading etc. have been the common way to try to reduce nutrient losses. Today, when evaluating the success of these measures from over a period of more than two decades, it appears that we have not been successful enough. One complicating factor may be the mineralisation of soil organic nitrogen, which may strongly influence the potential long term changes in nitrogen losses. The nitrogen load on ground waters, surface waters and on the Baltic Sea has at the most been reduced by 20-30 %, which is far from the 50 % (HELCOM, 1988) aimed at from the mid 80:ies and even farther from what is necessary for a healthy Baltic Sea. There also is an important time lag built in these systems, which will be noticed when measuring the nitrogen contents in the Baltic Sea, and this will delay the expected reductions. In that perspective it may today be more feasible to agree on trying to achieve a higher nitrogen utilisation as a complement to the implementation of all the measures earlier identified. Efficient tools to effectuate the reduction must be decided on. Some alternatives can be increased, such as advisory service, nutrient balances, education, taxes on commercial fertilisers and agro-environmental measures for sustainable agriculture.

IMPROVED MANURE HANDLING

The improvement of manure storage and controlling of point pollution sources **at** individual farms, mainly in the countries in transition and Poland should be based on a judgement of the long term sustainability of the individual farm with respect to livestock number, available land for manure application etc. Structural adjustments to the farm often must precede pollution reducing measures, otherwise corrective measures may become an obstacle for necessary structural changes for long term sustainability.

Another obstacle is that the building of manure and urine storage is expensive and the economy will very much set the limits and will be the main obstacle to how fast improvements can take place. The economic profitability at farm level from these types of environmental investments is unfortunately very low. There are of course also positive effects for the farmer, such as positive effects on the environment and on the immediate surroundings of the farmer, by improved drinking water quality, less odour, cleaner yards and animal housings, as well as reducing the amount of fertilisers to be bought.

REDUCTION 0F ARABLE LAND

The modelling task has shown that one of the most efficient ways of reducing the nitrogen load on the Baltic **Sea** is to **take arable land out of food and feed production.** It can instead be used for bio-energy purposes or just be left as extensive grassland or forests. This will decrease nutrient losses substantially within these abandoned areas, especially if fertile land with large losses of nitrogen and phosphorus is converted. This measure will not protect ground and surface water from pollution on the remaining areas of arable land. An even more intensive production and increased nutrient load may instead become a fact on this remaining land, if other measures described above are not implemented successfully.

8.2 Ammonia emissions

Concerned countries, regions and type of holdings

Ammonia emissions are a problem mainly in regions with high livestock density. The largest problems with ammonia emissions exist today in **Denmark, Germany** and to some extent in **southern Sweden.** Even in areas with a general low livestock density, local problems can occur **on individual farms with high livestock density.** Acute toxic effects, such as necrosis **and clorosis** on needles and leaves of near-by trees, have been noticed

on poultry or pig farms with a very high livestock density. Local problems can be found in all countries, but large problems are common on the **joint stock companies in the countries in transition and Poland.**

Consequences of proposed changes, obstacles and gaps

In the modelling task it was calculated that the ammonia emissions at the national level would in the "Business as usual (BAU)" model increase for Sweden and Denmark, while in the "50% nutrient loss reduction - sustainable agriculture" model, it was calculated that the ammonia losses would be reduced in Denmark, Sweden and in Lithuania (table 1). The situation in Lithuania, BAU, is completely different to Sweden and Denmark with a decrease in ammonia as the number of animals, the production of milk and the amount of nitrogen in manure and urine is lowered by half in Lithuania. Several measures are proposed to reduce the problems with ammonia emissions.

Table 1. ***Results from the model task on ammonia emissions in tonnes per year itonnes/yearJ at a national level for the base year 1995 and the two scenarios.***

NH, tonnes/year	7 995	Susiness as usual 2010	2030	50% nutrient loss reduction
Sweden	39'	48'	53'	25'
Denmark	84'	87'	95'	39'
Lithuania	25'	16'	15'	10'

REDUCTION 0~ LIVESTOCK DENSITY

In the modelling scenario task the largest effect was noticed from reducing the livestock density. A reduction in the amount of animals reduces the amount of manure produced and also the amount of ammonia that can be lost. Other actions possible to reduce livestock density locally can take place in countries with great regional differences in livestock density, where moving animals between regions, could reduce the local problems with ammonia emissions. A reduction in livestock density can be difficult to **implement and usually takes many years to achieve, but it is also very effective.**

IMPROVED FEEDING OF ANIMALS

Another way of reducing ammonia emissions is by reducing the amount of ammonia in the manure. This can be done by using **improved systems of animal feeding and careful planning when preparing the feeding plans as well as the usage of basic fodder analysis** for all animal types. For dairy cows and cattle, systems for evaluation of the protein content and quality can be used for a better utilisation of the nitrogen content in the **fodder. The use of synthetic amino acids specially adapted to the animals requirements can** also reduce the ammonia content of manure. **Phase feeding** in pig production is **common in some countries and has lowered the content of nitrogen in manure. The utilisation ratio of feed is poor in the countries in transition and Poland compared to the EU countries. In the countries in transition and Poland large improvements should be possible within the time frame of this task, but the improvements will not only be dependent on improved feeding systems, but also on general improvements in animal production and welfare.**

Animal housing

In **animal housing** measures can be taken such as **using litter or bedding,** e.g. chopped straw, sawdust or peat to take up the ammonia from urine and manure or else by having **efficient systems to quickly remove the effluents from the building** to the slurry or urine tank or to the manure pad. Special filters for the air outlets on animal housing are so far usually too expensive to motivate their use.

Storage of manure, slurry and urine

An efficient use of manure in crop production prerequisites sufficient **manure storage capacity** in relation to optimal timing of spreading. The manure pad, slurry tank or urine tank must be of a suitable size (at least be equivalent to 6 months storage capacity) and of such quality that leaks and spillage is prevented. This is today mainly a problem in the **countries in transition and Poland,** due to insufficient or non-existing manure storage and often large animal holdings and production systems based on handling enormous amounts of very diluted slurry.

Covering slurry and urine tanks will also reduce the ammonia emissions. This measure is in the process of being implemented in some of the EU countries and will **be of** importance in the whole Baltic Sea region.

Also the **choice of manure handling system** is of great importance for deciding the size of ammonia losses. Today we mainly have measures to reduce ammonia emissions from **slurry** and urine handling. Large ammonia losses are always found in solid manure handling systems and a large portion of the ammonia emissions occurs during cornposting. Even though sufficient measures for storage and spreading exist for urine, there is always a solid phase and the problems connected. General recommendations should be given for **slurry handling systems** where applicable, especially when starting new family farms or agricultural enterprises or when changing the production.

Application of slurry, urine and solid manure

Environmentally sound application techniques for slurry, urine and solid manure should be promoted. Especially important for urine and slurry is that **incorporation into the soil** takes place as soon as possible, preferably immediately after spreading. Also low level **spreading** by different techniques, such as trailing hoses should be promoted. To prevent surface run-off in connection with precipitation and snow melt, it is also important to incorporate farmyard manure as soon as possible. Large reductions in ammonia emissions can be achieved with these measures. **Nutrient balances and plant fertilising plans** are important, to make sure that manure, slurry and urine are used as fertilisers in appropriate amounts and times.

CONSEQUENCES OF IMPROVED MANURE HANDLING

The elaboration and implementation of legislation concerning manure storage and spreading, as well as information, demonstrations, a well functioning extension service, and funding to make the necessary investments possible will be important for the success of the Baltic Sea Agenda 21 for agriculture. In the modelling task it was calculated that the ammonia emissions from manure handling in the **"Business as usual" model** would be approximately 35% of the ammonia content in manure. In the "50% **nutrient loss reduction - sustainable agriculture" model,** it was calculated that the ammonia losses from manure will be 30% in 2010 and 25% in 2030.

8.3 Plant protection products

Concerned countries, regions and type of holdings

Problems connected with handling of plant protection products can be found in all countries in the Baltic Sea region. Much effort has been taken in the EU countries in programmes connected with the use of and risks connected with plant protection products. In the countries in transition and Poland the situation is completely different and can be summarised as follows:

- awareness is increasing
- problems with old pesticides
- poor spraying technology, mal-functioning sprayers
- poor knowledge on handling, need for education
- systems of national approval of plant protection products needed
- need of financing of plant protection products programmes

Destruction of outdated chemicals can be both difficult and costly, as the necessary knowledge for this not always exists within the countries.

In all countries **national risk reduction strategies** that should be based on Best Environmental Practice (BEP) must be elaborated and implemented. These strategies should include proper risk assessment systems for plant protection products. The need of such strategies is greatest in the countries in transition and Poland.

The risks in **using plant protection products must be reduced** as much as possible. **All plant protection products must be registered and approved** by national or international authorities before use, which means that the countries in transition and Poland must elaborate governmental functions to accomplish this task.

When handling plant protection products it is of utmost importance to **educate the farmers regarding safety and environmental aspects.** It should be necessary to have a **certificate or license** after accomplished education before using pesticides. Certificates already exist in the Nordic countries and in some EU countries, but there is a lack of knowledge in the countries in transition and Poland.

Spraying technology is another important aspect in handling plant protection products. The sprayers should be well functioning and properly maintained. **Testing of sprayers** has been shown to lead to meaningful improvements. In the countries in transition and Poland there is generally a large lack of functioning sprayers. Funding for investments in good spraying technology, perhaps as machinery rings and subsidies to finance testing of sprayers are important measures and are necessary in the countries in transition and Poland.

Consequences of proposed changes, obstacles and gaps

In the modelling task in the “50% **nutrient loss reduction - sustainable agriculture” model** the amount of arable land needed for production of food and fodder decreased in all three of the modelled countries in 2030. The decrease in sown area in the model was found to be largest in Lithuania, as improved management will lead to larger yields in both plant and animal production, than in Sweden and Denmark. Arable land will be available for other options. Depending on what this land is used for, production of energy crops, industrial crops, afforestation, wetlands and other nature conservation areas, the usage of plant protections products is bound to decrease to different extents.

The suggested measures for funding and subsidies should definitely improve the handling of plant protections products and to cleaner ground and surface water with lower levels and frequency of contamination with plant production products. Positive effects can also be expected on the farmers health.

8.4 Soil fertility

Concerned countries and consequences of proposed changes, obstacles and gaps

POLLUTANT LOAD TO SOILS

Soils may become contaminated by heavy metals, nuclides and other persistent toxic substances or micro-organisms. Mineral fertilisers may be contaminated with pollutants due to the process by which they are manufactured, or depending on the origin of the raw materials, such as phosphorus fertilisers with cadmium. Some countries, like Sweden, Finland and Norway already have limit values for the cadmium content of mineral fertilisers. An urgent need for limit values exists in the rest of the region. Another problem in some countries is nuclides from nuclear plants and military activities. Radiation fail-out could possibly be a problem for the entire Baltic Sea region as radiation can be deposited at great distances depending on the weather. As the quality and security aspects of nuclear power stations often are poor in the countries in transition, the problems today and the risk for future problems are larger than in the EU countries.

Sewage sludge, manure and composted materials are also contaminated with heavy metals, dioxins or polycyclic aromatic hydrocarbons (PAH), depending on their origin and composition. The usage of sewage sludge in the EU countries is regulated by the council directive on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture (86/278/EEC). On top of the directive the countries have national regulations, that commonly are more restrictive than the EU directive. The countries in transition and Poland which have applied for membership to the EU, are currently elaborating the EU sewage sludge directive in their national legislation as a part of the process of preparation for membership. As for animal manure, the contents of undesirable components is depending on the fodder. Additions of e.g. zinc or copper to fodder to newly weaned piglets can greatly influence the zinc or copper content of manure and also in the long run of the soil. Such additions to fodder must be minimised. Consideration must be taken to the environment when processing animal feed in all countries.

Acidification of soils is another kind of pollution of soils. Agricultural soils are usually regularly limed to compensate for the reduction in pH that takes place due to acidifying components and processes. This could be a future distant problem on set-aside land.

EROSION

Soil erosion is a problem in all countries. Large problems can exist in hilly areas where large amounts of soil are eroded every year. Even where there is a more flat topography, erosion of phosphorus with soil particles can be a problem. Erosion can lead to eutrophication of surface waters. On heavy clay soils with a permanent crack formation, inner erosion of phosphorus and soils particles in connection with heavy rain or melting of snow can be the most important source of phosphorus losses, which also is very difficult to counteract as we currently have very few efficient counter measures.

COMPACTION

Soil compaction is a problem mainly in intensively farmed areas and where heavy farm machinery with inappropriate wheel equipment is used. The climate must be considered when planning machinery operations or heavy transports on arable land. These problems can be found in all countries in the region and must be prevented by good agricultural practice. It is especially important to prevent subsoil compaction, as it is irreparable. Consideration must be taken to total weight, wheel pressure and wheel equipment when developing or purchasing farm machinery for sustainable agriculture. Farmers in the countries in transition and Poland must be aided to invest in appropriate machinery. Machinery rings is one solution.

UNBALANCED FERTILISATION

Unbalanced fertilisation could lead to problems affecting soil fertility in the future. A deficit in the contents of phosphorus and potassium of agricultural soils may be a problem affecting yields and quality of agricultural products. Risks of deficits are larger in specific types of agriculture, such as organic farming, where artificial fertilisers are not allowed. Recirculation of plant nutrients in human effluents becomes increasingly important in these systems.

8.5 Biological diversity

Concerned countries, regions and type of holdings

PRESERVATION OF SPECIES

Agriculture is regarded as the main cause for species and biotope decline among plants but traditional farming used to play an important role in the formation and preservation of species diversity. For landraces and old species of both crops and farm animals, there is presently a risk of extinction and a need both for conservation in genebanks like the Nordic gene bank, Alnarp, Sweden and the Vavlivov institute, St Petersburg. On farm conservation in demonstrations and practical agriculture can be part of the solution.

Reduced levels of nutrient inputs could increase the need for using landraces and old species, adapted to a much lower input level than modern species, while at the same time increasing the risk of nitrogen run-off.

LAND USE

Intensive agriculture deprives numerous biota of their habitat, as compared to the relatively small spectrum of new biota. This becomes problematic for the preservation of species and species diversity when insufficient areas exist to which species can withdraw. The amount of arable land varies between the countries in the Baltic Sea region from 7 respectively 8% in Sweden and Finland to 62, 58, 54 and 48% in Denmark, Poland, Lithuania and Germany.

The area covered by forests of total land area varies also, with a minimum of barely 10% in Denmark, 29% in Poland, 30% in Germany and Lithuania, 47% in Estonia and Latvia, to a maximum of 66% in Finland and 60% in Sweden. Forests can be important for biodiversity and also function as corridors for species. Strips or islands of forests in the agricultural landscape can be of importance for biodiversity.

The amount of permanent pastures is most likely one of the most important factors for biodiversity and the areas vary from between only 4% in Finland, 12% in Denmark, 14% in Lithuania, 17% in Sweden to 21% in Estonia, 22% in Poland, 30% in Germany, 32%

in Latvia and 33% in Belarus of total agricultural land use. Permanent pastures are more common in the countries in transition and Poland. An important problem for sustainable agriculture is that the numbers of grazing animals has been reduced by approximately 40-60% in the countries in transition and Poland. It is not any longer possible to graze all of the permanent pastures. As land ownership changes take place during the restructuring of agriculture, massive areas of permanent pastures are ploughed up and put back into crop production, while other areas are abandoned. Remains of other small biotopes can also be of great importance for the local biodiversity, such as stone walls, solitary trees, islands of trees and bushes in the agricultural landscape, or corridors of trees and meadows.

Consequences of proposed changes, obstacles and gaps

According to the "50% nutrient loss reduction - sustainable agriculture" model the amount of arable land needed for production of food and fodder decreased in all three of the modelled countries in 2030, with the largest decrease in Lithuania. Larger areas of arable land will be available for other purposes than in 1995. In Sweden these areas were calculated to increase by approximately 50%, in Denmark by 200% and in Lithuania they will increase from 0 to 2 300 000 hectares. The set-aside areas can be used for nature conservation, wetlands, afforestation or for production of bio-energy improving biological diversity.

Programmes exist in the EU countries within the framework of EC Regulation 2078/92 (on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside) which promote a broader use of extensive management methods. Criticism has been levelled in some countries at the economic inefficiency in agricultural environment programmes.

8.6 Animal health and welfare

Concerned countries, regions and type of ho/dings

GROWTH PROMOTERS AND ANTIBIOTICS

The usage of growth promoter and antibiotics as growth promoters in animal fodder must be stopped as they may cause bacterial resistance with a future likely impact on mankind. Even the general use of antibiotics for medical purposes must be reduced. The use of growth promoters and antibiotics varies in different countries. Depending on the poor economy of farming in the countries in transition and Poland, it is most likely not a problem there today, but to a larger extent in the EU countries. Sweden and Finland have forbidden all use of antibiotics as growth promoters and have reduced the use of antibiotics for veterinary medical purposes. Some work is currently going on in Germany and Denmark to reduce the use of growth promoters. A reduction in the use of growth promoters and antibiotics makes it necessary to increase the efforts to improve the general situation for the animals, such as fodder, housing and cleanliness to ensure a high production of good quality. Raising healthy animals is an important measure for sustainable agriculture.

ANIMAL WELFARE

How we treat our animals will be of increased consumer's concern in the future. Natural behaviour should be promoted by the production systems and animal housing. Systems where animals have access to the outdoors and can be kept in loose housing systems are to be preferred. Other necessary measures that are included in good management to assure that the animals needs are seen to, such as keeping the animals clean and trimming of hooves etc. must be implemented. Increasing the farmers competence on

these issues is worthwhile, and large gaps in knowledge can be found on some of the newly started family farms in the countries in transition and Poland, as the agricultural tradition and passing on of management skill between generations often does not exist.

ANIMAL TRANSPORTS

Transports of live animals should be minimised to reduce the use of energy. Important is also how the animals are transported. Good transports should be in properly adapted vehicles, with appropriate stops for watering and resting if necessary. Long transports between different countries has been subject to a lively debate recently in the press. This cruelty to animals and the costs involved with the use of fossil fuels and energy should be minimised. The EU has recognised these problems and has therefore a directive on the protection of animals during transport (91/628/EEC) with several amendments (90/425/EEC, 91/496/EEC, 95/29/EEC, 90/628/EEC). The present trend in many countries is towards localising only a few large slaughterhouses and shutting down small ones, which increases transports. This is obviously a larger problem in geographically large countries.

Consequences of proposed changes, obstacles and gaps

For sustainable development in the future purposeful actions will be necessary. In the modelling task, according to the "50% nutrient loss reduction - sustainable agriculture" model the number of animals in all three countries will decrease in 2030. The largest reductions, slightly more than 50%, were calculated to take place in Lithuania. With such a large reduction of the amount of animals as is calculated and with a well-functioning extension service, there should be sufficient possibilities of improving both animal health and welfare. Very important for the consequences of these proposed changes is the market's will to increase the payment for animal products. Also regulatory systems, such as milk quota in the EU can influence the direction and speed of changes. In the "Business as usual" model the number of animals will increase in Denmark and Sweden and decrease in Lithuania.

8.7 Farming under less competitive conditions

Concerned countries, regions and type of holdings

In the EU countries, farming under less competitive conditions is usually in remote agricultural areas, where the land can be less fertile and/or the climate harsh, production costs high and the yields and profitability accordingly lower. A lack of infra-structure, other employment and consequently the moving of people out from the area is common. This applies mainly to the northern parts of Finland and Sweden.

In the countries in transition and Poland conditions can be even worse, as in some of the countries there is very little or no support to agriculture, such as in Estonia. There is also an enormous problem with unemployment of women in rural areas. Due to the land ownership changes, family farms are in the process of establishing themselves on the market. The size of these farms is small in an international comparison, which can make long-term profitability and the possibilities of supporting a family small. As in many of these countries, social infra-structure was previously supplied by the collective farm. There is a lack of social services today and also of agricultural buildings and housing in rural areas. Common for farms in both of these areas is a lack of funds for investments in necessary farm machinery, buildings or for commodities. If these areas are valuable, they will need special concern and policy actions with financing support to be able to survive.

Consequences of proposed changes, obstacles and gaps

Farming under less competitive conditions with a lack of infra-structure and other employment will lead to people leaving the area. We suggest that special concern and policy actions with financing support must be taken to be able to make these valuable areas survive. Throughout the entire Baltic Sea region some rural areas will be depopulated according to the modelling task, as both the arable land area in use and the numbers of animals will be reduced. Unless, in rural areas, new innovations, new products or new possibilities of earning incomes are developed, it will not be possible to continue to keep the countryside open.

One large possibility for agriculture is to become an important producer of bio-energy, which could lead to the usage of large arable areas and also employment. Currently, the trend in business is that people work at home to a larger extent. The development of improved information technology has made this possible and could affect the situation in rural areas.

8.8 Non-renewable deposits

Concerned countries and consequences of proposed changes, obstacles and gaps

The use of non-renewable deposits is to a large extent currently a problem in the western countries, where phosphate fertilisers are used more than in the eastern countries, mainly due to poor economy in agriculture in the countries in transition and Poland. The usage in the EU countries has decreased during the last decade as well as in the countries in transition and Poland. All countries previously used large amounts of phosphate fertilisers from 1960-85 and have large amounts of phosphorus stored in the soil, that can be used for growing crops for decades in the future.

The establishment of sewage treatment plants started already in the 60:ies and has come far in the western countries. It is currently starting and expanding in the countries in transition and Poland. The quality of sewage sludge is of utmost importance for the possibilities of recirculation to agriculture, contamination with heavy metals or other non-biotic pollutants must be prevented. At the same time the nutrients from society are needed in agriculture, especially phosphorus, instead of nutrients from non-renewable deposits. Another obstacle, that has been noticed in some of the Nordic countries, is that the farmers organisations have protested against the use of sewage sludge in agriculture out of concern for consumers opinions and that they have reduced the amount of sewage sludge spread on agricultural land. Another obstacle is that the toilet systems of today with our sewage sludge handling are not optimal for the recirculation of nutrients. New systems for sewage water and handling of human effluents are bound to be developed, that will promote a better utilisation and recirculation of nutrients to agriculture during the next 30 years.

In the “50% nutrient loss reduction - sustainable agriculture” model the amount of arable land needed for production of food and fodder decreased in all three of the modelled countries in 2030. Large land areas will be available and important for production of bio-energy and will also be able to give employment to the rural population to some extent. Here, we can perhaps foresee one of agriculture’s important potentials for the future, not only to be self-sufficient with regard to energy, but also to replace some of the fossil fuel and nuclear power used in urban areas. The areas available for other purposes than food and fodder production were calculated to increase compared to1 995 by approximately 50 and 200% in Sweden and Denmark respectively and to increase in Lithuania from 0 to 2 300 000 hectares.

8.9 The greenhouse effect

Concerned countries and consequences of proposed changes, obstacles and gaps

Agriculture produces **nitrous oxide (N_2O), methane (CH_4), and carbon dioxide** (CO_2) which contributes to the **greenhouse effect** with global warming as the ultimate result. These emissions are mainly attributable to ruminants in livestock farming (CH_4) and regarding CO_2 and NO_X to emissions from agricultural machinery. Di-nitrogen oxide (N_20) can also be emitted from soil as a result of the nitrification and denitrification processes.

A greater extensification in farming, especially through reduced use of mineral fertilisers and imported fodder, which would mean less transports and less production of gaseous emissions during processing and transports, introduction of a CO_2 energy tax on non-renewable energy and reduced tillage methods could lead to a lower production of greenhouse gases. A less **intensive agriculture** in the Baltic Sea Region is already existing on the family farms in the countries in transition and Poland. When the economy revives there is a risk of intensified farming, which must be considered.

A reduction in ruminant livestock could contribute to reductions of greenhouse gases. In the modelling task, according to the "50% **nutrient loss reduction - sustainable agriculture" model** the number of cattle in all three countries will decrease in 2030. The largest reductions, slightly more than 50%, were calculated to take place in Lithuania. This reduction, if implemented, will lead to considerable reductions in the production of methane.

Agriculture could have an important role to play by producing bio-energy not only to suffice agriculture's own needs, but also to supply urban areas with energy. This would reduce the production of greenhouse gases, not only by replacing fossil fuel but also by the fixation of CO_2 in the growing plants that are used for bioenergy purposes. In the "50% **nutrient loss reduction - sustainable agriculture" model** the amount of arable land needed for production of food and fodder decreased in all three of the modelled countries in 2030, with the largest decrease in Lithuania. Larger areas of arable land will be available for production of bio-energy and for other purposes than compared to1995, in Sweden these areas were calculated to increase by approximately 50%, in Denmark by 200% and in Lithuania increase from 0 to 2 300 000 hectares.

8.10 Education, information and management skill

Improving the general level of education and management skill is of utmost importance to any group in society. Farmers and consumers are both important target groups for information and extended education. The **farmers** must improve their competence to be able to be more profitable and to spare the environment. A continuous improvement of their competence is therefore necessary in all countries. Especially in some of the countries in transition and Poland, where the tradition of family farming is recent, a great need of educating the farmers has become evident. To be able to do this, applied research, demonstration trials and a well functioning extension service and funding is necessary.

The education should contain all of the important aspects of being a good farmer, from nutrient balances, fertiliser strategies, utilisation of manure, techniques for spreading manure and spraying plant production products, soil tillage, animal feeding plans, animal welfare, book-keeping, diversification etc. Also the **consumer** must be well informed to

be able to make the "right" choice, not only for his/her wallet but also for the benefit of the environment in the Baltic Sea region.

New information technology and networks will enable farmers living in remote areas to overcome problems related to the remote location and help them to compete on the market.

8.11 Occupational health of the farmer

Concerned countries and consequences of proposed changes, obstacles andgaps

Many of the proposed measures should affect the farmers health in a **positive** way. Improved quality of drinking water, a reduced amount of plant protection products in use, a better climate in animal housing with less ammonia emissions and dust, improved farm machinery, reduced contamination with heavy metals, improved food quality such as meat produced without growth promoters, and an increased level of competence, management skill and education will all lead to improved health for the farmer.

Some **obstacles and negative factors** will also affect the farmers health in the future. The risk of radiation fall-out from breakdowns at nuclear power plants will be a hazard. There is also always the risks of the spreading of infectious diseases over large areas. Furthermore, prognosis calculate that the number of farmers will decrease, in Sweden by 40% in 2021, which is bound to lead to heavy work loads and social problems with loneliness when working in rural areas. The pressure of achieving profitability on the farm and also of finding time for all the necessary tasks and for extended education, will continue to be a problem for farmers in the future. The largest changes in a farmers life are to be expected in the countries in transition and Poland, where many factors are bound to change, from the quality of housing to the use of highly technical systems, such as in the concept of precision farming with global positioning systems (GPS) for spreading fertilisers.

8.12 Genetically modified organisms

A source for future risks may be the use of genetically modified organisms in agriculture. From an environmental point of view, an assessment of future developments in the field of genetic engineering is a difficult undertaking because of lack of experience.

8.13 Social issues

Social issues are extremely important already today and are bound to be even more so in the future in many countries for sustainable development. Some factors, such as the number of farms, the average size and structure of the farms, the number of people that can be provided for on an average farm, the distribution of the arable areas, as well as how available the social services are for the rural population are all key factors to how sustainable the agriculture will be in the area. One specific factor for concern in the future, which has both been shown in the analysis as well as in the model task, is that the arable area needed for growing food and fodder is going to be reduced in all countries. The reduction will, if other alternatives are not found, be largest in the countries in transition and Poland where large parts of the population are situated. This means that the number of active farmers is going to be reduced in all countries and other new crops or production alternatives and diversification alternatives are needed.

8.14 Food quality

High food quality is important for both farmers and consumers. Food production should be sustainable. The consumers should be able to choose high quality food from a large assortment to be able to compose a healthy, nourishing and tasty diet. Information to the consumers on food production should be increased to help the consumers make the "right" sustainable choice. To ensure the quality of agricultural products, systems of marking or labelling and controlling can be implemented and can be voluntary or obligatory. On the one side, the establishment of a quality marking programme could be a system the consumer trusts, while at the same time it is a possibility for the producer to show in which way his/her produce is different from the competitors and also to motivate an increased price to compensate for the specific quality properties. Quality marking could be based on permits and be used on all food of animal or crop origin. All steps in the production and processing should be included and the device "from the soil to the table" is applicable. The requirements should be based on consumers interests. The programmes should be simple, visible and easy to control. Many different parameters can be included in these systems, some examples are:

- Food safety:
  - salmonella and other zoonoses
  - residues of medicines, plant protection products or heavy metals
  - hormones
  - antibiotics and growth promoters
- Different types of production, e.g. organic, integrated, grazing animals, gene technology etc.
- Food processing or preparing, e.g. energy, additives, packaging, functional foods, marking, work environment, research and product development etc.

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9. Action Programme

Goal of sustainable agriculture

Agriculture contributes significantly to the society of the future. Sustainable agriculture is the production of high quality food and other agricultural products/services in the long run with consideration taken to economy and social structure, in such a way that the resource base of non-renewable and renewable resources is maintained. Important sub-goals are:

1. the farmers income should be sufficient to provide a fair standard of living in the agricultural community
2. the farmers should practise production methods which do not threaten human or animal health or degrade the environment including biodiversity and at the same time minimise our environmental problems that future generations must assume responsibilities for
3. non-renewable resources have to gradually be replaced by renewable resources and recirculation of non-renewable resources maximised
4. sustainable agriculture will meet societies needs of food and recreation and preserve the landscape, cultural values and the historical heritage of rural areas and contribute to create stable well developed and secure rural communities
5. the ethical aspects of agricultural production are secured

Contents of the action programme

The achievement of sustainable development is an enormous step for society to take and the process is bound to take time. Sustainable agriculture can be achieved by regarding the holistic dimension of sustainability. Agriculture is one of the basic sectors and is dependant on biology, technology and economy. Agriculture uses the main natural assets, water, soil, air and genetic resources and can also play an important part in recirculation of nutrients between urban and rural areas. Agriculture has therefore a large potential to be an important sector for sustainable development.

The action programme for sustainable agriculture has been divided into two different parts. In Part 1 the programmes that will be necessary for sustainable agriculture are described briefly. The Programmes should have clear goals that continuously should be monitored and evaluated. The Programmes below have not been ranked and no consideration has been taken to the relative importance of each programme when listing them.

Part 2 contains proposals for seven actions for the agricultural sector for sustainable agriculture. The interactions between the sub-goals and the actions can be seen in table 1. The Actions are used to implement the Programmes and also the way to reach the goals. The interactions between the actions and the programmes are shown in table 2. The actions are ranked according to the following and are general throughout the entire Baltic Sea Region, no consideration has been taken to the fact that there is a larger need of some of the actions in specific countries. The actions are ranked into three groups, where the first priority is the most important and in this case the difference between first and second priority was minor. The remaining four actions were found to be equally important and are therefore not ranked. On top of the agricultural actions and programmes, three trans- and cross-sectorial actions are proposed that are not specific for the agricultural sector.

Table 1. The relation between actions and subgoals in the agricultural sector. A link is denoted with X and an indirect link with (X).

Subgoals Actions	Subgoal 1 The farmers income should be sufficient to provide a fair standard of living in the agricultural community	Subgoal 2 The farmers should practise production methods which do not degrade the environment including biodi-versity or threaten human health and at the seme time mini-mise the environ-mental responsibili-ties that future gen-erations must as-sume	Subgoal 3 Non-renewable re-sources has to gradually be replaced by renewable resources and recirculation of non-renewable resources maximised	Subgoal 4 justainable 3griculture will nest societies leeds of food and acreation and Ireserve the andscape. cultural values and the his-orical heritage of ural areas and :ontribute to create 3 stable well de-/eloped and secure ural community	Subgoal 5 The ethical aspects of animal pro-duction should be promoted and secured
Action 1 Education and training	X	X	X	X	X
Action 2 Create demonstration watersheds with demonstration farms in a network in the different countries	X	X	X	X	X
Action 3 Establish a co-ordinating function for sustainable agriculture in the Baltic Sea Catchment Area	(X)	X	X	X	X
Action 4 Develop a "virtual research Institute" for sustainable sgriculture in the Baltic Sea Region	(X)	X	X	X	X
4ction 5 Elaborate and mplement agro-snvironmental egislation and policies	X	X	X	X	X
Action 6 institutional strengthening for sustainable agriculture		X	X	X	X
Action 7 Develop support to the :ountries in transition	(X)	X	X	X	X

***Table 2. The relation between actions and programmes in the agricultural sector. A link is denoted with* X**

Subgoals Actions	**Programme 1** Programme s to reduce the nutrient losses from **agriculture**	**Programme 2** Programmes to reduce the risks con-netted with **the use of** plant protec-tion products	**Programme 3** Programmes to protect ground and surface water **for** dnnking water pur-poses in agncultural areas	**Programme 4** Programmes to preserve agricultural productivity for production of high quality food and feed	**Programme 5** Programmes to maintain and develop biodiversity and rural landscapes	**Programme 6** Programmes to reduce the usage of growth promoters and anti-biotics in agriculture	**Programme 7** Programmes to develop rural infra-structure and to promote a high quality of life in rural areas and the economic conditions	**Programme 8** The ethical aspects of animal pro-duction should be promoted and secured
Action 1 Education and training	x	x	x	x	x	x	x	x
Action 2 Create demon-stratron watersheds in a net-work in the countries	x	x	x	x	x	x	x	x
Action 3 Establish a **Co-**ordinating function for sustainable agriculture	x	x	x	x	x	x	x	x
Action 4 develop a "virtual re-search insti-tute" for sustarnable agriculture in the Baltic Sea Region	x	x	x	x	x	x	x	x
Action 5 Elaborate and imple-ment agro-environ-mental legislation and policies	x	x	x	x	x	x	x	x
Action 6 Institutional strengthen-ing for sustainable agriculture	x	x	x	x	x	x	x	x
Action 7 Develop support to the countries in transition and Poland	x	x	x	x	x	x	x	x

The contents of the action programme are:

Part 1. Programmes to strengthen and promote a sustainable agricultural sector

PROGRAMMES:

1. Programmes to reduce the nutrient losses from agriculture
2. Programmes to reduce the risks connected with the use of plant protection products
3. Programmes to protect ground and surface water for drinking water purposes in agricultural areas
4. Programmes to preserve agricultural productivity for production of high quality food and feed
5. Programmes to maintain and develop biodiversity and rural landscapes
6. Programmes to reduce the usage of growth promoters and antibiotics in agriculture and to promote animal health
7. Programmes to develop rural infra-structure and to promote a high quality of life in rural areas and the economic conditions of sustainable agricultural production
8. Programmes to promote the development of new production alternatives for arable land
9. Other measures for sustainable development in agriculture

Part 2. Actions for sustainable agriculture

ACTIONS:

First Priority

1. Education and training

Second Priority

2. Create demonstration watersheds with demonstration farms in a network in the different countries

Third Priority

3. Establish a co-ordinating function for sustainable agriculture in the Baltic Sea Catchment Area
4. Develop a “virtual research institute” for sustainable agriculture in the Baltic Sea Region based on the already existing NOVABOVA
5. Elaborate and implement agro-environmental legislation and policies
6. Institutional strengthening for sustainable agriculture
7. Develop support (knowledge, financial) to the countries in transition and Poland

Part 1. Programmes to strengthen and promote a sustainable agricultural sector

The programmes can be divided into two parts, already existing tools or tools under preparation and proposed new elements. A brief summary of the existing tools and tools under preparation can be found below.

SUMMARY OF THE EXISTING TOOLS AND TOOLS UNDER PREPARATION

1. ***ANNEX III to the Helsinki convention Prevention of pollution from agriculture***
   - Plant nutrients
     - Livestock density
     - Storage of slurry, urine and solid manure
     - Agricultural waste water and silage effluents
     - Application of organic manures
     - Measures to reduce ammonia emissions
     - Application rates for nutrients
     - Winter crop cover
     - Water protection measures and nutrient reduction areas
   - Plant protection products
     - Registration and approval
     - Storage and handling
     - Licence
     - Application technology
     - Testing of spraying equipment
     - Alternative methods of control
   - Environmental permits
   - Environmental monitoring
   - Education, information and extension service

2. *EU legal basis and policy documents:*

- **Maastricht Treaty**
  - **the principle of environmental integration**
- **Amsterdam Treaty**
  - **inclusion of sustainable development**
  - reinforces environmental integration as one of the basic principles of the **Community**
- **The Fifth Environmental Action Programme and Review**
  - agriculture is one of the five target sectors
  - conservation of water, soil and genetic resources
  - reduction of chemical inputs
  - balance between inputs and the absorption capacity of the soil and plants
  - promote rural environmental management practices
  - conserve biodiversity and natural habitats
  - minimise natural risks
- **Agenda 2000**
  - the integration of environmental goals into the CAP and the farmers important role to manage **natural resources and landscape conservation**
  - **food safety and quality, the creation of complementary or alternative income and employment for rural areas**
  - **agri-environmental instruments support a sustainable development of rural areas and respond to society's increasing demand for environmental services**

- agri-environmental instruments support a sustainable development of rural areas and respond to society's increasing demand for environmental services
- Member States will be able to make direct payments conditional on the respect of environmental provisions
- targeted agri-environmental measures should be reinforced and encouraged through increased budgetary resources and higher co-financing rates
- the integration of new Member States among the countries in transition and Poland

- Common Agricultural Policy (CAP) reform: The restructuring of agricultural markets and encouragement of farmers to use less intensive production methods to reduce the impact on the environment and cut surpluses. Includes complementary agro-environment and afforestation measures.
- Nitrate directive (91/676/EEC)
  - **establishing vulnerable zones**
  - **establishing action programmes**
  - **monitoring of waters**
- **Organic farming regulation (No 2092/g 1 /EEC)**
  - **rules on production, labelling and inspection**
- Protection of the environment and maintenance of the countryside regulation (No 2078/92/EEC)
  - farm practices compatible with protection of the environment and natural resources
  - reductions in use of fertilisers, plant protection products and in farm livestock
  - an environmentally favourable extensification of farming
- Directive on placing of plant protection products on the market (9 l/41 4/EEC)
  - registration of plant protection products
- Directives on Pesticide residue: cereals (86/362/EEC), meat and dairy products (86/363/EEC) and other plant produce (90/642/EEC)
- Directive on Biocides (under preparation)
- IPPC Directive (No 96/61 IEEC) authorisation of permits for large animal production units
- Directive on the protection of animals during transport (91/628/EEC) and amendments (95/29/EEC))
- Directive laying down minimum standards for the protection of pigs (9 1/630/EEC)
- Directive laying down minimum standards for the protection of calves (9 1/629/EEC) and amendments (97/2/EEC)
- Directive on the protection of animals at the time of slaughter and killing (93/l 1 S/EEC)
- Directive on the protection of hens in battery cages (88/l 66/EEC)
- Directive on veterinary medicinal products (8 l/85 1 /EEC)
- Directive on food additives (70/524/EEC)
- Directive on sewage sludge (86/278/EEC)
  - limit values for heavy metals in soil
  - limit values for heavy metals in sewage sludge
  - treatment of sludge before spreading

    - sludge and soil analysis and sampling and analysis methods
- Directive on placing of genetically modified organisms (90/220/EEC)
- Regulation instituting a community aid scheme for early retirement from farming (No 2079/92/EEC)
- Regulation on an aid scheme for forestry measures in agriculture (No 2080/92/EEC)
- Water Framework Directive (under preparation) including
    - drinking water directive (80/778/EEC)
    - surface water directive (75/440/EEC)
    - fresh water directive (78/659/EEC)
    - ground water directive (80/68/EEC)
- Regulation on improving the efficiency of agricultural structure (No 950/97/EEC)
    - landscape aspects
    - Regulation on the conservation , characterisation, collection and utilisation of genetic resources in agriculture (1467/94/EEC)

3. Codes of Good Agricultural Practice

National Codes of Good Agricultural Practice already exist in the EU-countries as they are required according to the EU nitrate directive and are also mentioned in the regulation on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside. In the countries in transition and Poland they are under preparation as a part of HELCOM's work and also where applicable, as a part of the preparation for EU membership.

4. Regional agreements

- **Working Programme 1996-2000 for Nordic Co-operation in Agriculture and Forestry, Nordic Council of Ministers**
- **Nordic Environment Strategy for Agriculture and Forestry 1996-1999. Nordic Council of Ministers**

5. National legislation and programmes

Many countries already have legislation and compulsory and voluntary action programmes running on issues that are important to Baltic 21-agriculture. These programmes should be used within the frame of Baltic 21.

Action programme for sustainable agriculture

The programmes, part 1, contain components that will be necessary for sustainable agriculture. In all the programmes there will be activities that should be included, such as legislation, information, education, research and development and instruments of control. The Actions described in part 2 are used to implement the Programmes and also the way to reach the goals. The interactions between the actions and the programmes are shown in table 2.

9.1 Programmes to strengthen and promote a sustainable agricultural sector - Important elements

Programme 1. Programmes to reduce the nutrient losses from agriculture

Already existing tools or tools under preparation

- According to the HELCOM Annex Ill
  - Livestock density
  - Storage of slurry, urine and solid manure
  - Agricultural waste water and silage effluents
  - Application of organic manures
  - Application rates for nutrients
  - Winter crop cover

    Water protection measures and nutrient reduction areas
- Accirding to EU's nitrate directive (91/676/EEC)
  - establishing vulnerable zones
  - establishing action programmes
  - monitoring of waters
- According to EU's regulation on protection of the environment and maintenance of the countryside (No 2078/92)
  - farm practices compatible with protection of the environment and natural resources
  - reductions in use of fertilisers and in farm livestock
  - an environmentally favourable extensification of farming
- Code of Good Agricultural Practice
- National legislation

Proposed new elements

- Nutrients
  - The use of the nutrients on the farms should be as efficient as possible, which should in many cases lead to reduced inputs.
  - Nutrient balances should be used to promote an efficient use of nutrients
- Phosphorus
  - The available phosphorus content of arable topsoils should not exceed the requirements of an acceptable crop production.
  - The annual phosphorus input should be calculated in relation to:
    - the phosphorus content in the topsoil of the field
    - the crops requirements
  - The phosphorus input should be of the same size as the phosphorus removed
  - Need for good monitoring data on the phosphorus status of arable land and nutrient balances to show if the supply of phosphorus in the soils increases or is depleted
- Crop and animal production should be more integrated in all countries.
- Farm size: very large non-sustainable animal holdings should reduce the number of livestock or be split up into smaller, more evenly distributed animal holdings to reduce the negative environmental impact and to improve the recirculation of plant nutrients from manure.
- Choose crops, crop variety and crop rotations for a minimum need of soil cultivation to reduce nitrogen mineralisation
- The farmers should take environmental considerations when removing land from food production in a situation of excess agricultural land for food production:
  - soils poor in phosphorus
  - organic soils from previously drained wetlands

- **soils sensitive to erosion**
- **soils sensitive to nitrate leaching**

- Promote the development and implementation of new technology that can reduce the losses of nutrients, such as site specific crop management (SSCM).

Programme 2. Programmes to reduce the risks connected with the use of plant protection products

Already existing tools or tools under preparation

- According to the HELCOM Annex III regarding:
  - A national risk reduction strategy which shall be based on Best Environmental Practice (BEP). The strategy should be based on an inventory of the existing problems and define suitable goals. It shall include measures such as:
    - Registration and approval
    - Storage and handling
    - Licence
    - Application technology
    - Testing of spraying equipment
    - Alternative methods of control
- AC&ding to the EU directive concerning Placing of plant protection products on the market (91/414/EEG)
  - registration of plant protection products
- According to the EU regulation on Protection of the environment and maintenance of the countryside (No 2078/92)
  - farm practices compatible with protection of the environment and natural resources
  - reductions in use of fertilisers, plant protection products and in farm livestock
- According to EU's Pesticide residue directives: cereals (86/362), meat and dairy products (86/363) and other plant produce (90/642)
- According to EU's Drinking water directive (80/778)
- According to EU's Biocides directive (under preparation)
- According to the EU regulation on organic farming (No 2092/91)
- Code of Good Agricultural Practice
- National legislation

Proposed new elements

- **Elaborate proper risk assessment systems for plant protection products**
- **Reduce the use of plant production products by selecting crops and cropping systems with less need for pesticides**
- **Where applicable, the substitution principle should be included in the authorisation scheme of active substances in plant protection products.**

Programme 3. Programmes to protect ground and surface water for drinking water purposes in agricultural areas

Already existing tools or tools under preparation

- According to EU's nitrate directive (91/676/EEC) (see programme 1)
- According to EU's regulation on protection of the environment and maintenance of the countryside (No 2078/92)
  - riparian zones
  - extensification of agricultural production
- According to EU's water framework directive (under preparation) including

- drinking water directive (80/778/EEC)
- surface water directive (75/440/EEC)
- fresh water directive (78/659/EEC)
- **ground water directive (80/68/EEC)**

- Code of Good Agricultural Practice
- National legislation

Proposed new elements

- Long term water quality should be secured by suitable land use within potential and existing pumping areas for high quality ground water. This usually corresponds to less intensive forms of land use.

Programme 4. Programme to preserve agricultural productivity for production of high quality food and feed

Already existing tools or tools under preparation

- According to the HELCOM Annex Ill (see programme 1)
- According to the EU regulation on Protection of the environment and maintenance of the countryside (No 2078/92) (see programmes 1 and 2)
- **According to EU's sewage sludge directive (86/278/EEC)**
  - **limit values for heavy metals in soil**
  - **limit values for heavy metals in sewage sludge**
  - **treatment of sludge before spreading**
  - **prohibited crops for spreading sewage sludge and timing of spreading**
  - limit values for amounts of heavy metals that may be added annually to **agricultural land**
  - **sludge and soil analysis and sampling and analysis methods**
- According to EU's Pesticide residue directives: cereals (86/362), meat and dairy products (86/363) and other plant produce (90/642)
- According to EU's Drinking water directive (80/778)
- According to the EU regulation on organic farming (No 2092/91)
- Code of Good Agricultural Practice
- National legislation, if existing

Proposed new elements

- Soil fertility and the high quality of produce should be maintained by protecting land from contamination with heavy metals or other residues and minimising the carbon depletion of soils
  - **reduced soil cultivation**
  - **all inputs to arable land (e.g. fertilisers, sewage sludge, manure) should be of a high quality and not contaminated with residues etc.**
  - **decreased deposition of heavy metals**
- Choose crops and crop rotations for a minimum need of soil cultivation
- The recirculation of nutrients and organic matter in urban bio-waste to the production of biomass on arable land should be promoted.
- Establish food quality control programmes/measures
- Erosion
  - **cropping systems and soil cultivation methods should be selected to minimise surface run-off and erosion**
  - **permanent bufferstrips should be promoted along open waterways wherever risks of soil erosion are prevalent**

Programme 5. Programmes to maintain and develop biodiversity and rural landscapes

Already existing tools or tools under preparation

- According to the EU regulation on Protection of the environment and maintenance of the countryside (No 2078/92) (see programme 1)
  - Support to maintain biodiversity on old permanent grazing land, such as promoting **grazing ruminants.**
  - **Remains of natural biotopes such as wetlands, stone walls, islands in field etc. should preferably be saved.**
  - **Create bufferzones and wetlands to increase biodiversity**
  - **Support to conservation of landraces of farm animals**
- **According to the EU regulation on the conservation, characterisation, collection and utilisation of genetic resources in agriculture (1467/94/EEC)**
- Code of Good Agricultural Practice
- Regional agreements within the Nordic Council of Ministers
- National legislation

Proposed new elements

- Promote diversified production systems (e.g. Agriculture/Forestry)
- Promote the family farm structure
- On-farm conservation of landraces and old species (both plants and animals)

Programme 6. Programmes to reduce the usage of growth promoters and antibiotics in agriculture and to promote animal health

Already existing tools or tools under preparation

- According to EU's directive on the protection of animals during transport (91/628/EEC) and amendments (95/29/EEC))
- Directive laying down minimum standards for the protection of pigs (91/630/EEC)
- Directive laying down minimum standards for the protection of calves (91/629/EEC) and amendments (97/2/EEC)
- Directive on the protection of animals at the time of slaughter and killing (93/l 1 S/EEC)
- Directive on the protection of hens in battery cages (88/l 66/EEC)
- Directive on veterinary medicinal products (8 l/85 1 /EEC)
- Directive on food additives (70/524/EEC)
- National legislation if existing

Proposed new elements

- To promote animal health and welfare, animals should:
  - be fed well balanced diets
  - not be subject to long distance transports
  - preferably have outdoor access and be kept in loose housing systems
- The use of antibiotics in animal medication should decrease and the use of growth promoters terminate
- Risks threatening animal health should be avoided, e.g. BSE

Programme 7. Programmes to develop rural infra-structure and to promote a high quality of life in rural areas and the economic conditions of sustainable agricultural production

Already existing tools or tools under preparation

- EU Common Agricultural Policy - Economy : The farmers income should be sufficient to provide a fair standard of living for the agricultural community

- According to the EU Regulation on improving the efficiency of agricultural structures (No 950/97)
  - Landscape aspects
    Aid for investments
- According to the EU regulation (No 2078/92/EEC) (see programmes 1, 2 and 5)
- According to the EU regulation (No 2079/92/EEC) on early retirement from farming
- According to the EU regulation (No 2080/92/EEC) on forestry measures in agriculture
- National legislation

Proposed new elements

- **All countries in the Baltic Sea Region should be able to support less market competitive farming and the development of essential services and complementary employment in remote and less densely populated areas, in order to preserve a viable countryside all around the Baltic Sea e.g. to promote a stable farming community in rural areas.**
- Employment: Emphasise a sector commitment to develop new profitable services and products based on farm assets and produce.
- Co-operation between neighbouring farms should be promoted to overcome negative effects of extensive specialisation on individual farms by mutual care for the arable resources, such as permanent grazing land, exchange of feed and manure etc. This can be a way to reach sustainability for the total area without jeopardising the benefits of specialisation of individual farms.
- Organic farming should be promoted wherever it is contributing to sustainable development.
- Support the transition to family farming in the countries in transition
- Promote the establishment of farmer/market organisations in the countries in transition and Poland

Programme 8. Programmes to promote the development of new production alternatives for arable land

Already existing tools or tools under preparation

- EU´s Common Agricultural Policy
- National agricultural policy

Proposed new elements

- Promote the development and production of industrial crops e.g. bio-polymers, vegetable oils and biofuels.
- Promote the development and production of energy crops and bio-energy production
- Develop diversification programmes
- Use information technology to increase employment in rural areas

Programme 9. Other measures for sustainable development in agriculture

Already existing tools or tools under preparation

- **Genetically modified** organisms: According to EU's directive on placing of genetically modified organisms (90/220/EEG)

Proposed new elements

- Promote the use of life-cycle analysis when choosing the type of transport logistics for feed, food and wastes.
- Promote markets for products from sustainable production
- The introduction of genetically modified organisms (GMO) in food production should be subject to a very restrictive approval procedure.
- Greenhouse effect

- Introduce CO, energy taxes on non-renewable energy
- Promote reduced tillage methods
- Promote farming with a reduced use of mineral fertilisers and imported fodder
- Measures to reduce methane emissions from livestock production

9.2 Actions for sustainable agriculture

ACTIONS FOR THE AGRICULTURAL SECTOR

First Priority:

Action 1. Education and training

This action relates primarily to all sub-goals. Education and training is one of the most important actions in the action programme. Farmers and consumers are both important target groups for information and extended education. The farmers in all countries are dependant on adequate education and training to be able to practice production methods that will lead to sustainable agriculture. As the knowledge on sustainable agriculture due to research and practical experience will be increased by time, it will be a continuous action to keep the farmers up to date with the latest development. Especially in some of the countries in transition and Poland, where the tradition of family farming is recent, a great need of educating the farmers has become evident. To be able to do this, applied research, demonstration trials and a well functioning extension service and funding is necessary. Even the public should be educated to be able to make decisions that will promote sustainable development in their everyday life.

Important aspects for education and training are:

- **to make sure that all levels (farms, agricultural schools, extension service, universities / research institutes, ministries) are included in the education programme and are reached by the same information and knowledge**
- **to develop and implement series of shorter courses with repetition courses including demonstrations for farmers**
- **to develop and implement adapted education for different levels for farmers on how to reach sustainable agriculture**
- **to develop diplomas for different levels that can be given after participation in education on sustainable development in agriculture (Baltic 21 -Agriculture courses for different levels)**
- **to develop and implement basic courses on agriculture for family farms in the countries in transition and Poland, important to reach the young farmers**
- **to work with public awareness to ensure the environmental, cultural, social and economic values and functions of agriculture**
  - **general environmental information including agriculture for the public**
  - **environmental information including agriculture for primary schools**
  - **information on environmental labelling**
- **to promote the use of information technology**

Actors

The main actors in the education and training of the farmers will be the agricultural schools, the extension services, universities and research institutes. The governmental Ministries, as well as possibly the EU will also support the activities. An important function for the co-ordinating function for sustainable agriculture in the Baltic Sea Region could be to co-ordinate education and training, and to set up the criteria for the different diploma levels. The demonstration watersheds should be an active part in the

education and training and their facilities should be used for this purpose. Industries and the agro-business sector have interests here. The farmers organisations should partake in the education and should also have an important role with public awareness. Even NGO's and consumers organisations could be involved at some stages.

Financing

For education and training EU's funds that are connected to the Common Agricultural Policy, CAP and the Environmental policy could be very important sources, as well as EU's eastern support (TACIS, PHARE). Governmental sources should also be of importance. IFI's could also be interested in partaking, at least to the extent where the courses will take place in the demonstration watersheds.

Time frames

In the EU countries education programmes financed by the EU's environmental programmes within the CAP are currently running and could be a necessary part of sustainable development. In the countries in transition and Poland, some education and training has been included in the Baltic Agricultural Run-Off Action Programme, BAAP where phase I has recently been concluded. Phase II of this programme will start during 1998 and could be used for this purpose. However, much larger efforts, as a large general investment on education on sustainable agriculture, will be needed in the countries in transition and Poland for the next 10 years. Education and training must be a necessary part of the entire time span of the Baltic 21 programme and all countries must be involved.

Monitoring methods

The proposed indicators should be elaborated further and implemented, with consideration taken to a base value e.g. 1995 and a target value for the years 2010 and 2030.

Second Priority:

Action 2. Create demonstration watersheds with demonstration farms in a network in the different countries

This action relates to all sub-goals. It is of utmost importance to demonstrate to the farmers and public what sustainable agriculture is and how it can be performed under different conditions. Working within demonstration watersheds gives valuable possibilities of showing the whole concept of sustainable agriculture in a way that is easy to understand for all involved and also to replicate in other watersheds and on other farms. At least one demonstration watershed should be established in every country, in larger countries with varying conditions the demonstration watersheds should be able to show sustainable agriculture in the most important agricultural regions of the country.

By creating a network of functioning demonstration watersheds with demonstration farms, in all countries in the Baltic Sea region, the codes of Good Agricultural Practice can be demonstrated and the following can be included:

- **implementation and demonstration of legislation and agro-environmental policy (see action 5)**
- **demonstration of environmentally friendly production technology, such as:**
  - **building of manure, slurry and urine stores**
  - **handling of manure, slurry and urine**
  - **handling of plant protection products**

- demonstrate agricultural machinery and new techniques, manure spreading, fertilisation, plant protection product spraying, soil tillage, site specific crop management etc.
- demonstrate recirculation of nutrients and organic matter in urban bio-waste to the production of biomass
- diversification projects
- bufferzones, wetlands, biological diversity
- on-farm conservation of landraces and old species
- energy crops
- infra-structure measures

- educate and train the farmers (also consumers, advisers, policy makers)
- monitor changes in water and soil quality
- carry out field trials and applied research
- develop and implement environmental management systems based on systems such as ISO 14 000 or EMAS etc. on all farms to improve the environmental management and resource utilisation

The farmers organisations in the respective countries could base a joint programme, with the concept of "farmers saving the Baltic Sea" on the network of demonstration watersheds/farms and extension service centres.

Actors

The farmers will be the most important participants in this work. A national team of experts in each country is recommended to implement the work in the country on the demonstration watersheds. The team will consist of experts from different areas, such as from agricultural schools (education and training, demonstrations), advisory service (education and training, demonstrations, applied research), research institutes and universities (monitoring, applied research, education), as well as ministries (legislation, agro-environmental policy, support). Experts from other fields can also be used for shorter engagements to partake in specific actions, although they will not be members of the national team. The co-ordinating function for sustainable agriculture will co-ordinate the activities taking place in the demonstration watersheds, as well as transferring knowledge.

The watershed approach has been implemented in many of the countries, both in the EU and in the countries in transition and Poland. These watersheds could be the base for future demonstration watersheds. One example is the Baltic Agricultural Run-off Action Programme (BAAP), that has been working in demonstration watersheds regarding agro-environmental development since 1992 in Estonia, Latvia and Lithuania and in demonstration farms in Poland and in the Leningrad and Kaliningrad regions in Russia since 1994. The second phase of this programme will start during 1998 and would in a broadened version be suitable to represent sustainable agriculture and to function as a model for the demonstration watersheds. The demonstration watersheds will be a part of the action programme for sustainable agriculture and actions and results will be easily transferable to other regions and countries.

Financing

Potential interested parties for financing the network of demonstration watersheds with demonstration farms are the World Bank and the Nordic Environment Finance Corporation. NGO's, such as UN Volunteers have also professed some interest in partaking in some of the actions. Other IFI's and NGO's may also be interested in partaking to some extent. Governmental funding as well as intergovernmental funding is possible. The enlargement of the EU with the countries in transition and Poland is also an important time frame and these countries will after that be under EU's financial

umbrella and will be partaking in EU's research programmes and activities. A source for some of the programmes could be the EU's agricultural funds, such as funding for demonstration farms mentioned in EU's regulation 2078/92 and for some structural measures, the EU's structural funds. Bilateral support will be important for the countries in transition and Poland.

Time frames

The time frames will of necessity differ between the western countries and the countries in transition and Poland and the development will take place according to every country's abilities. In all countries the first step will concern the choosing of suitable watersheds with demonstration farms. Necessary investments in the watersheds and on the farms, such as the building of sufficient manure storage, investments in water monitoring equipment and facilities, possible investments in environmentally friendly technology, as well as the building of an education room should also be performed during the first two years.

According to the countries in transition and Poland much effort must initially be put to build manure stores and teach proper utilisation and handling of manure. One of the most important issues to be taken care of initially, in the first years, is the livestock density of all areas, as there now exists a one time chance for adjustments, as the transition to family farms is taking place at the same time. Also great efforts should initially be used for teaching proper soil tillage, improving feed utilisation in animal production and also to transfer the knowledge from the western countries regarding the interaction between biology and technology producing a sound economy, that is a foundation in modern agriculture. This measure should continuously take place during the time span of the Baltic 21, with a larger investment during the first 10 years. Some of these actions are included in the HELCOM Annex III "Prevention of pollution from agriculture" and according to the preliminary time schedule should be implemented before the 1 January 2011.

In the western countries the HELCOM Annex III should be implemented at the latest on the 1 January 2002, according to the same preliminary time schedule. Education and training should start as soon as possible for the farmers and monitoring of environmental quality as well. Demonstrations and research should also be started in the near future.

Monitoring methods

A major task in the demonstration watersheds will be to monitor water quality in the catchment area and also to monitor other agro-environmental parameters. The indicators mentioned under chapter 6 could be used after further development.

Third Priority:

Action 3. Establish a Co-ordinating Function for Sustainable Agriculture in the Baltic Sea catchment area.

This action is established to ensure that the action programme will be carried out and will encompass the entire span of different programmes, projects and other actions that are proposed in this report. This action refers to the goal above including the sub-goals. The co-ordinating function will be able to provide the initiative and knowledge to start, support, assist and continue the actions and programmes. At the same time, the co-ordinating function will provide possibilities of co-ordinating the work in the different countries and also be able to co-ordinate the monitoring and also of adapting the programmes and projects according to the progress that will be reached within

sustainable development in agriculture. Some of the most important tasks for the co-ordinating function will be to:

- co-ordinate the network of demonstration watersheds and farms (Action1)
- develop, implement and monitor the sustainability programmes in part 1.
- monitor and evaluate the development towards sustainable agriculture, environmental surveillance
- stimulate countries with special programmes (Action 7)
- elaborate the indicators further
- assist individual countries in legislative or policy matters concerning sustainable agriculture (Action 7)
- create networks within the region for the actions, collect and distribute information
- promote research on sustainable agriculture in the region (Action 3)
- elaborate the criteria for education and training on sustainable agriculture including different diploma levels (Action I)
- distribute information on systems of environmental labelling for agricultural products
- promote public awareness concerning sustainable food production and consumption preferences

For more details on the programmes, see part 2 and chapters 7 and 8.

Actors

The co-ordinating function should be placed with some other suitable institute within the Baltic Sea Area, so as not to create new constitutions. Some suggestions regarding possible alliances could be Universities, Research institutes, HELCOM and some part of the EU commission. In the revision of EU 2078 /92 some reference is given to starting a centre for environmentally friendly agriculture. This institute could be a possible partner.

Financing

Financing of all of the different activities and of the co-ordinating function itself is not clear. Financing could be possible from several different sources such as through the EU's structural funds, TACIS, PHARE, governmental and intergovernmental financing. EU should be a very important source of financing for the proposed programmes. Governmental financing should be possible as many of the goals and programmes coincide with national goals and projects. Potential interested parties for financing parts of the proposed actions do exist, such as the World Bank and the Nordic Environment Finance Corporation for the network of demonstration watersheds with demonstration farms. Other NGO's such as UN Volunteers could also be interested in partaking in some of the actions. Other IFI's will most likely also be interested in partaking to some extent.

Time frames

The co-ordinating function should start its work in the near future and continuous evaluations of the work should be done. The different programmes will necessarily have different time frames, as for example the HELCOM Annex III will according to a preliminary time schedule be implemented at the latest 1 January 2002 in the EU countries and at the latest 1 January 201 1 in the countries in transition and Poland. The time frames for the individual programmes and measures within the programmes, will be discussed to some extent under the text for the specific programme.

Monitoring methods

Some of the proposed indicators in chapter 6 could be further developed by the co-ordinating function for use in monitoring the action programmes. One of the main functions of the co-ordinating function will be to co-ordinate agro-environmental

monitoring within the Baltic Sea Area and also to monitor some specific parameters for the proposed actions.

Action 4. Develop a "Virtual Research Institute" for sustainable agriculture in the Baltic Sea Region based on the already existing NOVABOVA

This action applies primarily to all sub-goals. To be able to steer the development towards sustainable agriculture relevant research programmes are extremely important. Possibilities of creating a network of research institutes and universities in the form of a "virtual research institute" for this purpose could be of importance. Important tasks for the "virtual research institute will be:

- **to develop research programmes to further develop the concept of sustainable agriculture**
- **to promote strategic and applied research that will show the way to sustainable agriculture, such as development of sustainable technology**
- **to promote research concerning the environmental, social and economical aspects of sustainable agriculture**
- **to promote research that will identify optimal infra-structure for the agricultural sector e.g. transports**
- **to elaborate and implement systems of monitoring surface water, groundwater and programmes in all the countries in the Baltic Sea region (EU nitrate directive, EU 2078/92 and national monitoring programmes) in co-operation with the co-ordinating function of sustainable agriculture in the Baltic Sea Region**
- **to elaborate and implement methods of monitoring the soil (nutrient losses, heavy metals, toxic substances, nuclides) in co-operation with the co-ordinating function of sustainable agriculture in the Baltic Sea Region**
- **to further elaborate the proposed indicators in co-operation with the co-ordinating function of sustainable agriculture in the Baltic Sea Region**
- **to develop and strengthen research institutions**
- **to motivate international and national research funding institutions to fund research on sustainable agriculture in the Baltic Sea Catchment**
- **to co-ordinate research together with the co-ordinating function for sustainable agriculture in the Baltic Sea Region**
- **to promote research exchange**
- **to develop common MSc and PhD courses**
- **to secure the availability of research results to farmers and other interested parties**

A second Royal Colloquium on Agriculture and Sustainability should be held preferably during 1998 or 1999 to follow up the development on agriculture and sustainability and to promote research within this area.

Actors

This action will involve universities and research institutes within the Baltic Sea Catchment Area. Links could be made to the already existing co-operation network between NOVA -the Nordic Forestry, Veterinary and Agricultural University and BOVA - the Baltic Forestry, Veterinary and Agricultural University. NOVABA is the name of the steering group. NOVABOVA is based on a co-operation agreement signed in 1996 between the rectors from the Nordic and Baltic agricultural universities. The main activities so far concern higher education, development of modern information services in the curriculas and initiation of joint research activities. Contacts have already been taken with the rector of NOVABOVA. The "Virtual Research Institute" will need both development and funding to be able to fill this function. A large degree of co-operation between the co-ordinating function for sustainable agriculture in the Baltic Sea Region and the "Virtual Research Institute" will be necessary for tasks such as co-ordinating

and promoting research programmes for sustainable agriculture, elaborating indicators and monitoring programmes etc. There could possibly be some interest for this action from the NGO's and from agro-business organisations to support the research programmes.

Financing

Funding from the EU and from governmental sources should be most important for creating and developing a "virtual research institute". It is possible that the IFI's could possibly be interested in partaking in specific projects. The Nordic Council of Ministers is already involved in the financing of NOVABOVA.

Time frames

The NOVABOVA has already started its activities. A need to broaden the field of work and involve new universities and institutes that will be able to represent all of the participating countries, as well as the total width of the concept of sustainable agriculture will occur as suitable research programmes and projects are identified. Three ten year periods for research with initial large investments in research during the first 10 year period are hereby proposed. The amounts to be invested during the second and third research period should be dependant on the results achieved earlier and on the relevance and quality of the proposed programmes and projects.

Monitoring methods

With five year intervals an evaluation could be performed to check on how the "Virtual Research Institute" is functioning. Every ten years, in connection to the research period being renewed, a thorough review should be taken of the research and development from the period and it should be compared to the goal of sustainable agriculture.

Action 5. Elaborate and implement agro-environmental legislation and policies

Adequate legislation and policy is of great importance to achieve the goal of sustainable agriculture. The elaboration and implementation of agro-environmental legislation and policy is a part of the whole action programme for sustainable agriculture, both at the intergovernmental and governmental level. This action relates to the entire goal of sustainable agriculture. In all EU countries of today there already exists EU legislation and policies as well as national legislation and compulsory and voluntary action programmes. A revision of EU's Common Agricultural Policy in Agenda 2000, is now being undertaken and could affect work within this area in the future. Many of the countries in transition and Poland have applied for membership in the EU and are starting to adapt their national legislation to the EU. One of the important time frames will be EU's enlargement. By the year 2030 it is plausible that all the countries in transition and Poland are members of or associated to the EU and will be comprised by the EU's activities and agro-environmental programmes. The legislation and policies in all countries must be adapted and improved in the long run to be able to achieve sustainable development.

Two measures are proposed at the international level:

- **Review of current national agro-environmental legislation and policy**
- **Intergovernmental workshops and network to harmonise agro-environmental legislation and policy where appropriate**

The transferring of knowledge and support to individual countries when elaborating and implementing national legislation and policy, especially regarding the countries in transition and Poland, will be another important measure.

In the following areas legislation should be elaborated and implemented:

- **reduction of nutrient losses (HELCOM, EU, national)**
- **reduction of the risks connected with the use of plant protection products (HELCOM, EU, national)**
- **bio-diversity (HELCOM, EU, national)**
- **the use of growth promoters and antibiotics in agriculture (EU, national)**
- **promote the development of rural infra-structure and rural development**
- **the protection of ground and surface water for drinking water purposes in agricultural areas (HELCOM, EU, national)**
- **genetically modified organisms (EU, national)**
- **recirculation of nutrients between urban and rural areas (EU, national)**
- **the greenhouse effect**
- **quality control**

Agricultural and environmental policies should be integrated in the following areas:

- **social, agricultural and environmental objectives must be accounted for**
- **improve co-operation and co-ordination among governmental agencies and between the different stake holders, farmers organisations, farmers, consumers**
- **use a balanced mix of policy instruments, such as legislation, development of functioning markets, financial instruments, education and training of farmers, advisory services**
- **the relationship between the policies and the environmental situation should be as visible and concrete as possible for the farmers, the authorities and the public**
- **environmental quality goals for the policies should be established at different levels**
- **implemented policies should be cost-effective on the farm level**
- **incentives for farmers**
- **further explore the use of economic instruments as a means to internalise external environmental costs and benefits**

Actors

The main actors will be national and international authorities. At the national level it will mainly be the Ministry of Agriculture and the Ministry of Environment. Other Ministries could be involved. Parts of the EU commission, such as DG VI and DG XI will be involved. International organisations, such as HELCOM will also be involved. The co-ordinating function for sustainable agriculture in the Baltic Sea Region could also play an important part here.

Financing

National legislation and policy should mainly be financed by governmental sources. The proposed review of legislation and policy could be financed as a project by intergovernmental sources as well as the proposed workshop and network for harmonisation. EU should be a very important source of financing for the proposed programmes. Until the enlargement has taken place, bilateral financial support and PHARE and TACIS in EU will be of importance for the countries in transition and Poland.

Time frames

It is extremely important that the work with agro-environmental legislation and policy, starts as soon as possible. The countries in transition and Poland are already in the process of replacing all their old legislation and a great need for harmonisation and for transferring of knowledge exists already today. Another important aspect to take into consideration is that the process of transition to family farms is now taking place in the countries of transition and gives us a one time opportunity to make adjustments in the livestock density of all areas. As this is a chance that will never occur again, great

efforts should be put in this area for the next seven years. For the EU countries the development of legislation and policy is dependant on the EU and national governments and it is a continuous process. The development of legislation should start in 1998, with an increased effort in the countries in transition and Poland during 1998 - 2005. The review of national agro-environmental legislation and policy should take place in 1998 or 1999. The workshop and network for harmonisation should take place during 1999.

Monitoring

With five year intervals a review on national agro-environmental legislation and policy could be performed to check on the status. If there is a need this review could be followed by an intergovernmental conference for harmonisation.

Action 6. Institutional strengthening for sustainable agriculture

Institutional strengthening applies mainly to sub-goals 2 to 5. The target group is all organisations involved in the education and training of farmers, agricultural students and advisory specialists, such as research institutes, universities, advisory service centres and agricultural schools as well as institutions involved in research and development. They should be developed and strengthened to be able to partake in the proposed actions that are to:

- support and develop a well functioning advisory service on sustainable agriculture in all countries
- support applied research and the development of sustainable practices and technology in agriculture
- elaborate and demonstrate ways of co-operation between involved stake holders

The Vavilov institute in St Petersburg is of particular institutional interest for the Baltic region as well as for the rest of the world. The institute holds one of the world's largest collections of plant genetic material, some of which is unique. Because of serious institutional problems these collections, including material from the Baltic Sea region not preserved elsewhere, presently run the risk of being lost. The institute needs support.

Actors

The actors are agricultural schools, the advisory service, universities, research institutes, as well as governmental Ministries, and the EU. The agro-business sector and the farmers organisations, perhaps even other NGO's could also partake in the activities.

Financing

Governmental sources as well as EU funds will be necessary. IFI's could also be interested in partaking in specific projects. Bilateral financial support could be important for institutional strengthening in the countries in transition and Poland. Other sources of funding could possibly be the farmers organisations, the market and other NGO's.

Time frames

As it is of utmost importance to be able to start the process of education and training as soon as possible, institutional strengthening will be one of the initial investments in the action programme. The largest investments should take place during the first five years of the project. Later investments are bound to be necessary, but if they are needed for ten or for twenty years after the initial investments, will depend on the progress achieved to that date on sustainable agriculture.

Monitoring methods
Evaluating reviews at regular intervals, five years are proposed, could be a tool to evaluate if the involved institutes can live up to the expectations on their partaking in the action programme. If not, reinvestments should be considered. Some of the proposed indicators could be used after further elaboration, together with more conventional tools.

Action 7. Develop support (knowledge, financial) to **the countries in transition and Poland**

The countries in transition and Poland need support to be able to improve their agriculture towards sustainable development. This action relates to the whole goal of sustainable development. Support will be needed in the following areas:

- transferring of knowledge
- Financial support to the building of manure stores. A project based on the demonstration watersheds is recommended, with financing possibilities for building materials. The farmers could be taught how to build them on the demonstration farms and drawings, building frames and tools could be used on many other farms
- financial support to purchase environmentally friendly technology (e.g. machinery rings)
- develop economic possibilities to borrow money with arable land as security (land property rights, water laws regarding drainage systems on arable land)

Actors
An important actor will be the **co-ordinating function for sustainable agriculture in the Baltic Sea region.** Also the **demonstration watersheds** with the **national expert teams** will play an important part in transferring and implementing the support. The **ministries** must be active in this process, as well as **universities** and **research institutes.** The **EU** could also be an important organiser of projects and programmes. NGO's such as the United Nations Volunteers could possibly be interested in participating.

Financing
The need of support is very large in many countries and to be able to reach the goal of sustainable development considerable investments will be necessary. The **EU** with its massive programme of activities will be involved to a large extent in this area. **Bilateral financial support** will also be of importance to the countries in transition and Poland. **Governmental funding** could be used for some measures. **IFI's,** such as the World Bank, will most likely be interested in partaking in specific projects.

Time frames
This type of support has already started to a minor extent in the form of various programmes and projects. The activities in this area must be greatly increased to be able to reach the goal of sustainable agriculture. The support must start as soon as possible and could preferably be divided into five year support periods. The investments and efforts must of necessity be larger during the first five year period. This type of support is proposed to continue for four five year periods, with the amounts of investments and also support successively reduced during the 20-year period.

Monitoring methods
Many of the proposed indicators in Chapter 6 could be used after further elaboration to monitor the development in the countries in transition and Poland and also to monitor how successful the transferring of support has been.

TRANS-SECTORIAL ACTION

Action 1. Promote the recirculation of nutrients and organic matter in urban bio-wastes to the production of biomass on arable land

Recirculation of plant nutrients and organic matter from urban bio-wastes to arable production will be of great importance to increase the efficiency of the use of nutrients, especially of phosphorus, as it is a non-renewable resource that we are dependant on for agricultural production. For the quality of soils, the organic matter content is an important factor. Recirculation is only possible if the quality of the bio-wastes is high and they are not contaminated with heavy metals or other residues. Agriculture has an important role in this area for sustainable development. A plan on how this goal can be achieved should be elaborated by the participating countries, the Union of the Baltic Cities and other interested parties.

CROSS-SECTORIAL ACTIONS

Action 1. Promote the development and production of energy crops and bio-energy production

Production of energy crops, bio-energi and bio-gas could be one of the major new uses of excess arable land and of manure and agricultural waste. A programme to increase the production of energy crops and of bio-energy to replace fossil fuel and create new employment in rural areas should be elaborated. This action will also involve the forestry and energy sectors.

Action 2. Elaborate diversification and rural development programmes.

The participating countries should elaborate diversification and rural development programmes and networks to create employment, conditions to improve rural infra-structure and to stabilise the economy base in rural areas. Spatial planning will be an important tool. This action could involve the tourism, fishery, energy and forest sectors.

10. Process of Work

10.1 Project organisation

The project of elaborating an agricultural sector programme and report was given to the Lead party for the sector. The Lead party consists of Sweden (Ministry of Agriculture) and HELCOM. The contact person at the Ministry of Agriculture is Mats Aberg and at HELCOM, Ulrich Kremser. The Ministry of Agriculture contracted two expert groups to elaborate the programme and sector report. An international project leader, Bjorn Sundell, director, Swedish Institute of Agricultural Engineering, with a technical secretary, Christine Jakobsson, Swedish Board of Agriculture, were engaged to produce the documents and take the necessary bilateral contacts. The Swedish University of Agricultural Sciences was engaged to develop the scenario task and the involved background documents to this task. This expert group consisted of Rune Andersson, Christine Jakobsson and Staffan Lund.

An international Baltic 21- Agriculture Network with national representatives, agricultural and environmental experts and various organisation and NGO's was set up to participate in the preparation of the agricultural sector programme. The names of the national representatives and appointed IFI's and NGO's are listed in appendix 1.

70.2 Workshops and Seminars

In the work-plan it was decided that the sector would have three workshops.

On the 16-l 7th of September **the first workshop** within the agricultural sector took place in Stockholm. The main subjects for the meeting were:

- sustainable development
- the background regarding agricultural production and non-sustainable issues
- goals, criteria and indicators
- the preliminary framework for the scenarios

The first progress report was written for the third Senior Officials Group Meeting, SOG3. The meeting was held on the 24 -25 September in Vilnius, Lithuania and a presentation was also given by the agricultural secretariat at the meeting.

An extra seminar was decided on at the Workshop in Stockholm, to help to co-ordinate the scenario task. The seminar would specifically cover the Model task and it was held in Uppsala, Sweden during the 24th of October.

The **second workshop** took place on 20-21" of November 1997 in Braunschweig, Germany The topics of the second workshop were "Scenarios for sustainable development and policy implied" and "Identification of obstacles and gaps". Also the revised texts that were discussed during the previous meeting were discussed.

The second progress report was written for the SOG4 meeting that took place during the 10-12th of December 1997 in Copenhagen. The agricultural secretariat presented this material at the meeting.

The **final workshop** took place during the 26-27'h of January 1998 in Warsaw, Poland and the main topic was "The Action programme" and "The Executive summary". All of the background documents in their revised versions were discussed.

The SOG5 meeting took place in Helsinki during the 9-10th of February 1998. The agricultural sector presented the main challenges, the action programme and the priority elements to be covered in the final document.

10.3 Mode of work

The expert groups produced draft versions of the chapters for the agricultural sector report. These documents were presented at the three workshops for the participants, the Baltic21 -Agriculture network. These documents were then discussed in great detail and revised. The revised version was then discussed at the next workshop and revised until agreement was reached. The goal was to reach consensus on the contents of the agricultural sector report.

The final agricultural sector report will be ready for the 23rd of February according to the revised timetable decided on at SOG4.

Draft material to the sector report, invitations to the workshops and minutes from the workshops/seminars have continuously been published and renewed on the Baltic 21 homepage on the Internet to keep the process open and transparent.

Appendix 1.

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Appendix 2.

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Staniszewska, Maria	POLAND	Polish Ecological Club / Coalition Clean Baltic

Storck, Wolfgang	GERMANY	Ministry of Agriculture
Sundell, Bjijrn	SWEDEN	Ministry of Agriculture
Svedinger, lngrid	SWEDEN	Environmental Protection Agency
Svejgaard, Mette	SWEDEN	Swedish Society for Nature Conservation/ Coalition Clean Baltic
Switala, Jan	POLAND	Ministry of Agriculture and Food Economy
Tilander, Ylva	NORDIC COUNCIL OF MINISTERS	
Vagstad, Nils	NORWAY	Centre for Soil and Environmental Research
Volkgenannt, Uwe	GERMANY	Federal Environmental Agency (FEA)
Aberg, Mats	SWEDEN	Ministry of Agriculture

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11. *Executive Summary for the Agricultural Sector*

Introduction

The agricultural sector is vital for all the countries in the Baltic Sea Region. One of the most important issues for the state of the Baltic Sea is high contents of nutrients, such as nitrogen and phosphorus. Agriculture is one of the most important sources to nutrient losses and also to pesticide residues in the environment including the Baltic Sea. Especially in the countries in transition and Poland, the population is to a large extent involved in agriculture, living in rural areas and the population is an important base for rural development. Agriculture comprises many different types of activities, such as animal and plant production, as well as local processing, distribution and combinations with e.g. forestry, tourism and other sectors. Farming is not sustainable if the farmers can not make their living. The climatic and soil conditions for agriculture within the Baltic Sea Region vary greatly from a mild climate and high production potentials in e.g. parts of Denmark, Germany and Poland to very harsh arctic conditions and low production potentials in northern Finland, Russia and Sweden. A viable agricultural sector is an essential part of the sustainable society by guaranteeing a basic food supply, sheltering many of the terrestrial species and by being a base for sustainable development for the future through e.g. recirculation of plant nutrients and organic matter between urban and rural areas.

Definition and goals of sustainable agriculture

Agriculture contributes significantly to the society of the future. Sustainable agriculture is the production of high quality food and other agricultural products/services in the long run with consideration taken to economy and social structure, in such a way that the resource base of non-renewable and renewable resources is maintained. Important sub-goals are:

1. the farmers income should be sufficient to provide a fair standard of living in the agricultural community
2. the farmers should practice production methods which do not threaten human or animal health or degrade the environment including biodiversity and at the same time minimise our environmental problems that future generations must assume responsibilities for
3. non-renewable resources have to gradually be replaced by renewable resources and recirculation of non-renewable resources maximised
4. sustainable agriculture will meet societies needs of food and recreation and preserve the landscape, cultural values and the historical heritage of rural areas and contribute to create stable well developed and secure rural communities the ethical aspects of agricultural production are secured

On-going activities

In the agricultural sector there are certain elements that have a great influence on the sector. For the EU countries the most important are EU's legislation and policy including the Common Agricultural Policy, the 5th Environmental Programme etc. These are to some extent already of importance even for the EU-applicant countries in their preparations for membership. Bilateral action programmes and agreements, as well as binding conventions, such as Convention on the Protection of the Marine Environment of the Baltic Sea Area, HELCOM, also influence the sector. In 1988 the Ministerial Declaration of HELCOM launched a 50% reduction target of the total nutrient input to the Baltic Sea by 1995. Measurements have so far shown that the 50% reduction target was most likely not met by the EU countries in 1995. Difficulties in assessing the effects of implemented measures exist, due to a significant time lag that affects the soil and sea systems depending on the mineralisation of stored nitrogen in the soil,

erosion of soil including phosphorus and many other processes in these systems. In the Baltic Sea area different countries are involved in many bilateral projects of importance for sustainable agriculture. The projects exist at varied levels. Several countries have programmes to promote organic agriculture, as one way of achieving a more sustainable agriculture.

Problems for the agricultural sector

Regions and farms with a high livestock density and/or high inputs of fertilisers, as well as inappropriate agricultural management, can often be a serious environmental threat. The main challenges are to reduce the negative effects of agriculture on the Baltic Sea, by reducing the pollution by nutrients which to a large extent originates from animal production and improper use of fertilisers and by reducing the risks in connection with the use of plant protection products, as well as developing and maintaining bio-diversity. Great differences exist between the countries that are members in the EU and the countries in transition and Poland. In the EU countries point sources in connection with manure handling have been in focus for environmental action programmes for a couple of decades, as well as more recently also diffuse sources. On the other hand, in the countries in transition and Poland, an immediate problem today is nutrient point sources, due to insufficient or non-existing manure storages and often large animal holdings. Even here diffuse pollution is a problem.

Nitrogen losses are basically correlated to the total turnover of nitrogen in the system and different corrective measures in crop production practices have so far not been proven enough to reduce the nitrate losses to acceptable levels for the water environment. Efficient tools to effectuate the reduction are important.

Modern agriculture relies on imported feed and non-renewable fossil fuel and phosphorus resources. The specialisation of agriculture has greatly increased the transportation of commodities and agricultural products. Large differences exist between countries and regions in their economic conditions and infra-structure in rural areas. This means that measures necessary for sustainable development are not always the same within the entire Baltic Sea Region. As there is a large lack of education and knowledge on sustainable agriculture, it is necessary with education, advisory service and training in the whole region, but particularly for the new family farms in the countries in transition and Poland. Throughout the whole Baltic Sea Region, there is a need of developing and demonstrating more sustainable agricultural systems. Appropriate monitoring systems and the proposed indicators of sustainable development are indispensable tools to evaluate the progress towards the set-up goals of sustainable agriculture.

Scenarios

It was decided that the scenario was mainly to be based on a summary of existing knowledge, from earlier studies, literature and professional experience as well as to a minor degree on an explanatory and guiding model analysis regarding nitrogen and phosphorus. A strict scenario approach for all 10 involved countries, with mathematical analysis of consequences, was not considered to be possible within the framework of this project. Within the model analysis it was only possible to go into depth regarding the environmental issues of sustainable development, although the social and economical issues are just as important and are a prerequisite for sustainable agriculture. As the nitrogen and phosphorus load from agriculture to the Baltic Sea including ammonia emissions to the atmosphere are some of the most important non-sustainable issues for agriculture, the model was run against the sustainability goal of 50% reduction of nitrogen, phosphorus and ammonia losses and

gave the maximum production of food and fodder possible without exceeding the goals. Business as usual was also modelled.

Measures were identified in three areas, sustainable agricultural structure, sustainable farm management concerning nutrient losses and additional measures. The scenario shows that less arable land and fewer animals will be needed in the future to provide the needed amounts of food and feed, due to greater efficiency in production, improved management and more sustainable technology. Opportunities to increase agricultural production of energy- and industrial crops, etc. on excess arable land will be obvious. This will also be of great importance to develop the infra-structure and employment in rural areas. The changes are bound to be larger in the countries in transition and Poland than in the rest of the Baltic Sea Region. The implementing of action programmes with effective measures is an important component to reach sustainable agriculture.

Action programme

The action programme for the agricultural sector consists of nine different Programmes that are supported by seven Actions. In all the programmes legislation, information, education, research and development, as well as instruments of control could be included. The Programmes should have clear goals that continuously should be monitored and evaluated. The Programmes below have not been ranked and no consideration has been taken to the relative importance of each programme when listing them. The Actions are used to implement the Programmes. In the Agricultural sector report the most important elements in all of the proposed programmes are described. Instruments, such as legislation, environmental taxes, support systems etc. will have to be elaborated in more detail in the future work within the programmes.

Programmes for the Agricultural sector

1. Programmes to reduce the nutrient losses from agriculture
2. Programmes to reduce the risks connected with the use of plant protection products
3. Programmes to protect ground and surface water for drinking water purposes in agricultural areas
4. Programme to preserve agricultural productivity for production of high quality food and feed
5. Programmes to maintain and develop biodiversity and rural landscapes
6. Programmes to reduce the usage of growth promoters and antibiotics in agriculture and to promote animal health
7. Programmes to develop rural infra-structure and to promote a high quality of life in rural areas and the economic conditions of sustainable agricultural production
8. Programmes to promote the development of new production alternatives for arable land
9. Other measures for sustainable development in agriculture (measures regarding transport logistics, markets for sustainable produce, GMO, the greenhouse effect)

ACTIONS FOR THE AGRICULTURAL SECTOR

The agricultural sector proposes seven actions for the implementation of the programmes. The actions are ranked according to the following and are general throughout the entire Baltic Sea Region, no consideration has been taken to the fact

that there is a larger need of some of the actions in specific countries. The actions are ranked into three groups, where the first priority is the most important.

PRIORITY 1.

Action *1: Education and training*

This action relates to all sub-goals. Education, training and information is one of the most important actions in the action programme and both farmers and consumers are important target groups. The farmers in all countries are dependant on adequate education and training to be able to practice production methods that will lead to sustainable agriculture. Especially in the countries in transition and Poland, where the tradition of family farming is recent, a great need of educating the farmers has become evident. To be able to do this, institutional strengthening, applied research, demonstration trials and a well functioning extension service and funding for all of these mentioned components, as well as investments in education and training are necessary. Even the consumers should be informed to be able to make decisions that will promote sustainable development in their everyday life.

The main actors will be the agricultural schools, the extension services, universities and research institutes, as well as governmental Ministries and possibly the EU. Industries, the market, the farmers organisations and NGO's have interests here. Education and training could be financed with EU's funds (CAP, environmental, TACIS, PHARE, structural funds). Governmental sources should also be of importance. International financing institutions, IFI's could also be interested in the demonstration watersheds. In the EU countries education programmes financed by the EU's agri-environmental programmes within the CAP are currently running. In the countries in transition and Poland, some education and training has been included in bilateral projects. Much larger efforts, as a large general investment on education on sustainable agriculture, will be needed in the countries in transition and Poland for the next 10 years. Education and training must be a necessary part of the entire time span of the Baltic 21 programme and all countries must be involved. For monitoring the proposed indicators should be elaborated further and implemented, with consideration taken to a base value e.g. 1995 and a target value for the years 2010 and 2030.

PRIORITY **2.**

Action 2: *Create demonstration watersheds with demonstration farms in a network in the different countries.*

This action can relate to all sub-goals. It is of utmost importance to demonstrate to the farmers and public what sustainable agriculture is and how it can be performed under different conditions. At least one demonstration watershed should be established in every country, in larger countries with varying conditions the demonstration watersheds should be able to show sustainable agriculture in the most important agricultural regions of the country.

The most important actor will be the farmers. A national team of experts in each country is recommended to implement the work in the country on the demonstration watersheds. The team will consist of experts from agricultural schools (education and training, demonstrations), advisory service (education and training, demonstrations, applied research), research institutes and universities (monitoring, applied research, education), as well as ministries (legislation, agro-environmental policy, support). The co-ordinating function will co-ordinate the activities taking place in the demonstration watersheds, as well as transferring knowledge.

Potential interested parties for financing are the World Bank and the Nordic Environment Finance Corporation. NGO's, such as UN Volunteers are also interested.

Governmental funding as well as intergovernmental funding is possible. EU's agricultural funds, such as funding for demonstration farms mentioned in EU's regulation 2078/92 and the EU's structural funds could be used. Bilateral support will be important for the countries in transition and Poland.

The time frames will of necessity differ between the western countries and the countries in transition and Poland and the development will take place according to every country's abilities. In all countries the first step will concern the choosing of suitable watersheds with demonstration farms. Necessary investments in the watersheds and on the farms, such as the building of sufficient manure storage, investments in water monitoring equipment and facilities, possible investments in environmentally friendly technology, as well as the building of an education room should also be performed during the first two years. In the countries in transition and Poland one of the most important issues to be taken care of during the first years, is the livestock density of all areas, as there now exists a one time chance for adjustments, as the transition to family farms is taking place at the same time. Building manure storage, teaching proper soil tillage, improving feed utilisation in animal production and transferring knowledge on sustainable agriculture should continuously take place during the time span of the Baltic 21, with a larger investment during the first 10 years. Some of these actions are included to the Helsinki Convention Annex III "Prevention of pollution from agriculture" and a preliminary date has been set for the implementation but it is likely to be changed. This date differs between the EU countries (at the latest on the 1 January 2002) and the countries in transition and Poland (before the 1 January 2011). Education and training should start as soon as possible for the farmers and monitoring of environmental quality as well. Demonstrations and research should also be started in the near future.

A major task in the demonstration watersheds will be to monitor water quality in the catchment area and also to monitor other agro-environmental parameters. The indicators mentioned in chapter 6 could be used after further development.

PRIORITY *3.*

The remaining four actions were found to be equally important and are therefore not ranked. Details on actors, financing, time frames and monitoring methods can be found in the sector report.

Action 3: *Establish a Co-ordinating Function for Sustainable Agriculture in the Baltic Sea Ca tchmen t Area.*

This action ensures that the action programme will be carried out and will encompass the entire span of different programmes, projects and other actions that are proposed, as well as all the sub-goals. The co-ordinating function will be able to provide the initiative and knowledge to start, develop, support, assist, implement and monitor the actions and programmes. The responsibility of running the programmes and watersheds will lie within the countries. At the same time, the co-ordinating function will provide possibilities of co-ordinating the work in the different countries, co-ordinating the monitoring and also of adapting the programmes and projects according to the progress that will be reached within sustainable development in agriculture. The co-ordinating function should be placed with some other suitable institute within the Baltic Sea Area, so as not to create new constitutions, such as HELCOM, a research institute, university or some part of the EU commission. This function could also be located together with similar groups from other Baltic 21 sectors, e.g. forestry. The participating countries are invited to together promote and share the responsibilities and assets of the establishment of a co-ordinating function for sustainable agriculture.

Action *4. Develop a "Virtual Research Institute" for sustainable agriculture based on the already existing NOVABOVA in the Baltic Sea Region.*

A network of research institutes and universities in the form of a "virtual research institute" should be established to be able to promote and co-ordinate research concerning sustainable agriculture. This action could be linked to the already existing NOVABOVA (NOVA - the Nordic Forestry, Veterinary and Agricultural University and BOVA - the Baltic Forestry, Veterinary and Agricultural University). Relevant research programmes to further develop the concept of sustainable agriculture, monitoring and indicators should be elaborated and implemented.

Action *5. Elaborate and implement agro-environmental legislation and policies*

The elaborating and implementation of agro-environmental legislation and policy is a part of the entire action programme for sustainable agriculture, both at the intergovernmental and governmental level and relates to the entire goal of sustainable agriculture. The legislation and policies in all countries must be adapted and improved towards sustainable development to be able to achieve sustainable agriculture.

Action *6. Institutional strengthening for sustainable agriculture*

Institutional strengthening is a prerequisite for education and training for sustainable agriculture and applies mainly to sub-goals 2 to 5. The target group is all organisations involved in the education and training of farmers, agricultural students and advisory specialists, such as research institutes, universities, advisory service centres and agricultural schools etc.

Action *7. Develop support (knowledge, financial) to the countries in transition and Poland*

The countries in transition and Poland need support to be able to improve their agriculture towards sustainable development. This action relates to the whole goal of sustainable development. Support, both as transferring of knowledge and financial, will be needed for the building of manure stores, to purchase environmentally friendly technology, to implement agri-environmental legislation, to implement the Code of Good Agricultural Practice etc.

On top of the agricultural actions and programmes, three actions are proposed that are not specific for the agricultural sector.

TRANS-SECTORIAL ACTION

The recirculation of nutrien ts and organic matter in urban bio- wastes to the production of biomass on arable land should be promoted.

A plan on how this goal can be achieved should be elaborated by the participating countries, the Union of the Baltic Cities and other interested parties.

CROSS-SECTORIAL ACTIONS

Promote the development and production of energy crops and bio-energy production.

A programme to increase the production of energy crops and of bio-energy to replace fossil fuel and create new employment in rural areas should be elaborated. This action will also involve the forestry and energy sectors.

Elaborate diversification and rural development programmes.

Diversification and rural development programmes to create employment, conditions to improve rural infra-structure and to stabilise the economy base in rural areas should be elaborated by the participating countries. This action could involve the tourism, fishery, energy and forestry sectors.

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*) **out of print**
) **in print

Commentary

This report reflects the background and proposes detailed action for achieving the goal of sustainable agriculture in the Baltic Sea Region (BSR) in the next decades. The impact of agricultural activities to the environment is an important issue that the BSR is faced with.

Important sustainable issues are the dependency on non-renewable resources, plant nutrient and pesticide management, biodiversity and the socio-economic situation for the farming community.

Measures need to be taken at policy level as well as through specific field programmes.

Since lots of links and interrelations do exist between the social sectors like agriculture, energy, industry etc. the development within the BSR to sustainability has to integrate all of them. Furthermore not only environmental but also economic and social aspects have to be taken into account. These are safeguarded by the entire Action Programme of Baltic 21 process.

The Baltic 21 Series contains the following publications:

No 1/98 An Agenda 21 for the Baltic Sea Region
No 2/98 Sustainable Development of the Agriculture Sector in the Baltic Sea Region[1]
No 3/98 Sustainable Energy Development in the Baltic Sea Region ISBN: 87-986969-0-4)
No 4/98 Sector Report on Fisheries, Contribution to Baltic 21
No 5/98 Baltic 21 Action Programme for Sustainable Development of the Baltic Sea Region - Sector Report on Forests[2]
No 6/98 Sustainable Development of the Industrial Sector in the Baltic Sea Region
No 7/98 Agenda 21 - Baltic Sea Region Tourism[3]
No 8/98 Baltic 21 Transport Sector Report[4]
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No 14/98 Vision of Sustainability in the Baltic Sea Region: Beyond Conventional Development

The reports can be downloaded from the Baltic 21 website (http://www.ee/baltic21/). At the website you can also find information on where you can order the reports.

1 Also published by the Baltic 21 - Agricultural Secretariat, Swedish Institute of Agricultural Engineering, 1998
2 Also included in the Publications of the Finnish Ministry of Agriculture and Forestry.
3 Also published by the Finnish Ministry of Trade and Industry, Working Papers 6/l 998.
4 Also published by the German Federal Environmental Agency in the TEXTS series.