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HELSINKI SEMINAR ON ENVIRONMENTAL BENEFITS FROM AGRICULTURE

COUNTRY CASE STUDIES

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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FOREWORD

The Seminar on Environmental Benefits from Agriculture, hosted by the Finnish Ministry of Agriculture, was held in Helsinki on 10-13 September 1996, and included a one-day study visit to farms implementing the EU's agri-environmental measures. It was opened by the Finnish Minister of Agriculture, and brought together around 100 participants from agriculture and environment ministries in 22 OECD countries and 1 OECD Observer country, 4 international non-governmental environmental organisations and representatives of farmers professional organisations. The Finnish Minister for Environment hosted a lunch during the Seminar.

The OECD Secretariat presented an overview paper, as the basis for discussion of four consultant papers on conceptual areas on the nature and measurement of environmental benefits from agriculture and a set of country case studies, prepared by the countries themselves, describing specific policies and practices addressing the issue of environmental benefits from agriculture. The participation of non-governmental environmental organisations, researchers, and professional farmers organisations was particularly useful in widening the area of discussion.

The Seminar was an integral part of the programme of work on agri-environmental issues in the OECD. Its purpose was to define the key policy issues and the experience and role of different policy measures and market solutions in OECD countries, in the context of agricultural policy reform, and to suggest areas that might require further work to be undertaken in the OECD. There was a very useful general discussion based on an oral summary of the content and the discussions of the papers, introduced by the rapporteur. This led to a broad consensus on the conclusions that emerged from the Seminar.

The Joint Working Party of the Committee for Agriculture and the Environment Policy Committee discussed the summary and the conclusions of the Seminar in December 1996. Subsequently, the Committee for Agriculture and the Environment Policy Committee agreed to recommend the derestriction of the Seminar's documents on the responsibility of the Secretary-General. The conclusions of the seminar, the overview paper from the OECD Secretariat, the Summary by the rapporteur, the conceptual papers prepared by consultants, the official statements, and summaries of the country case studies, prepared by the countries themselves, were published in 1997 as an OECD document entitled *Environmental Benefits from Agriculture: Issues and Policies - The Helsinki Seminar*.

Fifteen countries prepared country case studies outlining their policies and experiences relating to environmental benefits of agriculture. This General Distribution document contains these case studies.

The OECD expresses its appreciation to the Finnish authorities for the very active role they played in preparing, arranging and hosting the Seminar, as well as to eight other financial contributors: Belgium, the European Commission, Germany, Japan, the Netherlands, Norway, Switzerland and the United States.

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EUROPEAN UNION: THE EUROPEAN UNION'S AGRI-ENVIRONMENT REGULATION (EEC) 2078/92 — FRAMEWORK

by
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Introduction

Several Member States of the European Union have contributed papers describing agri-environment programmes, implemented at a national or regional level. The European Commission does not operate any agri-environment programmes itself and makes no agreements directly with farmers. The role of the Commission in relation to the implementation of the Regulation is to ensure that the programmes proposed in Member States meet the environmental objectives and other conditions set out in the Regulation. The Commission has examined and followed some 115 programmes or groups of programmes operating in the Member States. These are listed in Annex 1 and a summary of the individual measures under each programme is given in Annex 2. These tables illustrate the wide range and diversity of the agri-environment programmes.

1. The environmental policy context

The interaction between agriculture and the environment has been driven by the progress in technology, advancing farming techniques and developing conditions in the markets. In so far as environmental criteria are internalised as part of the factors of agricultural production, it may be expected that farmers will observe a corresponding level of environmental standards. However, experience so far has been that the market and other forces are not ideal stewards of the countryside and the application of economic reality can result in pressure on the environment.

The Treaty of Rome, Article 130r, provides that environment protection requirements must be integrated into the definition and implementation of other Community policies[1], including agriculture. One of the effects of this article is to require that policy in agriculture should promote environmentally beneficial farming techniques, through regulation, research, training, and systems of support.

Agri-environmental measures are also needed to contribute to the fulfilment of the European Union's commitments under Agenda 21. At the European Union policy level, these commitments form the basis for the Community fifth environmental action programme[2]. One of the five sectors of economic activity targeted in the action programme is agriculture[3], with the aim, among other matters, of promoting

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1 Article 130r (2) EC Treaty, introduced in the Single European Act, 1986.
2 COM (92)23, 27.3.1992.
3 The other sectors are industry, tourism, transport and energy.

sustainability in farming methods. The action programme describes specific policy aims for the agricultural sector: to conserve water resources (including reducing nitrate levels), soil resources and genetic resources; to reduce the application of chemical inputs to the point where sustainability is achieved through controls on use and the promotion of integrated pest control and organic farming; to manage land in order to maintain biodiversity and natural habitats, and to control natural disasters (such as forest fires), or loss of land through erosion.

The pattern over the last half century has been one of diminishing environmental resources and a reduction in biodiversity. There are the problems of actual pollution directly attributable to intensive types of farming practised. A case in point is the difficulties of disposal of waste products from intensive pig and poultry units, which have the potential for serious environmental damage. In these two sectors, producers operate in more-or-less free market conditions, and it is important to note that reliance on the operation of the market here has not resulted in systems of agriculture working in environmental harmony. The conclusion may be drawn that a liberal market environment and environmental sustainability are not directly connected and specific measures are needed. In the arable sector, the use of nitrates gives rise to concern, while the deleterious effect of some pesticides on the environment is also evident. Although a recent survey by the Commission's statistical service shows that between 1988 and 1992, the volume of pesticides sold in the European Union showed steady reductions[4] (with a few exceptions), there has also been a sharp and recent decline in some farm-dependent bird populations, which may be linked to pesticide use.

It has been argued that one way to resolve the current conflict between the demands for productive profitable agriculture on the one hand and the need to promote environmental concerns on the other, is to allow farming to operate in free market conditions where it is profitable to do so, and to allow marginal land to become wilderness. This "separation" option seems to be attractive not only because it saves public expenditure, but also because the hard decisions about which land should be farmed and which abandoned are taken by the market. From the environmental perspective, it is true that in certain circumstances the cessation of farming will allow the environment to become re-established to its former "natural" state.

However, in the EU, as elsewhere in Europe, much of the "natural" biodiversity is the result of centuries of farming activity. Furthermore, the continued health of this natural environment is dependent on the continuation of farming. If farming ceases, the agriculture-specific biodiversity is lost and in places the fabric of the landscape is threatened by soil erosion. A list summarising the landscape types in Europe is given at Annex 3; this is taken from the Dobris Assessment, "Europe's Environment"[5]. The large majority of these landscapes are to varying degrees dependent on some type of agricultural activity. Examination of the range of landscapes contained in the table also illustrates the great diversity across Europe, which needs to be taken into account in the development of agri-environment policy.

In large parts of Europe which are densely populated, there is a second reason why the separation argument is difficult to support: acute competition for land space is putting increasing pressure on the environment. In such regions it is necessary to integrate the competing and partially overlapping types of land use, which include agriculture, housing, industry, roads, nature protection, and preservation of the

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[4] Sales of pesticides for use in agriculture (1988-1992, 3-years' averages): reductions of over 20 per cent in Spain, Sweden, Finland, Austria; 10-20 per cent in Denmark, Italy, the Netherlands; 0-10 per cent in Germany, France, the UK; and an increase in use of 6 per cent in Belgium. (No data for Greece, Ireland, Luxembourg, Portugal). Eurostat 'Statistics in focus', Environment 1996/1, ISSN 1017-5849.

[5] European Environment Agency, Copenhagen, *D. Stanners* and *P. Bourdeau*, Office for Official Publications of the European Communities (Luxembourg, 1995) ISBN 92-826-5409-5.

landscape. In most Member States of the European Union there is no room for huge areas of natural park as there may be in countries of the New World.

While the European environment is substantially dependent on agricultural production, some farming techniques have themselves resulted in pressures which tend to diminish the quality of that environment[6]. In particular, the process of intensification and rationalisation of production over the last 50 years has to an extent been at the expense of the environment. For this reason, the aim of the European Union policy in respect of agriculture and the environment, can be defined by reference to the principle of sustainability. This concept, which applies in agriculture as in other economic sectors which impact on the environment, is defined as a function of the economic, socio-economic and environmental needs of the Union[7]. While policy has been developing over many years, a key date for agri-environment policy was 1992: in that year the Union launched the Fifth environmental action programme and reformed the common agricultural policy. One of the aims of the reform was to make agriculture more compatible with the environment, notably through the adoption of the Agri-environment Regulation. This Regulation makes a significant contribution to environmental protection, though it clearly does not affect the full range of production, or cover all the territory of the Union.

In the Commission's progress report on the implementation of the fifth environmental action programme[8], emphasis is placed on the need to integrate environmental conditions into agriculture policy in general. Concerning the agri-environment programmes, the report concludes that an evaluation methodology should be established and, subject to effective implementation in the Member States, an extension of the measures should be considered.

To a limited extent, some environmental problems can be addressed through codes of good agricultural practice, backed up where necessary by legal restrictions on some farming techniques. In the EU, codes exist in varying forms across the Member states, some are drawn up by the national or regional authorities, some by farming or other organisations. In some Member States the codes have the force of law, in others they are for guidance only. Legal restrictions on farming are in place in all Member States to prevent pollution and to ensure minimum standards of hygiene, animal welfare and so on.

However, in many cases the rural environment and landscape require a level of commitment well beyond the legal minimum and beyond good practice; to achieve real benefits, measures often entail considerably reduced productivity and costly and time-consuming improvements. Clearly, only very few farmers can afford to undertake such works for free. For this reason, payments from public funds for farmers who alter their activities substantially to benefit the environment is essential to achieve the environmental goals which society wants. This is the area where the agri-environment programmes operate.

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[6] The table in Annex 3 also summarises the "trends" affecting European landscapes, including pressures from farming.

[7] 5th Environmental Action Programme defines "sustainability" as the process of ensuring social and economic developments while respecting the environment and without compromising the natural resources which are indispensable for human activity.

[8] 10/1/96, COM(95)624 final. The Commission proposal for an European Parliament and Council Decision on the progress report commits the Community to a policy of further integration of environmental requirements into agriculture policy.

2. Agri-environment Regulation[9]: the measures

The agri-environment programmes are an attempt to meet the policy challenge posed by the need for the farming sector to protect and preserve the environment. The Regulation was adopted as an accompanying measure to the 1992 reform of the common agricultural policy. Through the programmes, farmers agree — usually by contract — to undertake efforts to maintain or improve the environment. The measures supported are listed in Annex 2; they fall into four broad categories: low-intensity farming systems; landscape; set-aside and maintenance of abandoned land; and training and demonstration projects.

The first, which forms the main emphasis of nearly all programmes, concerns land management measures to promote low-intensity systems, using reduced levels of inputs or indeed organic farming. The primary aim is to alleviate pressure on the environment and this type of programme exists in nearly all Member States, for example, in the programmes operated by the German Länder, and in the Italian and French Regional programmes and the integrated programmes in Ireland, Portugal and Finland. In this category, an important, if minor, part of the programmes is to encourage farmers to maintain genetic diversity, both of traditional crop varieties and of farm animals now in danger of extinction.

A second category of activities promoted under the programmes is to maintain traditional landscape features and to protect and enhance natural biodiversity. Much of the European landscape is characterised by specific features, for example stone walls, terracing and hedges, maintained using traditional craft skills. Without internalising these costs, the economics of modern farming is likely to dictate that farmers should plough up hedges and allow walls and terracing to fall into disrepair. These features, the maintenance of which can be labour-intensive, are not only valued for their aesthetic appeal, but also for maintaining biodiversity. Hedgerows are particularly important in this regard, provided they are carefully maintained from the environmental perspective. Programmes which focus on the maintenance of landscape can be found in the UK and Sweden and elsewhere. There are also activities which seek to protect and enhance biodiversity in ways which are less visible, for example by reducing pesticide inputs.

The third category of programmes is directed at land on which no farming takes place at all. In some locations, the long-term set-aside of land for environmental purposes, such as to create a wild habitat by flooding land, may be desirable. This is classed as an agri-environment activity — but only where the set-aside would represent a net environmental gain. In many cases, the continuation of extensive agriculture supports the greater biodiversity. In addition, where land has been abandoned, there may be a need to maintain land in reasonable condition in order to reduce the risk of fire and erosion. However, the continuation of low-intensity grazing is more often the better option from a strictly environmental perspective. Examples of programmes for set-aside can be found in Greece, Denmark, and elsewhere. There are few programmes focusing exclusively on set-aside; it is more often included as an option within wider programmes.

Finally, some of the agri-environment programmes also contain back-up measures to encourage public access and public leisure activities on land and to provide for training and demonstration projects to promote good-farming practices. Public access programmes exist in particular in the UK while training programmes and demonstration projects are the main focus of the programme in the Netherlands.

Implementation in the Member States has been very diverse; some countries have concentrated programmes on single activities — such as the promotion of organic farming or training; others have

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[9] Regulation (EEC) No 2078/92, OJ No L 215, 30.7.1992, p.85.

provided for regional programmes embracing the whole range of activities. None of the measures is compulsory on farmers, although implementation of the programmes is obligatory at the level of the Member States. Farmers may choose whether to continue their normal farming or to join an agri-environment scheme. For those who do commit themselves to the programmes, the obligations must be observed for at least five years, subject to cases of *force majeure*; for long-term set-aside the minimum obligation is for 20 years.

It should be underlined that, although the Commission has a very important role to play in ensuring the environmental objectives of the Regulation are respected and that programmes are properly evaluated, the conceptualisation of programmes, their implementation and evaluation, is in the first instance at the level of the Member States: in many countries the programmes are decentralised to the regions. This results in a very diverse approach to programming, and is an example of the principle of "subsidiarity", whereby policies and decisions are implemented at the least centralised level practicable. Such a decentralised approach is particularly important in a subject area such as agri-environment where there is a large diversity of agricultural and environmental conditions.

3. Agri-environment premia and budget

Premia are paid to farmers, who commit themselves for the minimum period to the measures under the programmes, in relation to the obligations taken on. The calculation of premia is based on costs incurred and income foregone, less any additional income resulting from participation in a scheme. In addition, where an incentive is needed to persuade sufficient numbers of farmers to join schemes, the Agri-environment Regulation allows for an appropriate incentive payment to be added to the premium. Incentives, where they are needed, serve to overcome transaction costs, to cover risk or similar costs which dissuade farmers from joining schemes. Any incentive payment must be justified on the basis of objective criteria and the total amount is limited under Commission legislation.

Checking the justification and calculation of premia forms an important part of the Commission's role in approving programmes. The fact that a prescription is an eligible activity and meets the objectives of the Regulation does not automatically mean that a payment should be made. It must also be demonstrated that the farmer is subject to costs or income loss as a consequence of entering into the programme. However, not all environmentally-beneficial activities are open to support under the programmes. In cases where farming practice is below the minimum standard acceptable in the region concerned, public funding is not available for a farmer who merely reaches the standard. Similarly, farmers are not paid to desist from causing pollution.

Upper limits for premia part-financed from Community funds are laid down in the Regulation. Community finance is provided from the 'guarantee' section of the agriculture budget at the rate of 50 per cent, or 75 per cent in the less prosperous regions of the Community (described as being "Objective 1" regions); the other 50 per cent or 25 per cent is paid by the Member State.

The budget in 1996 is ECU 1.4 billion, which represents 3.5 per cent of Community agriculture spending. However, it is very unlikely that this will be fully spent owing to low-take-up by farmers in some Member State programmes. For example in 1995 the out-turn stood at ECU 482 million against a budget of ECU 990 million. The difference was mainly due to late adoption of the programmes in the three new Member States, which resulted in zero expenditure in 1995; spending on the programmes in the twelve older Member States (ECU 482 million) accounted for 72 per cent of the available budget. However, the pattern of under-execution in some Member States is contrasted in others where programmes have been fully implemented.

In approving agri-environment programmes, the Commission has sought to take into account all the relevant environmental and agricultural aspects and thus ensure coherence between the different policy instruments. In this way, the Commission has established a body of guidelines for interpreting and implementing the provisions of the Agri-environment Regulation. These conditions are in the nature of frameworks for the application of criteria: detailed conditions are decided on the basis of each programme.

4. Agri-environment programmes in support of European Union environmental policies

In as much as the Agri-environment Regulation is an integral part of the CAP, the programmes also are compatible with and contribute to the achievement of European Union environmental policy. Measures which are compulsory on farmers, for example in relation to pesticide use, are not open for support. However, in promoting the protection of wild birds[10] and preserving species habitats[11], the agri-environment programmes have a role to play, in particular where the success of the preservation measures depends on farm activities going beyond good agricultural practice. For example, for bird species which thrive in traditionally-farmed environments, whether arable or pasture, agri-environment measures such as reducing the use of sprays, setting-aside or fencing off field boundaries and scheduling farm activities to avoid disturbing nesting sites, may be employed to contribute to the conservation effort.

5. Evaluation

Member States have implemented strategies for monitoring and evaluation designed to measure the changes on the environment and reductions in agricultural production. As with the management of programmes, the responsibility for evaluation rests with the national or regional authorities in accordance with the principle of subsidiarity. Nevertheless, the Commission does have a role to play in assisting in the adoption of appropriate techniques and in facilitating the sharing of expertise between countries[12]. The Commission has already received interim, and in some cases final, evaluation reports concerning the implementation of programmes, but so far mainly in respect of programmes which had been established before 1992. For most Member States where implementation only started after 1993 it is too early to assess the success of the measures.

Experience to date shows that scientific monitoring is a long-term activity which requires a considerable investment of effort. For each measure, indicators need to be developed and monitoring stations established at selected field sites. The data collection and analysis can be an expensive process. In addition to the environmental impact, some evaluation studies have been undertaken into the impact on market sectors and the socio-economic impact on farmers. These studies show that some agri-environment programmes have had positive, if marginal, effects on job creation and on lowering production. However, despite the conclusions of such studies, there is no overall picture yet available of the impact of the programmes across the EU.

An essential feature of any successful evaluation is the selection of appropriate parameters or indicators by which to assess the impact of measures. In addition to basic statistics on implementation, such as the number of hectares, the number of beneficiaries and levels of compensation and so on, indicators have been or are being established to measure the socio-economic and environmental impacts of the various programmes. Concerning environmental indicators in general, the Commission and several

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[10] Directive 79/409 of 2.4.1979, OJ L 103 2.5.1979, p.1.

[11] Directive 92/43 of 21.5.1992, OJ L 206 22.7.1992, p. 7.

[12] Commission legislation requires evaluation of all programmes cofinanced under the agri-environment regulation.

Member States are working on their development and contributing to similar efforts being undertaken in the OECD.

6. Conclusions

In many parts of the European Union the agri-environment programmes introduced under the Regulation marked the first comprehensive attempt to provide support for farmers in their role as guardians of the countryside. Therefore, the introduction of the Agri-environment Regulation, covering potentially all regions and all sectors of production, was a significant step in the direction of sustainable and environmentally-beneficial farming.

However, looking at the implementation of the programmes so far, it is clear that there is room for improvement, in particular levels of take up have been low in some Member States. Many farmers appear to prefer to stay with familiar intensive systems. Three main reasons have been identified for this position: firstly, the levels of assistance the premia — for costs and income foregone may be insufficient; secondly, farmers may be reluctant to bind themselves into contracts for 5 years; thirdly, a greater effort is needed to raise the awareness of farmers. In this context the training programmes and demonstration projects operated in some Member States should yield results in the medium term. For some farmers, therefore, the agri-environment approach appears to be too restrictive and runs against their professional desire to maximise the output from the land. In so far as this reluctance is cultural, it may change over time in response to changing attitudes to farming and the countryside in society at large.

The agri-environment programmes represent a long-term commitment; individual agreements with farmers last for 5 or 10 or 20 years depending on the measure and the programme. Furthermore, new applications are continually being approved. In those Member States which operated similar measures before the adoption of the Agri-environment Regulation, some farmers have reached the end of their initial agreements and are being offered new ones under the relevant agri-environment programme. Similarly Community support for the programmes will continue beyond the current budget period of 1997.

Thorough scientific monitoring of the environmental situation and progress of any agri-environment impact is a prerequisite of a successful evaluation. Not enough work has been done in this area so far. A beginning has been made with the adoption of an implementing Regulation[13], including the express obligation on Member States to monitor and evaluate their programmes.

The formulation and implementation of agri-environment programmes should remain primarily the responsibility of the national or regional authorities. They have the necessary knowledge, data, resources and commitment to establish programmes best suited to the local circumstances and which will command local support.

Recognition of the role of farmers as protectors of the environment and guardians of the countryside is now established policy of the Community. The perspective is of an active rural economy where farmers, in addition to their responsibilities as food producers, take on the role of 'rural entrepreneurs' providing services to the local community, including the provision of environmental goods. The successful implementation of policies such as the agri-environment programme constitute a substantial part of the EU's obligations under Agenda 21.

The unique environmental heritage of Europe, the result of centuries of sustainable farming, would be severely threatened by continued intensification or by abandonment. The same considerations

[13] Commission Regulation (EC) No 746/96, OJ L 102, 25.4.1996.

apply beyond the European Union and the Agri-environment Regulation has aroused considerable interest in the countries of central and eastern Europe — also part of the "old" continent.

Annex 1. List of agri-environment programmes approved for part-finance from community funds (EAGGF)

Member State	Programme	Member State	Programme
B	Federal	**Irl**	Rural Environment Protection Scheme
	Flemish region		
	Flemish Community - training	**I**	Programma nazionale
	Waloon region		Abruzzo
			Valle d'Aosta
Dk	Environmental farming and organic farming		Basilicata
	Amternes (counties)		Bolzano
			Calabria
D	National framework		Emilia Romagna
	Baden-Württemberg (I, II)		Friuli
	Bayern (I, II)		Lazio
	Berlin		Liguria
	Brandenburg (I, II)		Lombardia
	Bremen		Marche
	Hamburg		Molise
	Hessen		Piemonte
	Mecklenburg-Vorpommern		Puglia
	Niedersachsen (I, II)		Sardegna
	Nordrhein-Westfalen		Sicilia
	Rheinland-Pfalz		Toscana
	Saarland		Trento
	Sachsen		Umbria
	Sachsen-Anhalt		Veneto
	Schleswig-Holstein		
	Thüringen	**Lux**	Luxembourg
Gr	Organic agricultural production	**NL**	RBO 93 and RBON 95
	Reduction of nitrate use (Thessaly)		Part I: Netherlands
			Part II: demonstration and awakening projects
E	Castilla-La Mancha		Part III: extensification of bull farming
	Horizontal measures		
	Targeted measures	**Ös**	ÖPUL
	Basque Country programme:		Lower Austria
			Styria

(continued on next page)

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Member State	Programme	Member State	Programme
F	Maintenance of extensive pasture		
	Alsace	**P**	Continental Portugal programme
	Aquitaine		Acores programme
	Auvergne		Madeira programme
	Basse Normandie		
	Bourgogne	**Fin**	Finland
	Bretagne		Åland Islands
	Centre		
	Champagne-Ardennes	**S**	Transitional arrangements (1995 only)
	Corse		Agri-environment programme
	Franche-Compté		
	Guadeloupe	**UK**	UK - Moorland
	Haute-Normandie		UK - Organic Farming
	Ile-de-France		UK - Public access (I, II, III, IV)
	Languedoc-Roussillon		England - Countryside Stewardship
	Limousin		England - ESAs (I, II, III, IV)
	Lorraine		England - Habitats
	Midi-Pyrenées		England - Nitrate Sensitive Areas (I, II)
	Nord-Pas de Calais		N. Ireland - ESAs
	Pays de la Loire		N. Ireland - Habitats
	Poitou Charantes		Scotland - ESAs (I, II, III)
	Picardie		Scotland - Habitats
	Provence-Alpes-Côte d'Azur		Wales - ESAs (I, II)
	Rhône-Alpes		Wales - Habitats
	Réunion		Wales - Tir Cymen

Annex 2. Abridged list of agri-environment measures within programmes

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
BELGIUM		
	Federal programme	2(1)a)c), 6(2)
	Maintaining organic agriculture	
	Introducing organic agriculture	
	Reducing stocking density	
	Demonstration projects	
	Flemish region programme	2(1)a-d)
	Zonal environmental land management	
	Restrictions on grazing	
	Restrictions on cutting vegetation	
	Restrictions on arable land	
	Flemish Community programme	6(1),(2)
	Training and demonstration projects	
	Waloon region programme	2(1)a)b)d) 6(2)
	Late cutting of vegetation	
	Biodiversity on temporary pasture	
	Protection of border zones	
	Maintenance of hedges	
	Maintenance of extensive livestock	
	Increasing breeds in danger of extinction	
	Targeted measures in sensitive zones	
	Demonstration projects	
DENMARK		
Apr-95	**Environmental farming and organic farming**	2(1)a)b)d)f)
	Reduce use of nitrate fertilisers	
	Convert arable land to grassland	
	Maintain grassland	
	Undersow ryegrass in cereals	
	Convert to or maintain organic farming	
	Field margins free of spray	
	20-year set aside for environmental purposes	
Feb-96	**Amternes programme**	2(1)a)b)d) 6(1)
	Extensification of livestock	
	Flooding land	
	Ceasing production on field borders	
	Public access	
GERMANY		
	National Framework	
	Reduced input; extensification of pasture; arable conversion	
	Organic farming	
93-94	**Baden-Württemberg**	2(1)(a)-(f) 6(1)
	Landscape protection; Livestock extensification	
	Organic production; Organic farming	
	Bayern	2(1)abcdfg 6(1)
	Organic; extensification (cattle); lessen inputs	
	Extensive use of arable land	
	Extensive pasture	
	Specific farming methods	
	Long-term use of land for ecological purposes	
	Other environmentally-friendly farming	
	Berlin	2(1)(a)(c)
	Extensive & organic	
	Brandenburg	2(1)a-e) 6(1)
	Grassland maintenance (against flood)	
	Upkeep of abandoned land	
	Extensive farming (arable, grass, perm. crops)	
	Organic farming	
	Wetland (Spreewald)	
	Field margins	
	Integrated farming (fruit & vegetables)	
	Landcsape and conservation of lakelands	
	Local breeds in danger of extinction	
	Awareness and training	
	Bremen	2(1)a)b)c)d)
	Basic programme and further measures	
	Hamburg	2(1)abdef) 6(1)
	Extensive; organic; up-keep; other; training	

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
Germany continued:		
	Hessen	2(1)a-d)f) 6(1)
	Extensive farming and organic production Arable conversion; 20-year set-aside Local breeds in danger of extinction Upkeep of abandoned land	
	Mecklenburg-Vorpommern	2(1)a)b)c)
	Environmentally favourable use of grassland	
	Niedersachsen	2(1)abdf 6.1-2
	Ceasing inputs / phytosanitary products Organic production Extensive grassland Arable conversion 20-year set aside Breeds in danger of extinction Grassland; wet grassland Other measures (inc. voluntary scheme) Training and demonstration projects	
	Nordrhein-Westfalen	2(1)abde 6.1-2
	Farming for local environmental needs Flora in arable land Small orchards Wetland; water margin; other Training and demonstration projects	
	Rheinland-Pfalz	2(1)a)b)d)f)
	Integrated control farming Organic farming Extensive pasture Field borders 20-year environmental set aside	
	Saarland	2(1)a-e) 6(1)
	Field margins; measures against erosion Extensive grass; arable conversion Organic farming Breeds in danger of extinction Other environmental farming techniques Training	
	Sachsen	2(1)a)d) 6
	Organic farming Landscape Breeds in danger of extinction Training and demonstration	
	Sachsen-Anhalt	2(1)a)b)d)e) 6
	Farming for market/environmental needs Field margins Breeds in danger of extinction Other environmental farming techniques Training and demonstration	
	Schleswig-Holstein	2(1)a)b)c)d)
	Farming for market/environmental needs Biotopes Field margins Islands of Halligen	
	Thüringen	2(1)(a-f) 6(1)
	Environmental farming (arable & perm.) Extensive grass & arable conversion Landscape & nature conservation Animals in danger of extinction Training	
GREECE		
	Organic agricultural production	2(1)(a)
	Arable crops Annual crops Citrus fruit Olive groves Wine Other permanent crops	
	Reduction of nitrates pollution (Thessaly)	2(1)(a)
	cereals and cotton	

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
SPAIN		
	Agri-environment programme in Spain	2(1)a-g); 6(2)
1994	*Horizontal measures:*	
	Extensive cereals farming	
	Training	
	Preservation of local breeds of animals	
	Organic agriculture	
	Targeted measures:	
	Control of plant protection products	
	Conversion of arable land to pasture	
	Reducing livestock density	
	Conservation of flora and fauna (extensive)	
	Conservation of flora (wetlands)	
	Fire prevention	
	Measures to counter erosion	
	Perservation of biodiversity (Canaries)	
	Reducing the intensity of irrigation	
	Maintenance of abandoned land	
	20-year set aside	
	Public access	
	Demonstration projects	
	Basque Country programme:	
	Horizontal measures	
	Measures in specific zones	
FRANCE		
93-94	**Maintenance of extensive grassland**	
	Extensive grassland	2(1)(b)
	Regional programmes	
	General measures in regional programmes	2(1)a-d)f) 6
	Reducing inputs (nitrate and pesticides)	
	Conversion to organic farming	
	Conversion of arable land to grass	
	Livestock extensification by enlarging holding	
	Preservation of breeds in danger of extinction	
	Long-term set aside - protection of water and biotopes	
	Training, technical back-up, demonstration	
	Classification of all local measures (total number)	2(1)a-d)f) 6
	Preservation and protection of landscape (78)	
	Biodiversity of flora and faunae (98)	
	Protection of water and natural resources (14)	
	Measures against fire (11)	
	Public access (2)	
	Pilot projects (1)	
6-94	**Alsace**	
	All general measures (except input reduction, extensification)	
	5 local measures: landscape; biodiversity	
10-94	**Aquitaine**	
	All general measures	
	8 local measures: landscape; biodiversity; water	
10-94	**Auvergne**	
	All general measures (except input reduction, arable conversion)	
	5 local measures: landscape; biodiversity	
6-94	**Basse-Normandie**	
	All general measures	
	9 local measures: landscape; biodiversity; water	
6-94	**Bourgogne**	
	All general measures	
	6 local measures: biodiversity; water; access	
10-94	**Bretagne**	
	All general measures	
	6 local measures: biodiversity; water	
11-94	**Centre**	
	All general measures	
	6 local measures: biodiversity; water	
10-94	**Champagne-Ardennes**	
	All general measures	
	4 local measures: landscape; biodiversity	

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
France continued:		
12-94	**Corse**	
	General measures: organic only	
	2 local measures: against fire	
5-94	**Franche-Compté**	
	All general measures	
	7 local measures: landscape; biodiversity	
12-94	**Guadeloupe**	
	General measures: organic, arable conversion, set-aside	
	3 local measures: water; access	
6-94	**Haute-Normandie**	
	All general measures	
	4 local measures: biodiversity	
10-94	**Ile-de-France**	
	All general measures (except arable conversion, extensification)	
	3 local measures: landscape; biodiversity	
10-94	**Languedoc-Roussillon**	
	All general measures	
	24 local measures: landscape; biodiversity; water; against fire	
11-94	**Limousin**	
	All general measures (except arable conversion, set-aside)	
	7 local measures: landscape	
5-94	**Lorraine**	
	All general measures (except arable conversion, set-aside)	
	6 local measures: landscape; biodiversity	
8-94	**Midi-Pyrenées**	
	All general measures (except set-aside)	
	18 local measures: landscape; biodiversity; water	
6-94	**Nord-Pas de Calais**	
	All general measures	
	11 local measures: landscape; biodiversity	
8-94	**Pays de la Loire**	
	All general measures	
	14 local measures: biodiversity	
11-94	**Poitou Charantes**	
	All general measures	
	11 local measures: landscape; biodiversity	
5-94	**Picardie**	
	All general measures (except set-aside)	
	5 local measures: landscape; biodiversity; water; pilot projects	
12-94	**Provence-Alpes-Côte d'Azur**	
	All general measures (except input reduction, arable conversion)	
	15 local measures: landscape; biodiversity; water; against fire	
5-94	**Rhône-Alpes**	
	All general measures	
	24 local measures: landscape; biodiversity	
12-94	**Réunion**	
	General measures: input reduction, arable conversion, set-aside	
	1 local measure: water	
IRELAND		
4-94	**Rural Environment Protection Scheme**	2(1)a-d); 6(1)
	Environmental farm management; training	
	Supplementary measures	2(1)a)-g), 6
	Extensification in national heritage areas	
	Extensification in degraded areas	
	Increasing breeds in danger of extinction	
	Protection of riparian zones	
	Public access	
	Demonstration farms	
	Training actions	
ITALY		
Mar-95	**National programme**	6(1)
	Training	
94-95	***Regional programmes:***	2(1)a-g) 6
	Abruzzo	
	Reduced inputs; Organic farming	
	Extensive crop production	
	Upkeep of abandoned land; Long term set-aside; Training	

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
Italy continued:		
	Basilicata	
	Reduced inputs; Organic farming	
	Extensive crop production; Arable conversion to extensive pasture Reduction in livestock density; Long-term set-aside; Training	
	Bolzano	
	Extensive crop production; Arable conversion to extensive pasture Reduction in livestock density	
	Other farming practices; Rare breeds; Long-term set-aside; Training	
	Calabria	
	Organic farming	
	Other farming practices; Rare breeds; Upkeep of abandoned land	
	Emilia Romagna	
	Reduced inputs; Organic farming	
	Extensive crop production; Arable conversion to extensive pasture Reduction in livestock density; Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Public access	
	Friuli	
	Reduced inputs; Organic farming	
	Extensive crop production; Arable conversion to extensive pasture Reduction in livestock density; Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Public access; Training	
	Lazio	
	Reduced inputs; Organic farming	
	Extensive crop production; Reduction in livestock density Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Public access; Training	
	Liguria	
	Reduced inputs; Organic farming	
	Extensive crop production; Reduction in livestock density Other farming practices; Rare breeds; Upkeep of abandoned land; Training	
	Lombardia	
	Reduced inputs; Organic farming	
	Extensive crop production; Arable conversion to extensive pasture Reduction in livestock density; Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Training	
	Marche	
	Reduced inputs; Organic farming	
	Extensive crop production; Other farming practices Upkeep of abandoned land; Long term set-aside; Training	
	Molise	
	Reduced inputs; Organic farming; Upkeep/abandoned land; Set-aside	
	Piemonte	
	Reduced inputs; Organic farming	
	Extensive crop production; Reduction in livestock density Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Public access; Training	
	Puglia	
	Organic farming	
	Extensive crop production; Reduction in livestock density Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Training	
	Sardegna	
	Rare breeds; Upkeep of abandoned land	
	Sicilia	
	Reduced inputs; Organic farming	
	Extensive crop production; Reduction in livestock density Other farming practices	
	Upkeep of abandoned land; Long term set-aside; Training	
	Toscana	
	Reduced inputs; Organic farming	
	Extensive crop production; Reduction in livestock density Other farming practices; Rare breeds; Long term set-aside; Training	
	Trento	
	Reduced inputs; Organic farming; Extensive crop production Other farming practices; Rare breeds; Long term set-aside; Training	
	Umbria	
	Reduced inputs; Organic farming; Arable conversion to extensive pasture	
	Extensive crop production; Reduction in livestock density Other farming practices; Rare breeds; Long term set-aside; Training	

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
Italy continued:		
	Valle d'Aosta	
	Reduced inputs; Other farming practices; Rare breeds	
	Veneto	
	Reduced inputs; Organic farming; Reduction in livestock density	
	Extensive crop production; Arable conversion to extensive pasture	
	Other farming practices; Rare breeds	
	Upkeep of abandoned land; Long term set-aside; Public access; Training	
LUXEMBOURG		
1994	**Horizontal and localized measures**	2(1)a-d),(f)
	Organic agriculture	
	Reduction in livestock density	
	Extensification of vegetation	
	Other measures	
	Specific zonal programmes:	2(1)a-d)
	Landscape protection and anti-pollution	
NETHERLANDS		
Oct 93	**RBO 93 and RBON 95**	2(1)(a),(b),(d)
	Management agreements	
May 94	**Part I: Netherlands**	2(1)a)g) 6(1)
	Conversion to organic farming	
	Maintenance of organic farming	
	Public access	
	Training courses	
May 94	**Part II: demonstration and awakening projects**	6(2)
	Demonstration and awakening projects	
May 96	**Part III: extensification of bull farming**	2(1)(c)
	Extensification of male bovine animal farming	
AUSTRIA		
1995	**ÖPUL**	2(1)abdf) 6(1)
	Basic measures	
	Organic farming	
	Other extensive farming	
	Extensification of crops	
	Extensification of grassland	
	Preservation of landscape & genetic diversity	
	Manage & preserve landscape features	
	Training	
PORTUGAL		
Apr-94	**Continental Portugal programme**	2(1)a-e), 6
	Reducing the polluting effects of agriculture	
	Traditional extensive systems of agriculture	
	Maintaining natural resources and landscape	
	Training and demonstration projects	
Jun-94	**Açores programme**	2(1)(a)-(g)
Aug-94	**Madeira programme**	2(1)a-e), 6
FINLAND		
Oct-95	**Finland**	2(1)a)b)d)f), 6
	General agri-environment protection scheme	
	Farm environmental management planning	
	Fertilization and manure handling	
	Plant protection	
	Filter strips	
	Plant cover during winter	
	Landscape management	
	Supplementary protection scheme	
	Organic production	
	Long-term set-aside on riparian zones	
	Treatment of run-off water from arable land	
	Balanced use of manure	
	Landscape management and promotion of biodiversity	
	Extensification of agricultural production	
	Local breeds in danger of extinction	
	Advisory services and training	
	Advisory services and training	

MEMBER STATE	Programme Description of measure	Reg.2078 *Article*
Finland continued:		
	Demonstration projects	
	Demonstration projects	
Jan 96	**Åland Islands**	2(1)a)b)d)f), 6
	Agri-environment programme	
SWEDEN		
Aug-95	**Transitional arrangements (1995 only)**	
Sep 95	**Sweden**	
	Biodiversity conservation; cultural heritage	2(1)a)b)d), 6
	Mowed meadows	
	Semi-natural grazing lands	
	Habitats and cultural heritage environments	
	Open landscape	
	Training and pilot projects	
	Environmentally sensitive areas	2(1)a)b)d)f), 6
	Wetlands and ponds	
	Permanent grassland	
	Catch crops	
	Increasing breeds in danger of extinction	
	Brown beans (Oland)	
	Training and pilot projects	
	Organic production	2(1)(a), 6
	Conversion and continuation with organic production	
	Training and pilot projects	
UNITED KINGDOM		
93-94	*ESA - environmentally sensitive areas*	2(1)a-d)g)
	Classification of all ESA measures	
	basic environmental practices on all land	
	access for public	
	arable reversion	
	extensive arable	
	bird protection measures	
	coast: dunes, saltmarsh, etc.	
	livestock extensification	
	grassland: permanent, pasture, meadow, herb rich, etc.	
	hay meadows	
	rough grazing	
	grass margins, conservation headlands	
	heath, moorland, heather moor, etc.	
	boundaries: hedgerows, walls, banks	
	marsh	
	improved grass reversion to unimproved grass	
	bracken, rhododendron control	
	woodland	
	wetlands, ponds, water meadow, maintenance of water levels habitats, wildlife corridors	
	Programmes, areas (number of measures)	
	ESAs England Stage I	
	Broads (5); Pennine Dales (4); Somerset Levels and Moors (4); South Downs (4); West Penwith (1)	
	ESAs England Stage II	
	Breckland (6); Clun (8); North Peak (6); Test Valley (3); Suffolk River Valleys (7)	
	ESAs England Stage III	
	Avon Valley (3); Exmoor (11); Lake District (11); North Kent Marshes (3); South Wessex Downs (7); South West Peak (9)	
	ESAs England Stage IV	
	Blackdown Hills (8); Cotswold Hills (7); Dartmoor (11); Essex Coast (5); Shropshire Hills (8); U.Thames Tributaries (7)	
	ESAs Northern Ireland	
	Erne Lakeland and West Fermanagh (13); Mourne Mountain and Slieve Croob (8); Antrim Coast, Glens and Rathlin (9); Sperrins (7); Slieve Gullion (8)	
	ESAs Scotland Stage I	
	Breadalbane (12); Loch Lomond (12)	
	ESAs Scotland Stage II	
	Central Southern Uplands (10); Western Southern Uplands (10)	

MEMBER STATE	**Programme** Description of measure	Reg.2078 *Article*
United Kingdom continued:		
	ESAs Scotland Stage III	
	Argyll islands (14); Cairngorms Straths (15); Shetland Islands (11); Central Borders (11); Machair of the Uists, Benbecula, Barra and Vatersay (8); Stewartry (14)	
	ESAs Wales Stage I	
	Cambrian Mountains (original) (6); Ynys Mon (18); Radnor (18); Preseli (20); Clwydian Range (18)	
	ESAs Wales Stage II	
	Cambrian Mountains (extension) (21); Lleyn Peninsular (26)	
	Habitat Scheme	2(1)a-d)(f)
	Water margin, marsh, damp grassland (17)	
	Former arable land counted towards market set-aside (1)	
	Grassland habitats (21)	
	Woodland (2)	
	Nitrate sensitive areas I (22 sites) and **II (10 sites)**	2(1)a),b),d)
	Convert arable land to extensive grassland (2)	
	Former arable land counted towards market set-aside (2)	
	Extensification of intensive grassland (2)	
	Low-nitrogen arable cropping (2)	
	Organic farming	2(1)a),d)
	basic measure (4)	
	land outside LFA (2)	
	land within LFA (2)	
	arable and improved pasture (2)	
	unimproved pasture and rough grazing (2)	
	Moorland scheme	2(1)(c)
	Extensification (4)	
	Countryside stewardship and **Tir cymen**	2(1)a)-d)(g)
	Basic obligations (1)	
	Grassland, meadow (inc. arable margins & wildlife) (15)	
	Water meadow (1)	
	Coastal dunes, marsh, cliff, moor, heath (13)	
	Heath and moorland (5)	
	Woodlands and restoration of old orchards (2)	
	Public access (5)	
	Countryside access (England, Wales) and set-aside access (Scotland) programme	2(1)(g)
	Access on set-aside land (3)	
	Access to ESAs (England Stages I, II, III; Scotland Stages I, II)	
	Access to farmland (2)	

Annex 3. Types of landscapes and trends in Europe

Landscape type	Landform	Vegetation	Character	Trends
Tundras				
1. arctic tundra	lowlands covered by ice and snow	permafrost keeps vegetation scattered and low: moss/lichen	desolate treeless wilderness	wetland preservation
2. forest tundra	hills and lowlands; bogs and fens	dwarf shrubs (birch, alder) cover the valleys: heath everywhere	wild empty scattered forests	fires and overgrazing
Taigas				
3. boreal swamp	peatland, mires, bogs and fens	mixed thin forests without production only preservation	inaccessible uncultivated wetlands	drainage, extraction of peat
4. northern taiga	hills and plains, lowlands and lakes	coniferous forest (pine, spruce) relics of grazed woodlands	homogenous forests	clear felling, spruce becoming dominant
5. middle taiga	plains with sandy soils; moraines and mires	mixed coniferous forests and some pastures or fodder crops	some spaces within forests	
6. southern taiga	hills and plains of sand, silt and loamy soils	mixed coniferous forests: pastures are in the minority	semi-open forests	
7. subtaiga	out-wash plains and plateaus of loam/loess	mixed broadleaf and coniferous forest and arable land	silvi- and agricultural domination	drainage and deforestation
Uplands				
8. northern highlands	hills and mountains; lakes, bogs and fens	heath, grassland, rocks and relics of overgrazed woods	desolate, rough and very open	afforestation
9. mountains	high mountains, glaciers, steep slopes and valleys	moss, heath, grass and forest on slopes; intensive crops in valleys	wild, rough, enclosed versus cultivated, open	abandonment, afforestation and tourism
Bocages				
10. atlantic bocage	gentle slopes and plateaus of loam on rocks	pastures and arable land surrounded by hedges, walls or trees	enclosed, heterogeneous and cultivated	plot enlargement and removing of hedges
11. semi-bocage	hills and middle mountains, wet conditions	extensive grassland and crops; mixed forests and hedges	hybrid open-enclosed	abandonment and afforestation
12. mediterranean semi-bocage	hills and middle mountains, dry conditions	extensive grass, arable and permanent crops, walls/forests	relatively open	extensification
Openfields				
13. atlantic openfields	loamy and clayey soils on undulating plains	intensive arable land, trees only in valleys	large-scale openness: monoculture	intensification and set-aside
14. continental openfields	loess and loam on flat and hilly land	mixed grass, arable and permanent crops; forests on hilltops	diverse in scale	diversification

(continued)

Landscape type	Landform	Vegetation	Character	Trends
Openfields				
15. aquitaine openfields	outwash plains and slopes of lime, loam and loess	arable land on plateaus; forests on slopes; horticulture in valleys	open and intensively cultivated	
16. former openfields	undulating plains with loamy and clayey soils	land suited for arable crops, used for cereal, root crops, grass	intensively cultivated; large-scale openness	removing of trees on plots
17. central collective openfields	undulating plains with loess and loamy soils	arable land without any other vegetation; pastures on lowlands	large-scale, open and homogenous	water and wind erosion
18. eastern collective openfields	flat undulating plains covered with 'black earth'	treeless arable land and grass on moist lowlands	extremely open, large and dry	
19. mediterranean open land	hills, plateaus, valleys, water-limited conditions	forests and scrub v. cultivation: extensive crops and transhumance	contrasting patterns between hills and valleys	intensification, extensification and abandonment
Steppe and arid landscape				
20. puszta	salt-affected soils on the Hungarian plain	grassland and arable land	treeless open space; extensive breeding	salinization, water and wind erosion
21. steppe	plains with brown earth, valleys and saltmarshes	grassland and arable land, extensively cultivated	treeless, dry, endless, windy, extremely open	overgrazing, salinization
22. semi-desert	lowland plains and saltmarshes	grass, ephemeral and halophytic plants	salt, dry, open and extensively cultivated	changing levels of groundwater and sea water.
23. sandy desert	mobile dunes, dry rivers and shifting sands	absence of vegetation, only some ephemeral plants, sedges	uncultivated	pastoral husbandry protection
Regional landscapes				
24. Kampen	undulating plains with brooks and sandy soils	mixed crops, grassland; forests, heath,swamps and trees	enclosed fields, mosiac, small-scale patchwork	increase of scale and intensification
25. Poland's strip fields	small elongated field system	mixed crops, horticulture, orchards and forests	labour intensive, small scale diverse	
26. Coltura promiscua	fertile valleys; loamy soils, remnants of traditional use	three layers of permanent crops, cereals, horticulture, fodder crop	heterogeneous and small scale diverse	homogenization by intensification and extensification
27. dehesa/montado	poor dry stony soils on erosive gentle slopes	open evergreen forest (oak, olive), grazed and cultivated	agro-silvo-pastoral parkland	degradation; growth of shrubs

(continued)

Landscape type	Landform	Vegetation	Character	Trends
Artificial landscapes				
28. polder	estuaries on North Sea coast below sea level (clay, peat)	intensive arable and grassland; trees along roads, canals, dykes	flat, open, artificial, and uniform	intensification, set aside
29. delta (artificial form)	estuaries in coastal lowlands; deltas of large rivers	intensive arable, fodder and permanent crops on irrigated fields	intensive, open, flat, fertile and uniform	salinization and intensification
30. huerta	irrigated, fertile valleys on mediterranean coast	intensive horticulture and permanent crops (eg. fruits)	irrigation, terraces, orchards	expansion

Source: Dobris Assessment, Europe's Environment, p. 175.

EUROPEAN UNION: THE EUROPEAN UNION'S AGRI-ENVIRONMENT REGULATION (EEC) 2078/92 —EXAMPLES OF ENVIRONMENTAL BENEFITS

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Introduction

This paper is complementary to the one presented by the European Commission on the agri-environmental measures in Europe as established under Regulation (EEC) which describes what the policy is and how it is operated. The aim here is to give some examples of what Regulation 2078/92 means on the ground, particularly the potential it has for achieving environmental benefits and why an agricultural policy of this kind is needed to sustain what used to be termed "nature conservation" and what today is more fashionably called "biodiversity".

But before focusing on some detailed examples there is a much more general question which perhaps should be addressed, namely, do we really need agriculture policy measures to achieve environmental benefits? There is increasingly a view that, from a scientific perspective attempting to be objective in its assessment, the answer is an unequivocal yes, particularly where the current development of agriculture threatens the survival of farming systems of high biodiversity and landscape value.

This may be a situation which is particularly true of Europe because of this continent's long history of farming and also because of it's high human population density. The antiquity of agricultural practices across much of the continent of Europe has important ecological implications. The concepts of ecological stability as well as the predictability of dynamics or perturbations are important in explaining the distribution of plants, animals and biotopes, the productivity of species and populations and the ecological adaptations to environmental conditions (e.g. Garcia 1992, Austad *et al. 19*91, Crawford 1990). In land management terms this concept of ecological stability is usually associated with continuity of management, and there are some very good examples of current European farming practices which have their roots in ancient farming systems and long established management practices.

1. The origins of European open habitats

There is a widespread assumption that forests are the natural vegetation cover in western and central Europe and that open spaces, mostly grasslands of various types, were always very rare; being maintained by large herbivores, beavers and natural catastrophes such as fires, landslides, snow slips etc. (Ellenberg 1986). This stems from the conventional palaeo-ecological view that in post-glacial Europe forest spread northward in the wake of the retreating tundra until it clothed the landscape from the Mediterranean North to the limits of climatic tolerance.

However such a large proportion of Europe's wildlife is morphologically or behaviourally adapted to open habitats that this reconstruction is plainly flawed. To persist and evolve, the plants and animals of open habitats (grasslands, plains, wood pastures etc.) would demand more than the rare open spaces envisaged by Ellenberg. Accordingly, other authors (Geiser, 1983, Van Dijk, 1996, Tubbs, 1996) all suggest that the open component of the European landscape was far more important than supposed so far, as has been the role of large herbivores, some of which are now extinct.

Neither bustards nor vultures, both now viewed as "flagship species" in Europe, could persist in a forest environment and moreover they require very extensive open landscapes. The same can be said for most of Europe's rich steppeland, upland and mountain plants and animals. Even many woodland species (e.g. lichens) are very light demanding. Many insects have complicated and bizarre life cycles which could only have evolved in open conditions — the symbiotic relationships between the blue butterflies and some ants are examples. The importance of open ground is further underlined by the high number of species relying on these habitats. For example, in the former West Germany, Korneck and Sukopp (1988) have listed 588 species of higher plants and ferns in dry grasslands (steppes) and 297 in wet grasslands (marshlands); Holzner *et al.* (1986) list 1 041 species of insects in Austrian dry grasslands, of which 85 per cent are now Red List species (see van Dijk 1996).

Logic points to the development of a more diverse, ecologically more chaotic landscape than the neat progression from tundra to forest. Perhaps more realistic is a mix of woodland, heathland, grassland and wetland, occurring regionally in extensive tracts as well as in more intimate mosaics. Within these habitats grazing and browsing by wild herbivores would have created and maintained the open component of the landscape. This explains the need for continued grazing pressure to maintain habitats of European importance today.

2. The development of extensive farming

The precise nature of the open habitats in the early millennia of the post glacial will remain largely conjectural. In any event, from Neolithic times they were modified into a rich variety of farming ecosystems, as was most of the forest. Ultimately, these included the croplands, meadows, wood pastures, coppices and other habitats which derive most obviously from continual human intervention. The moorlands, mountain pastures, steppelands, saltmarshes and other "wilderness" lands derived much of their present character from extensive pastoralism. Commonly this involved annual transhumance between lowlands (winter) and upland (summer) pastures. The appropriate management of these semi-natural habitats is one of the primary aims of the conservation orientated measures being undertaken within the framework of Regulation 2078/92.

3. Transhumance — an example of an ancient European agricultural system

Transhumant agricultural systems, both in the South and the North of Europe, provide good supporting evidence to this historical perspective (Bignal, 1991, Ruiz & Ruiz, 1986, Bil, 1989). Transhumance evolved in widely separated geographical areas of Europe as a method of exploiting seasonally available pastures in mountains and lowlands, often involving the movement of great numbers of livestock, mostly sheep and cattle.

In Spain this agricultural practice originates from the 6th century (Klein, 1920), was well developed by the 8th century and by the year 1273 Alfonso X had established a national livestock association (Honrado Concejo de la Mesta) defending the rights of livestock raisers undertaking

transhumance across Spain until it's abolition in 1836. This organisation had equivalents across the Mediterranean countries, for example the Dogana in the Apulia — Apennine region of Italy (Grigg, 1974). Transhumance continued in Spain after 1836 (to the present day) but without the special structures provided by the Mesta to defend its privileges.

In Scotland the earliest surviving written documents referring to transhumance date from the 12th century (Barrow, 1981) and this pastoral-based agrarian economy persisted through to the 17th and 18th centuries gradually being replaced by more sedentary livestock rearing and cultivation and permanently inhabited farmland.

The point that these two examples make is that a sizeable proportion of the agricultural land in Europe, which is today regarded as being of high biodiversity, has its origin in a pastoral agricultural practice dating back for over 700 years. In many areas these practices only began to decline less than a century ago and in some places they still survive little-modified to the present day. So, at the landscape scale, transhumance developed and maintained over several centuries, has shaped the character of vast areas of the Mediterranean landscape, namely:

- The mountain pastures, often well above the natural tree-line, maintained by the regular summer grazing.

- The fallow lands adjacent to the drove roads (known as Las Canadas in Spain) where the manure from the migrating livestock contributed to the fertilization of periodically cultivated ground.

- The drove road itself; essentially a meandering elongated pasture-land, floristically quite distinct from surrounding areas.

- The winter grazings, in particular the steppes and the dehesa (Spain) and the montado (Portugal) - the open savannah like woodlands of cork oak and evergreen oak.

4. European farmland, biodiversity and agriculture policy

There has been great diversity in the ways in which farmers in Europe have responded to physical circumstances and climate over a long period of time. However the cultural landscapes which we now value and increasingly attempt to protect evolved as low-input, low-output, usually labour intensive, but sustainable, systems of farming often high in biodiversity. Many plants and animals of the more ancient open landscapes and habitats, proved capable of adapting to these semi-natural conditions. Indeed, in modifying the landscapes from which they derived, these farming systems may have increased plant and animal diversity at a local level. They have also existed for longer than the primaeval forest which most interpretations of pollen analysis would have us believe spread across Europe in the wake of the retreating ice in the early millennia of the Holocene. Because of the great regional diversity which they display across the continent, European low-intensity farming systems have a unique contribution to make to world biodiversity. In addition, even Europe's more intensively managed farmland, now of limited natural value, has its origins in the same ancient agricultural systems and retains fragments of the former agricultural landscape.

Since the middle of the 20th century, the high biodiversity agricultural landscapes which had remained little changed for centuries, have diminished before the assault of agricultural intensification involving high inputs of chemicals and fertilizers, increased mechanisation and the spread of low biodiversity farm monocultures which have swept aside ecological variation. It is the fragmented relicts of

the former systems (heathlands, chalk and dry grasslands, meadows) which are now so hard to manage as nature reserves or special sites; for example in all the lowlands around the North sea where intensification has largely detached modern farming from the slow evolution of the past.

However, low-intensity farming systems do remain widespread in Europe as a whole. A recent survey of nine European countries revealed that there remains more than 30 million hectares of extensive pastoralism alone (Beaufoy *et al., 19*94). Traditional small-scale mixed farming, low-intensity production of olives, fruit, cork and other products and non-irrigated systems of arable farming in dry lands - generally involving extensive fallows, and low or nil inputs of fertilizers and agro-chemicals, also remain widespread. Within the European Union these systems are mainly in the Mediterranean biogeographical region and in the mountain, upland and coastal areas of the Atlantic biogeographical region. The British Isles and large parts of France are exceptional in western Europe in having some of Europe's most widespread and botanically most important grasslands.

Small sites can be protected effectively as nature reserves if the resources are available. However, at the regional and landscape scale the best prospect of maintaining the mixture of vegetation features and management operations in areas of high biodiversity is mostly through appropriate agricultural management. It is the farming operations in these areas that create the variety of spatial and temporal conditions needed by wildlife. However most traditional practices, although ecologically sustainable, are not economically viable in a purely production orientated system — where the pressures of intensification and increased mechanisation are ever present. In the areas where high biodiversity low-intensity farming systems survive intensification often is not the main threat. Over large areas the principal pressures on agricultural management are marginalisation, abandonment and redeployment of farmland as a consequence of the ever reducing economic viability of traditional farming practices.

Achieving biodiversity aims on farmland therefore requires: i) measures to ensure the continued viability of farming systems which give rise to appropriate forms of land management; and ii) a means of persuading farmers to maintain or adopt specific practices which meet the requirements of particular habitats or species. Thus there are clear linkages between environmental, agronomic and socio-economic problems. In the past these have been addressed in a relatively crude way by both national and European measures such as the Less Favoured Areas (LFA) Directive which provides compensatory payments to ensure the continuation of farming in these areas. However, it is only recently that the environmental importance of particular farming systems has been directly addressed by Regulation 2078/92 and similar measures. These are agricultural or agri-environmental policy measures.

Several policy measures, both national and European, have historically addressed these economic, social and production problems (e.g. LFA Directive and the various livestock support regimes) but it is only recently and currently that the environmental importance of these systems has been directly addressed (e.g. by Regulation 2078/92). Purely from a nature conservation or biodiversity conservation perspective it would be unrealistic to influence the management of tens of thousands of hectares of land through, for instance acquisition and nature reserve management. Realistically the only feasible option, at least in the short term, are measures which seek to encourage the appropriate agricultural management practices. To effectively achieve this, measures are needed which firstly maintain the *status quo* in farmland of high biodiversity and secondly maximise the contribution that farming can make. To do this an understanding of the ecological relationships on farmland is needed.

5. Understanding and managing the ecological relationships of farmland

One of the challenges facing the development and refinement of a European agri-environmental policy is the wide range of variation and conditions that it must address across the continent. As well as strong North-south and east-west differences in plant and animal distributions, altitudinal, topographical and geological factors also affect both distributions and abundance. At the farm and field scale small changes in management practices such as cropping patterns, mowing dates and grazing regimes can cause significant changes to the ecological conditions required by certain plants or animals. Some examples are given below.

The marsh fritillary butterfly (Eurodryas aurinia)

The marsh fritillary butterfly is a species which is facing extinction right across Europe and one which has its strongest populations in the UK. The butterfly is on the wing for only a short period during May or June when the temperature is high enough and wind speed low. Adults lay their eggs on the underside of the leaves of the larval foodplant, devil's bit scabious *Succissa pratense,* where three weeks later they hatch to form colonies of caterpillars. Soon after emergence the caterpillars spin a dense web over the foodplant, beneath which they live and feed, moving to another plant when the first is consumed. During August a more substantive web is constructed, inside which they hibernate, emerging the next Spring to bask on sunny days and recommence feeding. They eventually disperse from the colony having spent about ten months in the larval stage. The caterpillar pupates close to it's foodplant and hatches about a fortnight later.

In Britain the marsh fritillary butterfly is a species of the heathland and acid grassland pastures of western Wales and western Scotland. A recent survey in Scotland (O'Keefe pers. comm.) found that the height of the vegetation where caterpillars were found in mid-summer (from larval sites marked in the Spring) ranged from 11-35 cms but that 80 per cent of sites were within a narrow range of 11-14 cms. These heights were significantly different from a random sample of vegetation heights in the areas examined suggesting that the caterpillars had preferentially selected this height sward. The vegetation within which eggs and caterpillars were found occurred as a mosaic of wet heathland and grassland which was maintained by extensive grazing by cattle. All UK colonies show similar attributes with the optimum conditions being a summer sward height of 11-14 cms, abundant *Succissa pratense,* in an area where the vegetation structure gives the butterfly and the foodplant shelter without dense shading.

These conditions are provided on pastures where the vegetation of grass and heath is maintained by the routine seasonal grazing pressure of cattle and sheep managed in an extensive system. Sheep grazing alone, supplemented by periodic burning (a common management regime today requiring less labour) did not provide suitable conditions, instead leading to heather monocultures and short sheep-grazed grassland.

In areas with optimum grazing pressure for this species the low density of grazing animals, primarily cattle, ensures that the risk of livestock trampling the colonies of caterpillars is low yet at the same time the grazing pressure is high enough to remove the coarse vegetation growth, favour the foodplant and produce the optimum height of vegetation. This example illustrates the importance of a specific grazing regime for a species of European conservation importance. As economic and technological conditions change, it will become difficult to persuade farmers to pursue this management option without offering incentive payments.

The red-billed chough Pyrrhocorax pyrrhocorax

The chough is a rare bird listed on Annex I of the EC Wildbirds Directive. It has a fragmented distribution in Europe. Over half of the estimated minimum European population of 16 000 pairs is concentrated in Spain, Greece and Italy; most populations are small and many are declining (Tucker and Heath 1994). Choughs feed principally on soil-living, surface active and dung-associated invertebrates which they obtain from extensive pastures (i.e. managed at low intensity) grazed by sheep, cattle, horses and goats. Optimum feeding conditions can occur in a wide range of arid to temperate vegetation with bare ground and short or open vegetation cover. However studies in the Scottish Hebrides (Bignal *et al. 19*96) have shown that there are i) different foraging strategies between breeders and sub-adults and non-breeders, ii) seasonal shifts in diet through the year, and iii) critical periods during which conditions limit population recruitment to below the level at which it can meet mortality.

The Scottish study found that the seasonal abundance and availability of the main items in the chough's diet are influenced predominantly by agricultural management operations: cereals are obtained from stubble fields, cattle feeding stations or cattle dung from October to April; fly larvae are taken from pastures between January and April and in large numbers in July; insects are obtained from cattle and sheep dung during spring and in late summer and autumn; and during high summer, a wide variety of surface invertebrates are consumed from the pastures.

During the periods of incubation and rearing nestling the adults selected grass pastures preferentially to other biotopes for foraging and fed predominantly on cranefly larvae (*Tipula* spp.). The abundance of *Tipula* larvae in the soil was found to be related to the agricultural management of the fields. The fields used preferentially by the birds in 1992 were those in which i) management during June to September 1991 produced medium to high grass swards, either through a low stocking density of cattle or the growth of silage or hay crops for late mowing, and ii) intensive grazing by sheep and cattle between January and May 1992 reduced the vegetation markedly. The former producing optimum conditions for adult craneflies to oviposit (in tall grass) and the latter optimum feeding conditions (short vegetation, bare ground) for foraging choughs.

Although weather conditions in autumn and spring can affect *Tipula* populations, and are largely beyond control, in many years the manipulation of pasture management could have a beneficial effect on nestling survival and subsequent population recruitment by creating optimum conditions at a critical time. The rather complex ecological conditions required by this rare European bird can most effectively be provided using very straightforward and routine farmland management activities timed to produce the desired conditions. As traditional forms of management become less cost effective incentive payments are becoming more important as a means of ensuring the continuation of previously routine farming practice.

The Corncrake Crex crex

The corncrake is a globally threatened bird which is a summer visitor to northern Eurasia and winters in south-eastern Africa. It frequents tall vegetation throughout the year and in the breeding season is strongly associated with grasslands managed for hay and silage. The requirements of the corncrake are vegetation cover which develops through the spring and summer to conceal and protect the birds their nests and their young, together with a diversity of invertebrates on which adults and young can feed. These conditions were traditionally provided through a combination of the vegetation of damp grasslands and the edges of marshes in spring and fields cultivated for hay and cereals in summer. The small-scale of cultivation and the gradual harvesting of grass and cereals provided a patchwork of safe refuges and feeding areas through the summer months for adults and young (most females attempt to rear two broods).

The tall summer vegetation cover was in many parts of Europe associated with local transhumance which removed the grazing pressure of domestic livestock around cultivation and meadows and concentrating it on the summer hill pastures.

As mechanisation and field size increased, fertilizers changed the botanical composition of grasslands and advanced the mowing dates and livestock rearing became more intensive the ecological conditions required by corncrakes have been eroded. Corncrake numbers have been declining and its distribution contracting since the 19th century (e.g. Broyer 1994) and this decline can largely be attributed to the intensification of grassland management.

6. Examples of policy support for ecological management

Regulation 2078/92 has a rather wide range of objectives and there is a great variety of measures being introduced across the Member States. Here I want to focus on three examples of how the Regulation aims at achieving ecological benefits, at difference scales, through influencing farming management practices.

A landscape scale measure — Maintaining grazing in Extremadura, Southwest Spain

Over the last 20 years there have been considerable changes to the agriculture of this Region resulting from the effects of rural depopulation and the marginalisation of traditional agricultural systems. The resultant development of scrub and woodland has created a major problem with the accumulation of dry vegetation leading to high fire risk and potential for resultant erosion. Wildfires are a major environmental problem in southern Europe, where hundreds of thousands of hectares of scrub, heath, grassland and farmland are burnt each year. Slopes that are left unvegetated after fire are highly vulnerable to erosion during the winter rains. These problems are particularly apparent in areas where livestock grazing has been abandoned through the marginal economics of farming or through conversion to commercial forest through State forestry schemes.

The two measures outlined below are both very new and form part of the zonal programme for Monfrague natural park in Extremadura. Their aim is to maintain extensive livestock grazing with the principal objective of fire prevention and countryside (landscape character) conservation; but the measures could potentially have wider ecological benefits by sustaining the mosaic of open grasslands and Mediterranean woodland and scrub. This mixture of vegetation is the habitat of a wide range of species of reptiles, amphibians, plants and mammals. These include some of Europe's most threatened species including the Imperial eagle (*Aquila heliaca*), the Black vulture (*Coragyps atratus*) and the Iberian Lynx (*Felis perdina*) the world's most endangered feline (IUCN). Confined to the Iberian peninsula (the total population is estimated at no more than 800) the remaining populations occur in upland areas where extensive livestock raising is present (but dispersed) and where the landscape is composed of approximately 40 per cent open grasslands (the hunting areas) and 60 per cent woodland and scrub (for seclusion and security), see Oberhuber 1995. For the Lynx these landscape measures could complement other more specific local conservation measures which would become more effective in the context of the broader landscape management.

Conservation of the countryside and fire prevention with extensive grazing systems

Within this measure conditions include maintaining an average stocking density of between 0.2 - 0.4 Livestock Units/hectare (LU/ha) and ensuring continual grazing between 15 April and 15 July

with at least 0.3 LU/ha. Scrub clearance is permitted where scrub exceeds 15 per cent of the holding. Annual payments for grazing are 9 000 pta/ha (£45/ha) + 20 per cent for native breeds and 30 000 pta/ha (£150) for scrub clearance.

Maintenance of abandoned land

Holdings are eligible if they are close to forested land and have been abandoned in the previous five years. Where land is to be managed by grazing this should be at between 0.15 and 0.3 LU/ha. Scrub clearance is also permitted. Different conditions apply to the management of permanent crops where grazing is not foreseen. Annual payments are for grazing 7 000 pta/ha (£35/ha) and for scrub clearance 30 000 pta/ha (150/ha).

A major challenge in the conservation of large mobile mammals and birds which require extensive foraging areas, such as the Lynx, Black vulture and Spanish Imperial eagle, is preventing the fragmentation of habitats and populations; for example in the Sierra Morena in Andalucia, SW Spain (Ales 1996). In most cases abandonment or redeployment (often to forestry) of marginal agriculture land has taken place in association with intensification of agriculture in neighbouring better areas; resulting in loss of habitat diversity on a scale that these species require. This is a widespread pattern taking place across Europe. For many of these species the most effective land management strategy, certainly in the short term, will be through maintaining a low-intensity, extensively farmed landscape (and preventing either inappropriate intensification or large-scale abandonment) with woodland and scrub providing seclusion and isolation and open ground foraging and feeding areas. Potentially the kinds of measures outlined above could make an important contribution but to achieve greatest benefit they need to be applied widely (the example above is restricted to the Monfrague natural park and Extremadura Special Protection Areas) and to have larger resources.

A habitat measure — Maintenance of grasslands in Causse Mejan, France

The Causse Mejan is a plateau of calcareous grassland in Lozere supporting steppeland birds including the Little bustard (*Terax terax*), numerous species of invertebrates, including the increasingly rare Apollo butterfly (*Parnassius apollo*) and the Southern damselfly (*Coenagrion mercuriale*) which is listed in the Species and Habitats Directive. In this area, in the face of economic difficulties, many farmers have increased production concentrating particularly on producing sheep's milk for Roquefort cheese. At the same time farm amalgamation and the concentration of production onto the best farmland has lead to the abandonment of around 1 000 hectares of farmland. Intensification reduces the biological diversity of the grasslands and abandonment results in the replacement of the grasslands through the development of coarse herbaceous vegetation, scrub and forest.

Two measures to support the traditional agricultural practices of the area have been established under Regulation 2078/92. A zonal programme provides payments of FF 1 100 per hectare and the *prime a l'herbe* a payment of FF 300 per hectare. Without these financial incentives the land use of the area would almost certainly develop rapidly away from agriculture and towards forestry, hunting and tourism. Surviving farming activities would be managed at a much greater intensity of management over a much smaller area than is needed to maintain the wildlife interest currently associated with this extensive calcareous grassland plateau.

A species measure — The corncrake in the Scottish Hebrides

Several of the Environmentally Sensitive Areas (ESA) schemes established as part of the UK's zonal programme (Regulation 2078/92) for the Scottish Islands include specific measures aimed at improving the breeding performance of the corncrake (it is supplemented by a corncrake initiative offering similar payments in corncrake areas outside of the ESA). A description of the ecological requirements has been outlined above. Corncrakes still occur on 19 of the Scottish Islands from Islay in the South to Orkney in the North. The strongholds are Lewis, North and South Uist and Tiree, all areas where farming is based on livestock rearing, involving the growing of hay (and silage) and cereals for winter fodder. The total numbers of pairs is around 500. The corncrake is a globally threatened bird.

The aim of the corncrake payment is to encourage farmers to continue their traditional management but to adjust the timing of their operation to avoid destroying the nests and young of the corncrakes as well as providing vegetation cover for the birds at critical times. Farmers are paid £180/ha for entering fields into the scheme. In return they agree to:

- Specify areas of tall ungrazed vegetation adjacent to hay meadows. If no such vegetation exists grants towards the costs of fencing grazing exclusions are available in addition to the basic per hectare payment.

- Remove all grazing animals from meadows by 1st. June at the latest.

- Complete all mechanised operations by the 1st May (harrowing and rolling) and complete manure spreading by the 15 May and chemical fertilizer applications by 1 June.

- Cut the crop after 1st August and to do so using a "corncrake friendly" technique, that is, cutting the crop from the centre of the field to the edges rather than in the conventional manner from the edge of the field towards the centre (the latter concentrating and trapping birds in the final section of the crop).

Although it is too early to judge the success of the scheme the population, which had declined for decades at a rate of 3-4 per cent per year increased by 4 per cent between 1993 and 1994 and by 16 per cent between 1994 and 1995.

7. Possible future development

From the examples above it is clear that for many of Europe's most valued habitats and the plants and animals associated with these, the only realistic short term strategy for addressing their needs is through modifications to the agriculture policy that influences the day to day management decisions of farmers. Regulation 2078/92 is a relatively new and developing policy instrument which undoubtedly has the potential for making a significant contribution to maintaining and enhancing European biodiversity but to achieve this potential will need greater resources and wider application. For instance the measures outlined above in Extremadura are geographically localised and more areas need to be included to be really effective.

It has often been argued that the CAP has had mainly negative effects on the environment, with the guarantee of high prices above the world market level and export subsidies seen as a stimulus for intensification. But at the same time the CAP and related structural measures have played an important

role in maintaining extensive farming systems throughout the European Union — the systems within which many of the most highly valued ecological processes operate.

In a current study for DG XI (Goss *et al., in prep*) the authors suggest that future generations of 2078/92-type schemes could be even more effective if they operate within an agricultural policy context which is directing agricultural practice in a similar (rather than opposing) direction. A similar theme was the focus of a number of papers presented at a seminar in Brussels in January 1996 (Mitchell 1996 ed.) where it was pointed out that the environmental contributions of their farming activities need to be recognised and appreciated. Many that are valued most from an environmental viewpoint have limited agronomic justification in modern production agriculture and their environmental products have to be paid for.

Perhaps we should also ask what the prognosis for nature conservation and biodiversity on farmland is if agriculture policy were to evolve without an integral environmental element such as the measures provided by Regulation 2078/92. Beaufoy *et al.* (1994) identify intensification or abandonment as the most likely scenarios for the areas which are currently of highest nature conservation value. Whilst it is difficult to make sweeping generalisations, since many of the ecological processes and relationships on farmland are complex and often poorly understood, there is a strong scientific justification for at least maintaining the *status quo* on farmland of high natural value where the infrastructure, human population used to traditional farming still remain to make this possible.

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AUSTRIA: ORGANIC FARMING

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Introduction

As in other countries the policies of environment and agriculture in Austria have to function in close co-operation. Agriculture and Forestry cover 80 per cent of Austria's territory and therefore suffer first from any deterioration in our environment (air pollution, climate change, erosion). Some cultivation-methods increase the pressure on the environment, so ways have to be found to solve the situation.

It is necessary, in a balanced approach across OECD Member countries, to try to find concepts on how to achieve a sound existence of the agricultural sector without harming the environment. Environment in this context is not restricted to air, water and soil only, but includes landscape (as an aesthetic value, rural amenities), biodiversity and human inhabitants of a region. All these aspects come under the notion of sustainability. Austria believes that organic farming represents the consistent way to reach sustainability. For measures targeted at a sustainable agriculture, it may thus be regarded as a model to follow.

1. Development

Organic farming has been strongly gaining momentum in the last years. In contrast to 15-20 years ago, it is now an accepted alternative to conventional farming, meeting strong interest among consumers and ecologists. The first organic farms in Austria had already been founded as early as between 1927 and 1935, belonging to the "rigorous" biologic-dynamic school, founded by the Austrian philosopher Rudolf Steiner. Much later (1962) the first farms belonging to the organic-biologic school had been founded in Upper Austria. Today there exist at least 8 different organisations of organic-farming of which the organic-biologic direction is by far the most important. The main production areas of organic-farming are the mountainous regions with permanent grassland and pre-alpine hills. Manpower on organic-farms is 10-50 per cent higher than on conventional farms. As to the age structure of organic farmers, 60 per cent are 35 to 55 years old and more than 25 per cent 18 to 35 years — thus they are somewhat younger than farmers in general.

The most important motivations to start organic farming are (data of a poll): a change in the general attitude towards life, changes in nutritional consciousness, sickness, problems with soil fertility, sickness or fertility problems with farm animals, problems encountered with chemical plant protection inputs or fertilizer. Public subsidies as such have allegedly not been found to be an important motivation to introduce organic farming. Forty-four per cent of all organic farmers are also active in landscape protection activities. For still rather extensive grassland farms with a solid manure system, the

introduction of organic farming does not cause very big problems in Austria. With organic arable farms, the crop rotation is more diversified than with conventional farms; without animal husbandry compost-systems are elaborated. The number of organic farms rose from 1 500 holdings in 1990 up to more than 18 500 in 1995.

2. Legal and economic impacts to organic farming

Organic farms in Austria have long-time been treated like all other farms; that means that they could apply for all types of promotion available for farming in general. But only recently — beginning in 1989 — special funds were made available for organic farms, starting with modest Sch 2.4 million in 1989. In 1995 the budget was cofinanced by the European Union in the framework of the Regulation 2078/92 and exceeded Sch 700 million.

Farms applying for promotion to become "organic" may receive premiums per farm and per hectare, to bridge the gap between the conventional and the new system (reduced yields). Premiums are different for grassland, arable land, horticulture, vineyards or orchards. Farms that wish to receive this support have to comply with the resp. national regulations included in the *Austrian Codex Alimentarius* (Chapter A 8B) and since 1994 with EU-Regulation 2092/91 and its amendments. The control is strict as before, carried out by private control-institutions under the supervision of public controllers.

The price for not using conventional inputs is a reduction of crop yields, but higher manpower involvement. Concerning yields, a recent comparison (1995) in Austria shows the differences between organic and conventionally-grown products:

Crop	Organic kg/ha	Conventional kg/ha
Wheat	3 590	5 780
Rye	2 600	4 000
Barley	2 850	4 940
Oats	2 720	3 610
Peas	2 440	2 860
Sunflower	2 180	2 780
Potatoes	10 360	19 050

In the sphere of research, the Federal Research Institute of Agrobiology in Linz now has a department for organic farming. In Vienna there exists a Ludwig Boltzmann-Institute for Organic Farming. The Agricultural University (Universität für Bodenkultur) in Vienna has established a chair for organic farming. (In the past, public acceptance of organic farming in Austria had been strongly promoted by students of that University).

3. The future of organic farming

The intensification of agriculture, especially in the past four decades, has brought along considerable impairment of the neighbouring ecosystems. Soil, water, air, plants, animals and man are affected by it, through expanding erosion, eutrophication of the waters, contribution to the anthropogenic

greenhouse effect, decline of species as regards plants and animals and the contamination of foodstuff by different harmful substances.

Like in other economic sectors, the demand for sustainable strategies is becoming more evident in agriculture as well. Ecologically compatible alternatives to the "plundering strategies" of the post-war period are being demanded. At first unrecognised and lacking essential contributions by agronomy and agricultural policy, organic farming, a comprehensive strategy of sustainable farming, was developed out of the agricultural practice itself in recent decades. Today, it represents an efficient form of farming. Although its potentials concerning sustainability are not yet fully exhausted, it has to be recognised that this kind of farming is the least violent towards nature. The Inquiry Commission for the Protection of the Earth's Atmosphere of the German Bundestag, for example, requested an accelerated transition to organic farming already years ago in order to lower the contribution of agriculture to the anthropogenic greenhouse effect. A possible reduction of 50 per cent of the emissions caused by agriculture are assumed.

Organic farming has clear advantages in all problematic fields mentioned before (soil, water, air, biodiversity, problems with residues). This fact is due to the consideration of the fundamental principle of "utilisation of natural mechanisms of self-regulation", "aiming at closed cycles where possible on the farm" and the "considerate use of non-renewable raw material and energy resources". Organic farming is committed to these fundamental principles. Meanwhile they have been made state-regularised farming-directives and they represent a binding framework for organic farming. Thus, this framework is clearly defined and can be scrutinised, sanctions may be imposed against offenders.

4. Why is the public interested in having more organic farmers?

Various scientific examinations prove the relative ecological excellence of organic farming concerning the aforesaid fields in detail:

Soil

Systematic varied crop rotation with shares of leguminous crops and green manure which are adapted to the site, combined with the predominant use of organic manure produced on the farm, prevent a unilateral leaching of the soils, support the equability of the humus balance and reduce the pest-potential inherent in the soil. Green fallow on arable land during winter time prevents erosion. Indirect soil cultivation through soil organisms and plantroots reduces the necessity for mechanical cultivation measures. Apart from the costs, the impairment of the soil structure and of the soil organisms (which would be the case if heavy implements were used) is reduced.

Water

The impairment of ground and surface waters caused by organic farming is relatively low. Due to a large renunciation of chemical plant protection products in organic farming, there is almost no contamination of the waters. The nutrient level which is low in organic farming compared to the level in conventional farming, strictly limits any contamination of neighbouring ecosystems. As regards the contamination of the ground-water through pesticides and nitrate, organic farming represents a suitable strategy in resolving this problem. Some waterworks realised this years ago and promote an ecological management of their water collection area.

Air/Atmosphere

Like for the water, it is true for the air as well that due to the renunciation of the use of chemical and synthetic plant protection products, organic farming cannot be responsible for an impairment of the air caused by these chemicals. Analogously to the situation concerning water, it can be said that organic farming furthermore can contribute to the contamination of the atmosphere only to a very small extent also because of the low total nutrient level. Livestock raising related to the own agricultural area, limitation of nutrient import achieved by the renunciation of easily soluble mineral fertilizers and the reglementation of the nutrient import by way of animal feedstuffs can be mentioned. Moreover new comparative calculations of the energy consumption of different agricultural systems show savings of more than 50 per cent in the total energy consumption for organic farming. This underlines the relief provided to the atmosphere by this kind of farming.

Biodiversity

The diversity of the crop rotation, the renunciation of external resources, the maintenance of living space close to nature which is necessary because of plant protection reasons or the creation of new living spaces by planting hedges and hedgerow timber contribute to the fact that within organically operating holdings manifold niches for species which are threatened from extinction are maintained or even newly created. This is to be seen from different comparative examinations on the richness in species within different cultivation systems.

Contamination of foodstuff

As already explained under the items water, soil and air, even a cultivation system which a priori abandons the use of chemical and synthetic plant protection products is no guarantee for uncontaminated foodstuff. The possibility of a contamination caused by ubiquitously present harmful substances can no longer be excluded in any region. But organic farming clearly proves the relative excellence of this alternative compared to conventional farming.

5. Focal points and measures of agricultural policy

The reform of Austria's instruments of agricultural policy, which was begun in 1987 and is being systematically continued, aims at safeguarding a sustainable, comprehensive and farmer-oriented agriculture and forestry. The concept of an eco-social agricultural policy has acquired a model function and was discussed within the context of several international meetings with the participation of OECD representatives, such as the 1992 European Forum at Alpbach, which was entitled "New Partnership in Market Economy or Ecological Self-Destruction", or a meeting in Salzburg (June 1993), where numerous national and international experts spoke about "Diversity of Performance in Agriculture and Forestry - Evaluation and Remuneration". At the 1992 OECD conference of the Ministers of Agriculture in Paris, the then Austrian Federal Minister, Dr. Fischler, supported the promotion of an ecological and sustainable agriculture.

The agricultural policy pursued by Austria since 1987 is characterised by the following concrete measures:

- **Passing of the 1992 Agricultural Law aiming at the following objectives (non-exhaustive list):** preservation of a comprehensive, farmer-oriented agriculture and forestry; safeguarding of the

natural resources soil, water and air; offsetting of natural disadvantages in comparison to other economic sectors; market orientation of agricultural production; promoting production alternatives in the animal and vegetable sectors; extending crop rotation and improving the soil structure.

- **Reform of agricultural support:** stricter standards with respect to ecology and animal husbandry for investment programmes; increased support for organic-farming; promotion of energy production from biomass; premiums for ecological landscape programmes; emphasis on production-neutral direct payments in keeping with GATT **Regulation**s; Emphasis on ecology in agricultural research, training and counselling.

- **Water Law:** establishment of quality standards for ground- and surface water; compulsory application for approval of fertilizer utilisation under the Water Law (210 kg resp. 175 kg of pure nitrogen per hectare and year).

- **Forestry:** improvement of the functions of the forest with respect to its utility and protective, welfare and recreational value; increased efforts directed against the destruction of the forest (Waldsterben) and measures to ensure its multifunctionality; promotion of a natural forestry, safeguarding of genetic diversity; encouragement of rehabilitation of protective forests.

- **Soil protection concept:** analysis and systematisation of soil pollution levels and quantification of its effects on the condition of the soil; evaluation of the regional hazards; development of soil protection programmes.

- **Plant Protection Law of 1990:** heightened emphasis on integrated plant protection measures; re-evaluation of licensed plant protectives; stricter criteria for the licensing of plant protectives; limited licensing.

- **Chemicals Law:** code to prohibit certain ingredients of plant protectives; ban of plant protective ingredients hazardous to health and the environment.

- **Clean Air Law:** law to regulate the burning of biogenous matter outside suitable installations.

Organic farming seems now to be at a crossroad. For the future, the ideologies are mixed: some experts propose that organic farming — or at least its general principles — should and will become the type of farming in the future; this would mean, that more and more conventional farms are absorbed by the organic way of production and “organic” farming as a special type of agriculture eventually disappears. The other and more common perspective holds that organic farming will and should remain a special type of agriculture distinguishing itself clearly and legally from other types of farming, this being the condition to receive higher product prices. There seems to be no doubt that the economic interest of most organic farmers corresponds the latter viewpoint.

FINLAND: ENVIRONMENTAL BENEFITS FROM AGRICULTURE

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Introduction

Finland is one of the northernmost countries in the world where agriculture is practised. This means that the growing season is short, although the days are long in summer. The relationship between nature and agriculture has always been very delicate. Farmers have traditionally been seen as guardians of the environment, too. Also non-farmers have valued the rural landscape; a public good and an example of a positive externality of agriculture.

However, agriculture has also had some negative impacts on the environment as the competition on world markets has laid more pressure on the cost efficiency of agricultural production. In tackling this new situation the environmental costs have (as in other countries, too) mostly been neglected. This has led to environmental degradation. Remedies for the growing environmental problems have been proposed by different committees in administration during the 1980s and 1990s. Research has also produced more information about the interaction of agriculture and the environment. Advisory organisations have for their part worked towards enhancing the environmental awareness of farmers. As a result, negative environmental impacts have been reduced and positive ones increased. Finnish food is one of the purest in the world.

Finnish agriculture is facing changes as it adapts to the EU's common agricultural policy (CAP). There are difficulties in this process, but there are also possibilities. The EU's Scheme for Agri-environmental Measures is regarded as a very important way to further promote the environmental protection, both to prevent environmental degradation and to produce environmental benefits.

This paper highlights the agri-environmental key issues in Finland. First, the impacts of agriculture to the environment are briefly outlined in the following chapter. Some conceptual issues regarding agriculture as a producer of public goods are discussed in Section 2. The Finnish Agri-Environmental Programme and its importance is described in Section 3. Section 4 describes the participation to that Programme and discusses the farm-level economic impacts of it. Section 5 summarises the findings presented in this paper.

1. Environmental impacts of Finnish agriculture

Agriculture has both positive and negative impacts on the environment. Agricultural landscape and biodiversity for all to see and enjoy can be seen as a positive externality of agricultural production, and the environmental degradation by nutrient runoffs can be regarded as a negative one.

Negative impacts

It is often difficult to measure the extent of these external effects. Agricultural pollution is non-point source pollution, i.e. it cannot be traced back to only one particular source, and the quantity cannot be easily measured. Also, measuring the value of these positive or negative external effects is a difficult task as there are no markets for them due to poorly defined property rights.

Various recent Finnish studies, e.g. Rekolainen *et al.* (1992), indicate that agriculture is the most important single sector causing environmental degradation. Presently, agriculture accounts for over one-third of the total nitrogen load and over half of the phosphorous load to watercourses in Finland. One reason for that is that point source pollution of industries or settlements is much more easily controlled than the non-point source pollution of agriculture.

Most of the agricultural production is concentrated in Southern and Western Finland. Thus, the impact of agriculture on surface waters in those areas is greater than in the northern regions. It has been estimated that 20 per cent of lakes and about 55 per cent of rivers in Finland are eutrophic. However, the quality of the groundwater is quite good in Finland. The nitrate levels on groundwater supplies remain in most cases below 25 mg/l. Also, ammonia and nitrous oxide emissions stem for the most part from agricultural production, although more than half of the NH_4 depositions originate from abroad. Agricultural methane emissions account for about one-third of total emissions.

Positive impacts

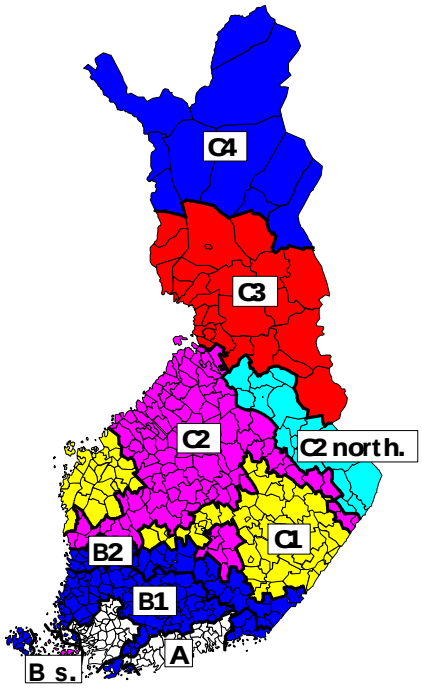
The Finns greatly value their rural landscape. Only 9 per cent of the land area is cultivated. Particularly in areas A and B open fields are characteristic of the rural landscape. The greatest threat to the rural landscapes is caused by discontinuing of agricultural production and depopulation of rural areas. Agriculture is the backbone of the Finnish countryside. Finnish rural landscape consists of many small features, and it is diversified in its details. Fields are often located like a mosaic on lake shores or in the middle of forests. The size of open field areas varies from a few hectares to tens of hectares. The large open fields in the river valleys in areas A and B, which can be 500 to 1 000 hectares, form an exception to this.

In the whole country animal husbandry has created the most versatile types of landscape among the rural cultural landscapes. Natural pastures and woodlands used for grazing, as well as natural meadows cleared in forests and on shores for the harvesting of winter fodder with their barns and fences have been dominating elements of the cultural landscapes of rural areas. In the beginning of this century cultivation by clearing and burning-over woodland was still the form of cultivation that dominated the landscape in eastern parts of the country. In the past few decades specialisation in cereal cultivation and decrease in animal husbandry especially in area A (see Map 1) has reduced the versatility of the rural landscape. As Finland is dominated by closed forest landscape, both small and large fields and pastures an all parts of the country are important for preserving an open landscape.

Species that favour the cultural environment of rural areas constitute a considerable share of the species in Finland. The managed traditional biotopes created by grazing and cutting have the greatest variety of species. Over one-third of vascular plant species (400 to 500 species) have benefited from grazing and cutting. Apart from plants, managed natural meadows and pastures are important for butterflies and other insects (Anon., 1994). But it is also estimated that changes in agriculture have caused altogether 300 plant and animal species to become endangered. The majority of endangered species in cultivated areas occur in the traditional biotopes, and others have become endangered as a result of

changes in cultivation methods. To continue agriculture in a sustainable way is considered in Finland to be also the best way to maintain rural landscape, but the agricultural methods must be compatible with the environment.

Map 1. Support regions



2. Theoretical and conceptual issues

Agricultural support for environmental reasons represents a fresh line of thought in agricultural policy making. The environment is no longer seen as a resource stock with no limits. It is recognised that agriculture can be practised in a sustainable way only if applied farming techniques take into account the needs of the environment. In a sense, the question is about the reappearance of ideas of classical economics that laid appropriate emphasis on land (read: environment) as one of the three factors of production (two others being labour and capital). Unfortunately, the change has not taken place because of rising environmental consciousness among farmers, but rather because of public criticism that has been directed towards prevailing farming practices and their adverse impacts on environmental quality.

In the long run an ever-increasing share of the total economic value of agriculture will be derived from public goods produced by ecologically more beneficial farming. It is clear that agricultural production practices maintain agricultural countryside environment (ACE). It is an array of many public good type goods, amenities, and services. The two main sources of utility related to ACE originate from the existence of agricultural landscape and biodiversity. As a public good, ACE can be enjoyed by anybody, and it would be extremely difficult to exclude somebody from enjoying it. However, ACE is not a pure public good, as it is not perfectly non-exclusive or non-rival. Its quality can be affected by externalities caused by human actions.

Figure 1. Public goods, externalities, and the entity of ACE

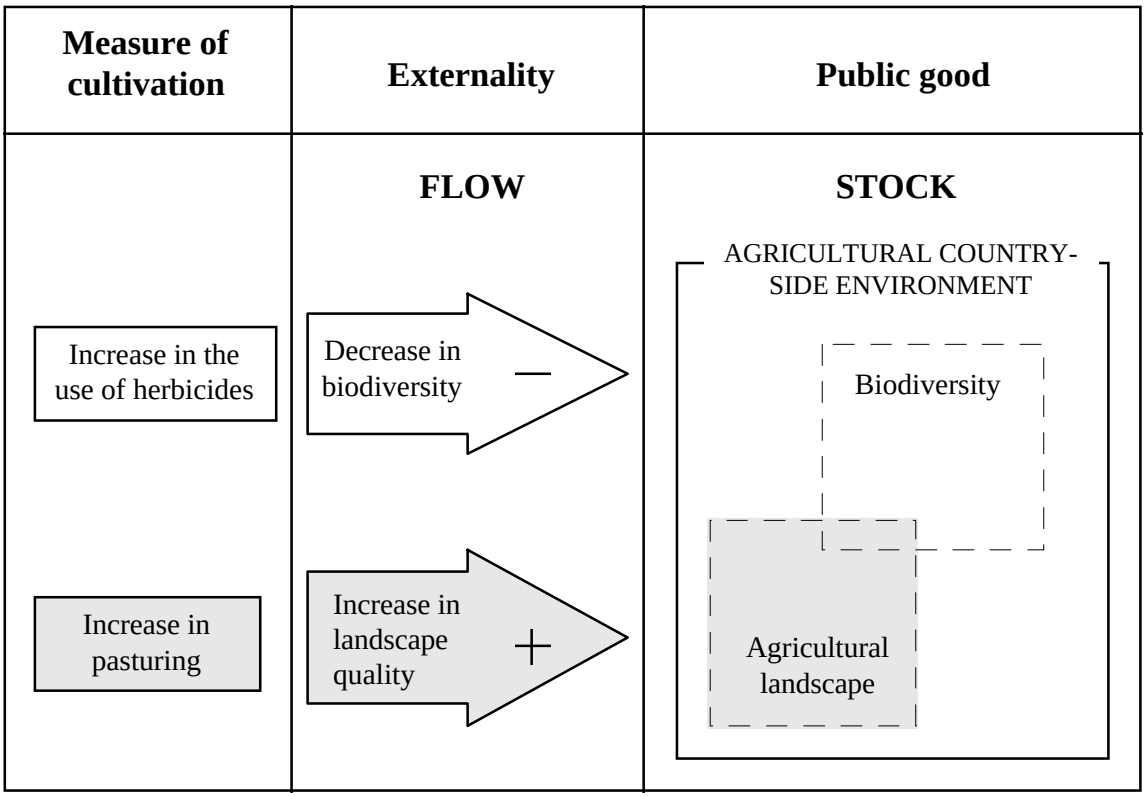


Figure 1 presents a simple framework that relates externalities and public goods to each other when ACE is concerned. According to Hanley (1991), a public good can be seen as a stock of benefits. An externality is a flow, positive or negative, that either increases or reduces the value of the stock of benefits. It is quite clear that agricultural production practices affect both the amount of biodiversity and the quality of agricultural landscape. For instance, an increase in the use of herbicides reduces the number of weeds and, as a consequence, biodiversity decreases, i.e. the flow of benefits decreases and the value of the stock or ACE goes down. Correspondingly, an increase in pasturing is considered to improve the scenic quality of the agricultural landscape because grazing cows create a sight that pleases the eye. Thus the flow of benefits increases, and the value of the stock or ACE goes up.

The problem here is that it is hard to detect how beneficial certain measures of cultivation really are: on the one hand, the promotion of visual and scenic quality of landscape may be in conflict with the preservation of biodiversity; on the other hand, cultivation measures creating public benefits are not necessarily profitable from a farmer's viewpoint. There is no method to find out in a completely reliable way when public benefits due to an action exceed the private losses that it may also have caused.

With the framework presented above in mind, it is quite easy to comprehend the reasoning behind the environmental support for agriculture. If ACE is considered to be a public good with positive welfare effects, its maintenance increases overall social welfare. For various reasons, there is no market for ACE, and the market prices of foodstuffs cannot convey enough information to secure an optimal level of ACE. There is an obvious need for public intervention to guarantee that farmers will choose production methods which will not endanger the quality of ACE any further. Because of the current set of prices of

agricultural outputs and inputs, farmers do not have an economic incentive to change their cultivation practices. Environmental support is designed to give them this incentive. If there is no risk of farm income loss, most Finnish farmers are assumed to be willing to develop their farms to take better into account ecological requirements of the environment. Through environmental support the commitment to environmental-friendly agricultural practices among farmers can be voluntarily promoted, which will in the long run lead to a major change in attitudes.

3. Description of the FAEP

Background

The Finnish Agri-Environmental Programme (FAEP) was prepared according to the Regulation 2078/92 of the European Council. According to the Accession Treaty with the EU, the share of the European Union in the financing of environmental support amounts to ECU 135 million annually. Thus the total amount of environmental support with the partial financing of 50 per cent is ECU 270 million, which corresponds to about Mk 1 570 million (US$334 million[14]) a year during the financing period of 1995-1999. The Regulation sets guidelines for the implementation of the Agri-Environmental Measures through national Programmes. Accordingly, Finland prepared the FAEP, adjusted to special conditions of the country. The preparation of the programme was done in co-operation with the Ministry of Agriculture and Forestry and the Ministry of Environment. The five-year programme was finally approved by the Commission in October, 1995.

Objectives of the FAEP

The objective of the programme, in short, is to ensure that agriculture is practised in a sustainable way. At a general level the objectives are defined as follows: i) to reduce pressures on the environment, especially on surface waters, groundwater and air, and to reduce hazards caused by the use of pesticides; ii) to preserve biodiversity and manage agricultural landscape; iii) to protect wildlife habitats and endangered species of flora and fauna; iv) to produce agricultural commodities in an extensive and environmentally friendly manner.

The environmental support programme is mainly concerned with the cultivation of field crops, as well as preservation of the landscape related to agriculture. There are connections to forestry only for the part of traditional biotopes, forest pastures, and concerning the staging zones of arable land and forest and advising on these issues. The FAEP aims at compensating the farmers for the costs or income losses accrued to them in fulfilling the criteria set for joining the programme. The FAEP can be seen as a means to fulfil the agri-environmental programmes and recommendations set up in the pre-EU era.

Structure of the Programme

The FAEP consists of four separate elements: i) the General Agricultural Environment Protection Scheme (GAEPS); ii) the Supplementary Protection Scheme (SPS); iii) the Advisory Services and Training Scheme; iv) The Demonstration Projects Scheme. The most significant of these, the GAEPS, is applicable in the whole country, and joining it is voluntary for farmers. A farmer who possesses a farm that fulfils the general requirements for CAP support can obtain environmental support. This basic support system has been formulated so that almost all farmers have the possibility to apply for

[14] US$1 = Mk 4.7 and Mk 1 = ECU 5.7

it and receive compensation for carrying out environmental measures. Altogether Mk 1 331 million (US$283 million) was paid through the GAEPS in 1995.

Special forms of support, i.e. the SPS, concern a smaller group of farmers and in more limited areas. In 1995 the budget share of the SPS was about 6 per cent of the total FAEP. In 1996 the share will rise to 9 per cent. The last two elements concern the preparation and advising of Farm Environmental Management Programmes (FEMPs), which are required for farms entering the GAEPS system. Also, education and training are important issues in this programme.

Premiums paid for participating the GAEPS differ between support areas and cultivated plants. Support levels vary between Mk 250 and Mk 1 730 (US$53 to US$368), and they are the highest in area A and decrease towards the north. The premium compensates the income losses and the costs of for instance soil and manure analyses, bookkeeping of all the actions taken in the agricultural production parcel by parcel (time consuming), having pesticides equipment tested regularly, participation of spraying training and test, yield losses because of the requirements of lower nutrient levels, yield losses because of uncultivated field margins and buffer zones, preserving landscape, maintenance of uncultivated areas, restricted number of livestock in areas A and B, changes in plant rotation because of the required plant coverage of 30 per cent and the construction of manure storage capacity. The expenditures of the programme in 1996 are presented in Annex 1.

Environmental effects of the Programme

It is expected that the Programme will lead to more extensive agriculture. This will result in some decrease in the environmental load, and, thus, in improvement in the quality of water and the air, as well as increase in biodiversity and beneficial impacts on agricultural landscape quality. The expected environmentally positive effects are: i) the use of fertilizers, in particular, as well as the use of pesticides will decrease; ii) the use of the nutrients in manure will become more efficient; iii) organic cultivation is expected to increase; iv) the use of tillage methods that are important for water protection will increase; v) buffer strips will be established on the sides of waterways and main ditches to reduce erosion and phosphoric load to waters; vi) the impoverishment of agricultural landscape will be prevented by means of preservation of culturally and aesthetically valuable landscape areas; vii) the loss of genetic material and biodiversity in agricultural and agriculture-related ecosystems will be stopped.

It is estimated that in the long run of 5-10 years these agri-environmental support measures will decrease both erosion and phosphoric and nitrogenous load by about 20-40 per cent. In addition, the improved management of animal manure will decrease ammonia emissions from agriculture. As yet, little data exist on the environmental effects of the programme.

The General Agricultural Environment Protection Scheme (GAEPS)

In order to be eligible for the GAEPS support, the farmer has to realise simultaneously certain measures on his/her farm. These are: i) the Farm Environmental Management Programme (FEMP) must be prepared; ii) certain base level fertilizing must not be exceeded; iii) manure must be appropriately stored and may not be spread on frozen soil or snow; iv) stocking density must be below 1.5 LU/ha; v) buffer strips (width 1-3 m) must be left on the sides of main ditches or water courses; vi) at least 30 per cent of arable land must be covered by plants during the winter in areas A and B; vii) landscape and biodiversity must be appropriately maintained on the farm; and

viii) spraying machinery must be tested by an authorised agency and pesticides may be applied only by a person who has completed training on pesticide use.

All these measures have detailed requirements, which will not be repeated here. The core of the GAEPS scheme is the FEMP. It is not only a document of the present environmental situation of the farm, but it also specifies the environmental measures needed on the farm joining the programme, and it documents the farmer's interest on supplementary measures under the SPS. The FEMP is a way to enhance farmer's awareness of the management and protection of the environment on his holding. The remaining of the criteria are more practical measures a farmer has to take in order to be eligible for the GAEPS premium. Under these criteria fertilizing levels will be lower than in the past. Considerable emphasis is laid on reducing the nutrient runoffs from the fields. Landscape management issues aim at keeping arable land cultivated and open, and to preserving biodiversity.

The Supplementary Protection Scheme (SPS)

When applying for SPS the farmer must also participate in the GAEPS. SPS measures are: i) organic production; ii) riparian zones; iii) treatment of runoff waters from arable land; iv) balanced use of nutrients in manure; v) landscape management and enhancing biodiversity; vi) extensification of agricultural production; vii) local breeds in danger of extinction.

Certain elements are available in all parts of the country, such as organic production and local breeds, but most of the other measures are conducted on the local level, and aim to produce positive impacts on the environment. Riparian zones, treatment of runoff waters, and extensification of production are restricted to focal areas of water protection and groundwater formation areas defined by environmental authorities. The landscape management and development measures are limited mainly to valuable landscape areas consisting of cultivated land as well as to landscape areas of importance e.g. in terms of the nature, history or, local special features.

The most important of these in monetary terms is the support to organic farming and to conversion to it. In 1995 Mk 36 million (US$7 million) was spent on this measure. Prior to the programme, about 30 000 hectares of fields were cultivated organically. It is estimated that at the end of 1999 over 70 000 hectares are under organic production, and that 45 000 hectares are being converted to it.

Scheme for advisory services and training and scheme for demonstration projects

The Finnish Agri-Environmental Programme lays a lot emphasis on advising and educating farmers to better environmental management. Advisory services and consults can get funding to arrange courses under this scheme. In general, training, education and demonstration projects promote the better understanding of the FAEP, and also give practical guidelines on how to meet the GAEPS criteria.

4. Implementation and effects of the FAEP

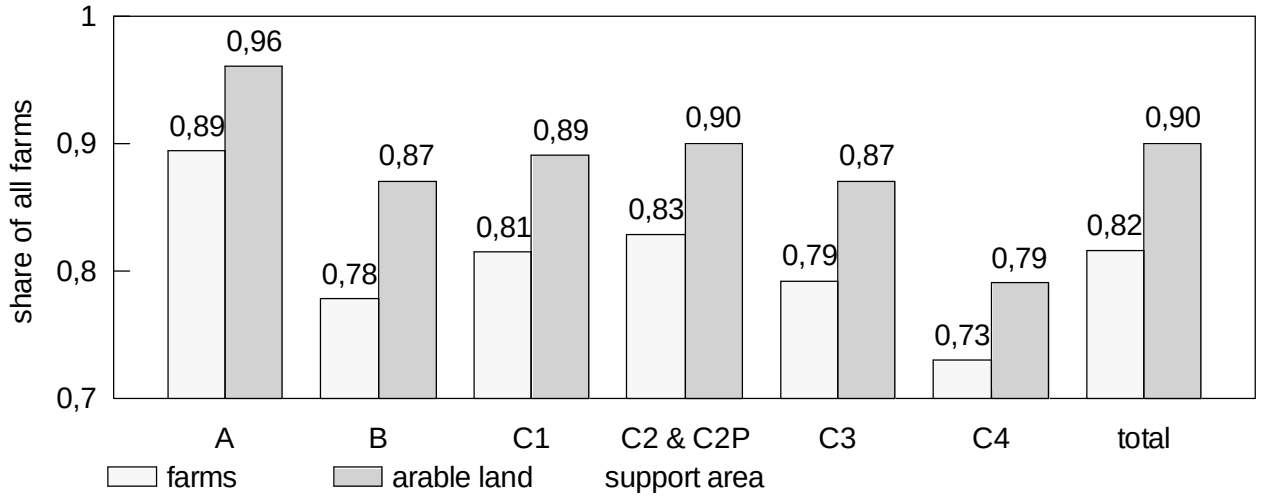
Participation in the General Agricultural Protection Scheme in 1995

In order to collect information on participating and non-participating farms in the GAEPS, the Agricultural Economics Research Institute carried out a farm survey in February 1996. The GAEPS attracted even more farmers to participate than expected. Some 80 000 farms in total joined the programme, and

only about a fifth of all farmers did not to participate in the programme. The average rate of participation was the highest (89 per cent of all the farms) in support area A. In areas B-C4 the rate of participation varied between 73 per cent (C4) and 83 per cent (C2 areas). Because most of the farms are located in areas A to C2 and the environmental burden caused by agriculture is the most serious in those areas, the high coverage of those areas is very significant.

Cultivated area under the GAEPS is at least as good an indicator of the impacts of the scheme as the relative amount of participating farmers. The GAEPS covers even more of the cultivated area than of the total number of farms (Figure 2). The GAEPS has almost a full coverage (96 per cent) in area A, and coverage of the cultivated land in the whole country is as high as 90 per cent. The coverage of the scheme in areas C2, C3 and C4 combined is 89 per cent. The original target of some 87 per cent coverage (Anon., 1994) of the total arable land area was slightly exceeded.

Figure 2. Share of farms and arable land under the GAEPS in 1995



Differences in the incentive to participate in the GAEPS between support areas and types of production seems to have caused only a small number of farmers to stay out of the GAEPS. Participation in crop and livestock farming is around 80 per cent of all farms, and the GAEPS covers around 90 per cent of the cultivated land on these farms. Pig and poultry farms make a slight exception in this sense, and coverage of the GAEPS is some 85 per cent of arable land.

Non-participants of the GAEPS

The information presented here is collected by the Agricultural Economics Research Institute and based on the same survey referred in the previous section. The most common reasons for the non-participation are reported in Figure 3.

As could be expected, among animal husbandry farms the criteria of minimum area for manure spreading and the investment need for manure storing facilities were the most important reasons for not joining the GAEPS. Some third of the non-participating pig and poultry farms face the biggest difficulty in fulfilling the criteria for a minimum area for manure spreading, whereas a third of farms with grazing

cattle (dairy farms mainly) consider the investment need for manure storing facilities to be the most difficult criteria to fulfil. The situation on farms with mixed animal husbandry and crop production appears to be similar to that on farms specialising in grazing cattle production. For the non-participating crop farms, the fertilizing criteria, the investment need, the buffer zone criteria, and the lack of information available were the most significant reasons for not joining the GAEPS.

Impact of the GAEPS on farming methods

In the survey farmers were also asked to describe the significance of the GAEPS criteria on farming practices. The level of impact was asked to be described in a scale from 1 (very significant) to 5 (not significant at all). The mean of the responses on the impact of the GAEPS varied between 3.5 and 5, and the GAEPS did not affect actual farming practices in a very radical manner. As expected, the impact of the GAEPS criteria differs between the types of production. The most significant changes in crop farming are considered to result from the fertilizing criteria and setting up the buffer zones. Preparation of the farm environmental management plan has also affected farming methods quite significantly. Setting up buffer zones has had a rather significant impact on animal husbandry farms.

The criteria for manure facilities has also been significant, and animal husbandry farms will face changes in their practices for storing and spreading manure. For example, for the period 1996-1999 it can be expected that the criteria for a maximum fertilizing level will have a more significant impact on farming practices. From 1996-1999 farmers will have a stronger incentive to lower the fertilizing levels, because if a 10 per cent decrease in fertilizing from 1994 to 1996 is not verified, the premiums paid under the GAEPS are lowered by 10 per cent. Table 1. describes the significance of different GAEPS criteria by using positive signs for relatively significant criteria and negative signs for relatively not significant criteria.

Participation in the SPS

Over 7 500 farms participated in the SPS programmes in 1995, and the majority of the contracts were set for five years. Measures under the SPS cost altogether some Mk 80 million (US$17 million), and most of it (Mk 36 million) was spent on organic production or conversion to this. Area under organic production and under conservation was totally over 100 000 hectares in 1996. Because of budgetary restrictions contracts of supplementary protection scheme measures have not, however, been made in the extent required by the agri-environmental programme in 1996, the expenditure on SPS will be increased in 1996-1999 if necessary finances will be received from the national and European Union budgets.

Farm-level economic impacts

The criteria set in the GAEPS impose costs to the farm. How extensive these costs or income losses are depends largely on the farm characteristics. For example, plant cover criterion affects cash crop farms more harshly compared to animal husbandry farms. Also, the criteria are to some extent differentiated by region. Changes in manure spreading and storing practices often cause substantial cost increases to animal husbandry farms, especially to pig farms if investments are required. Most notable criterion is the fertilizing criterion. On average the fertilizing levels drop 10-30 kg/ha. With grass production the decrease in the use of fertilizers is more substantial. The decrease in fertilizing has some influence on yield levels, but as the producer prices of crops decline, the income effect of the criterion decreases as well.

Figure 3. Reasons for not participating the GAEPS as stated by the farmers

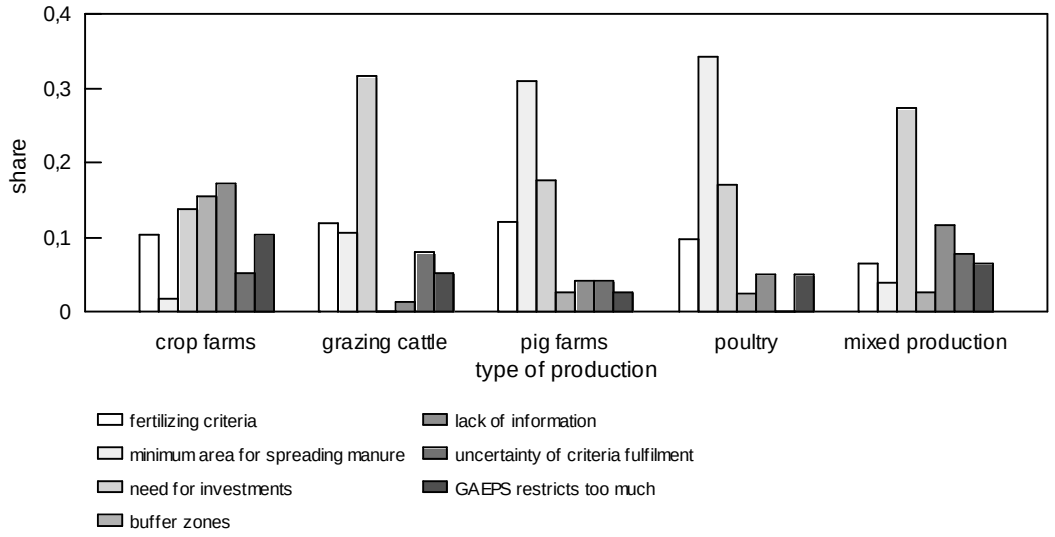


Table 1. Impact of the GAEPS criteria on farming practices on different farm types according to the survey in February 1996

CRITERIA	CROP FARMS	GRAZING CATTLE	PIG AND POULTRY FARMS
FEMP	+	+	+
FERTILIZING LEVELS	+	+	+
MANURE STORING AND HANDLING	- -	+ + +	+ +
STOCKING DENSITY	- - -	+ +	+ +
BUFFER STRIPS	+ + +	+ +	+ + +
30% PLANT COVERAGE	+	- -	+ +
LANDSCAPE MAINTENANCE	- -	- -	- -
SPRAYING CRITERIA	-	-	-

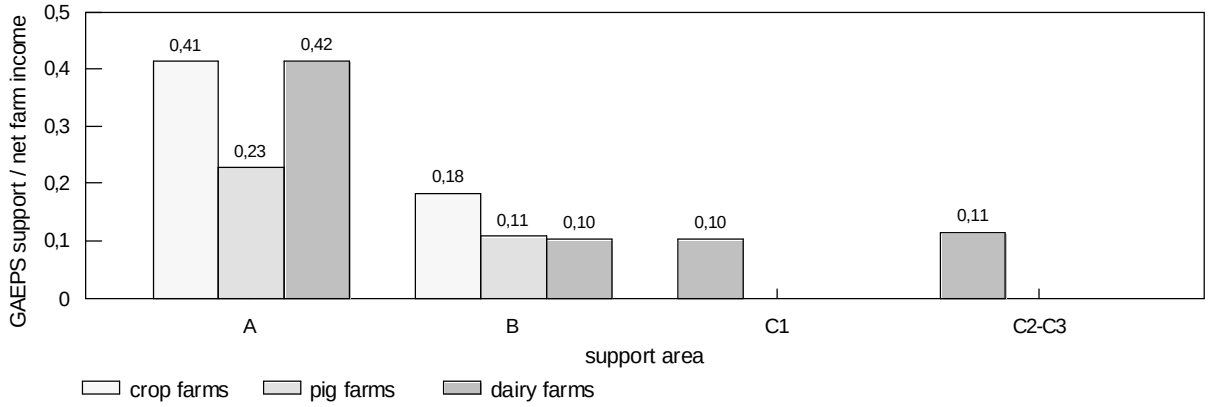
The income losses due to the GAEPS are difficult to define. Fulfilling fertilizing base levels has some effect on yields, but its effect cannot be fully pinpointed in the complex farm situation. Also, the land cover criterion may require changes in cultivation practices. Costs of the farm environmental plan and plant protection do not vary that much across the farms. Landscape management costs depend on farm characteristics. Investment costs on manure handling equipment and facilities may be fairly high for pig and dairy farms. In animal husbandry farms the costs of GAEPS may be higher than the GAEPS paid to the farm is. This is crucial as in accepting the GAEPS guidelines the farmer commits himself to making within three years the necessary investments specified in the farm environmental plan.

The GAEPS and financial situation of farms

The relative importance of the GAEPS support to the financial situation of the farms is reflected by the average relation between the GAEPS support and the net farm income[15]. Figure 4 shows the averages of this relation without taking any costs due to the GAEPS into account. To find out the actual relation, the cost of fulfilling the criteria should of course be taken into account. Although Figure 4 does not describe the "income effect" of the GAEPS support in a fully correct manner, it gives information on the financial importance of the GAEPS in different regions. Taking the actual farm-level costs of the GAEPS into account would lower the share of the support of the net farm income substantially, but the relative importance of the premiums in different areas would remain basically the same.

The average net farm income in area A without GAEPS support would vary from some Mk 50 000 (US$10 600) on crop and dairy farms to Mk 100 000 (US$21 200) on pig farms, which is certainly a level at which it is questionable whether the farm is able to stay in production. Support levels of GAEPS are mentioned above, under the section entitled "Structure of the Programme".

Figure 4. The share of the GAEPS support of the net farms income
(extra costs due to GAEPS are not included)



5. Summary

The role of agriculture in the Finnish society is changing. Agriculture has gained more relevance as a maintainer of the landscape and preserver of the biodiversity; not only as a producer of milk, meat and cereals. An increasing part of the value of Finnish agricultural production will in the future come from producing such public goods. Agriculture has both positive and negative impacts on the environment. Agricultural landscape for all of us to see and enjoy can be seen as a positive externality of agricultural production, and the nutrient load on waters can be regarded as a negative one. The greatest threat to rural landscapes is caused by discontinuing cultivation, depopulation of rural areas and closing of the open cultivated landscape.

Membership in the European Union brought about the task of adapting the EU's environmental support system to Finland. The Finnish Agri-Environmental Programme (FAEP) was formulated in this process. The FAEP is a means to fulfil the environmental guidelines and recommendations set for

[15] Net farm income is defined here as the revenue left for paying for farmer's own capital and labour.

agriculture in various committees during the past years. The FAEP is also seen as a means to promote the role of the agriculture as a producer of such public goods as landscape and biodiversity. The FAEP includes the General Agricultural Environmental Protection Scheme (GAEPS) and the Supplementary Protection Scheme (SPS), as well as schemes for advisory services and training, and for demonstration projects. The GAEPS is targeted to all farmers, but the SPS is targeted to environmentally more narrow or restricted local or regional measures. The GAEPS can be seen as a means to decrease environmental degradation, and the SPS as a way to further enhance the quality of the environment and to produce positive externalities.

The first year of implementation shows that the goal of farmers' participation in the programme is fulfilled better than was anticipated, and positive environmental impacts can be expected in the near future. Variation in participation between the support areas and production types was quite low, although there exists a decreasing trend in participation towards the north, and especially in the case of pig and poultry farms participation in the GAEPS was lower. Participation of farms with grazing cattle was high, and the most important reason for their non-participation was the investment need for manure facilities. The high rate of participation of animal husbandry farms is expected to result in reduced nutrient leaching from manure spreading and manure storing facilities. However, some animal husbandry farms might leave the GAEPS or stop the production if the investment need for manure facilities is too high and no investment aids are available. Farmers' willingness to join the GAEPS, even when it might cause them additional costs, also signals their willingness to contribute towards improving the rural environment.

Crop farms participated the GAEPS in a very large scale and, for instance, in area A the GAEPS covers the cultivated area almost totally. Areas of intensive crop production are covered by the GAEPS on a very large scale, which can be expected to result in a positive development in solving the agri-environmental problems of those areas. Perhaps the most important single change in farming practices due to GAEPS criteria was setting up some 30 000 km of filter strips (Anon., 1996) by water routes and main ditches, which will have a positive contribution in decreasing erosion and nutrient leaching. It must be noted that 1995 was the first year of the GAEPS and the criteria will not have a full impact until 1996 and 1997, when all the criteria must be fulfilled. In 1995, 82 per cent of the farmers applied for GAEPS premiums. This means that 90 per cent of the arable land is cultivated according to the criteria set in the programme, and in area A the programme covers 96 per cent of arable land. The GAEPS will have a positive impact on the environment, as fertilizing levels decrease and nutrient runoffs will be reduced. These environmental impacts cannot be seen immediately, but in the long run. SPS measures aim at producing further positive environmental impacts, such as increasing biodiversity and maintaining the landscape. Organic farming became a very attractive option for farmers because of the SPS. Organic farming is now an economically competitive alternative to conventional farming, especially in dairy production.

Economic impacts of the FAEP are still unclear. GAEPS premiums are essential for continuing production in area A, even though there are costs in fulfilling the criteria set in the programme. Finnish agriculture will move towards more extensive production as income from the sales of the products forms a lesser share of the total income of the farm. Less intensive production, buffer strips, better nutrient and pesticide management, organic farming — all these measures will contribute to a more diversified countryside and rural landscape. It is too early to say how positive an impact on the environment the FAEP will have in the long run. For instance, verifying the decreased nutrient leaching and its positive impacts will take several years. In spite of this, the first year of implementation already shows that the goal of farmers' participation in the programme is fulfilled better than was anticipated, and positive environmental impacts can be expected in the near future.

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Annex 1. Expenditures of the Finnish Agri-Environmental Programme in 1996 according to the state budget

	Mk million	US$ million
GAEPS	1 350	287.2
SPS	134	28.5
SPS at Ahvenenmaa archipelago	5	1.1
Preparation of the FEMPs	30	6.4
Training of advisors	3	0.6
Training of farmers	5	1.1
Preparation of advisory material	2	0.4
Experimental projects	8	1.7
Preparation of water projects	1	0.2
Administrative costs	5	1.1
Total	1 543	328.3

FRANCE: THE VALUE OF AID TO MOUNTAIN AND HILL FARMING FROM THE STANDPOINT OF BALANCED LAND-USE PLANNING AND DEVELOPMENT

by
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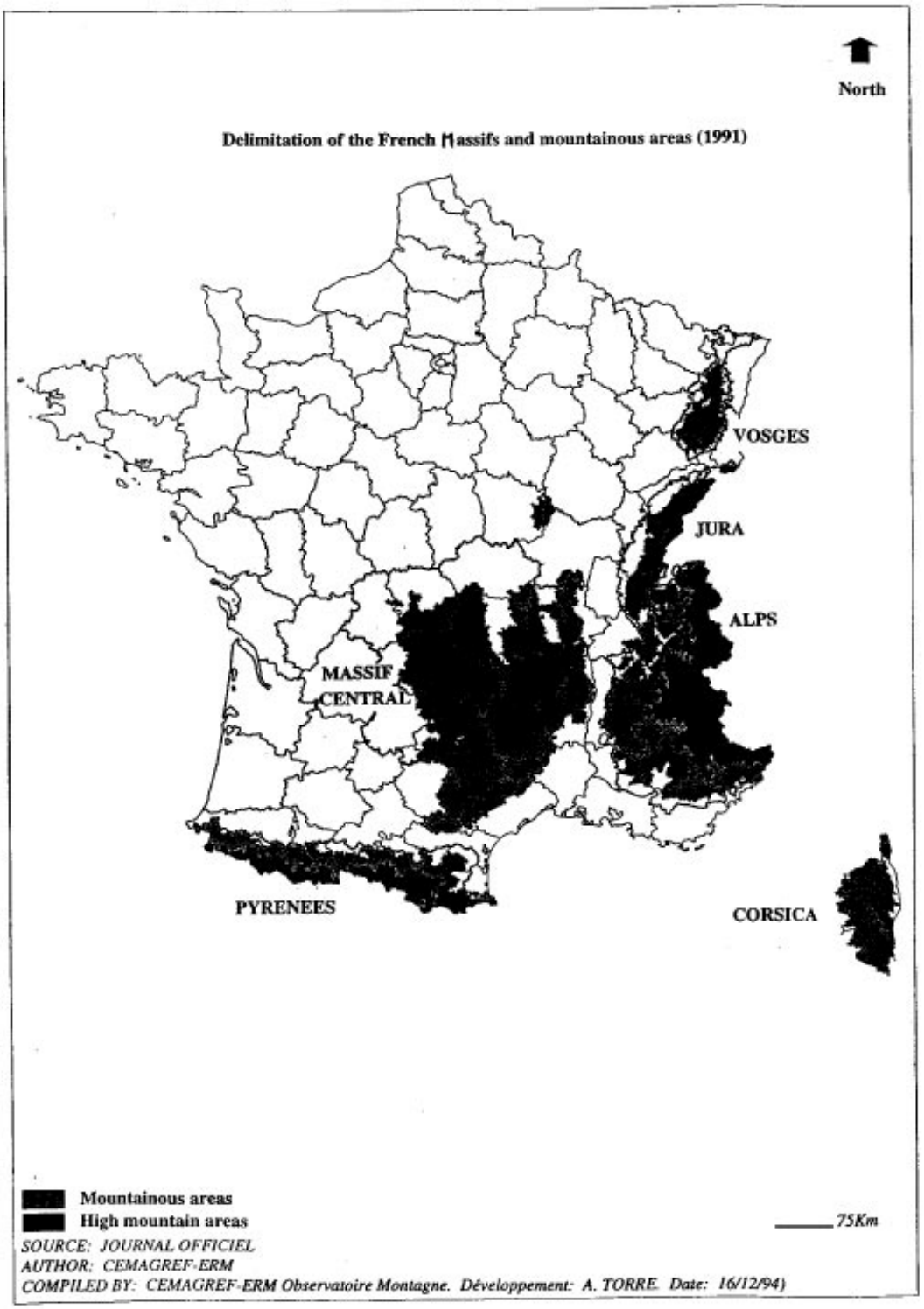
Agriculture's ecological benefits are not limited to the conservation of endangered natural resources, the maintenance of useful ecosystems and the preservation of landscape. In a broader sense, they must also encompass a number of benefits to society that stem from the fact that farming activities are kept alive in areas where physical conditions are highly adverse. Mountain and hill farming therefore has a part to play in balanced land-use planning and development.

This is an important objective of national and European agriculture policies; while the European dimension of policies of aid to mountain and hill farming is far from negligible, it is obvious that such policies vary according to the particular context— economic (size of the farm sector), physical (dimensions and characteristics of the land) and cultural — of each OECD country. The policies of aid to mountain and hill farming that have been developed in the European Union and some neighbouring countries, such as Switzerland, therefore have a number of specific features in common. For the sake of simplicity, the analysis here will be limited to the case of France. After presenting selected data on the place of mountain and hill farming in France, we shall review how the aid policy developed and analyse the benefits and ecological services associated therewith in order to clarify the expected dividends from balanced land-use planning and development.

1. Selected data on mountain and hill farming in France

In France, mountain areas, as defined according to European Union criteria (essentially altitude and slope), currently account for 23 per cent of land mass (see Map 1), 17 per cent of farmland (versus about 20 per cent in the European Union as a whole), 8 per cent of the workforce and 14 per cent of farms. The mountain mass is administered as seven areas: the Vosges, Jura, Northern Alps, Southern Alps, Corsica, Massif Central and Pyrenees. It should be noted that over 50 per cent of the French farmland and farms classified as being in mountain areas are located in the Massif Central alone. French mountain areas are highly diverse: for example, population density is 30 inhabitants per square kilometre in the Massif Central and 80 in the Vosges, as opposed to 100 for France as a whole.

Map 1


North
Delimitation of the French Massifs and mountainous areas (1991)
VOSGES
JURA
ALPS
MASSIF CENTRAL
PYRENEES
CORSICA
Mountainous areas
High mountain areas
75Km
SOURCE: JOURNAL OFFICIEL
AUTHOR: CEMAGREF-ERM
COMPILED BY: CEMAGREF-ERM Observatoire Montagne. Développement: A. TORRE. Date: 16/12/94)

2. A brief policy retrospective

As in many countries, industrialisation in France involved large-scale urbanisation accompanied by a massive shift of populations away from rural, and particularly mountain, areas. The substantial territorial imbalance did not arise in France until the 19th century, with the development of industrialisation. For example, the former department of Seine (corresponding to Paris and its near suburbs), which at the time of the French Revolution in 1789 had accounted for only 2 per cent of the French population, saw its share double by the 1851 census. From then on, the Paris area enjoyed considerable growth at the expense of the rest of France, giving rise to the notion of "Paris and the French desert" made fashionable by Jean-François Gravier in 1947. Over that same period, from 1850 until 1950, the population drain was especially severe in upland areas. Furthermore, nearly 20 per cent of the French population was concentrated in the Paris area. Realisation of all this led to the initiation of a land-use development policy in 1955, with the main objective of fostering industrialisation in problem areas and encouraging decentralisation by slowing the influx of industrial activities to greater Paris and shifting them to the provinces.

The 1960-62 framework legislation on French agriculture contributed to these aims by seeking to encourage the preservation of individually run farms spread evenly throughout the country. A specific uplands policy was gradually put in place in France, beginning in the 1970s; 1973 saw the institution of the system's core aid measure — the future compensatory allowance for permanent natural handicaps, which was to be paid according to the number of livestock units (LUs) and subject to ceilings with regard to stocking rates (i.e. LUs per hectare) and total LUs per farm.

In 1975, the European Community adopted a common policy for mountain and hill farming and for farming in certain less-favoured areas, drawing on measures that had already been applied in France and the United Kingdom. The policy included: i) common definitions of types of designated areas (mountain and hill areas, other less-favoured areas, etc.); ii) a compensatory allowance for permanent natural handicaps, paid per animal to producers in such areas; iii) a special system of aid to individual and collective investment. About FF 1.6 billion was paid out in France in 1995 for "Special Mountain Allowances", the chief subsidy under the uplands policy, and 74 000 recipients received an average of FF 22 000 each. The allowance varies from FF 660 to FF 960 per livestock unit (LU) for dairy cows and; a maximum of 50 LUs are subsidised, up to one LU per hectare of grazing area. Under this common policy 25 per cent of expenditure is reimbursed by the European Union. The compensatory allowance for permanent natural handicaps accounts for over 50 per cent of aid to mountain and hill farming in France. In addition to agricultural support, there are also aid programmes targeted at other sectors for broad-based rural development and support for local initiatives.

The European Union policy's explicit objectives are "to ensure the continuation of farming, thereby maintaining a minimum population level or conserving the countryside" (see Council Directive 75/268/EEC). By way of contrast, it is interesting to recall that the initial aim of the policy France had adopted a century earlier, around 1880, to restore plots of mountain and hill land was, on the contrary, to limit the effects of overfarming. This overfarming, which was due to overpopulation at the time, caused extremely harmful erosion in the most fragile areas, causing serious consequences for areas downstream.

3. The services rendered by mountain and hill farming (or the benefits thereof)

Mountain and hill farming renders a multiplicity of services, which is why it is said to be "multifunctional".

Protecting the natural environment and the diversity of the landscape

In mountain and hill areas, the abandonment of pastures and arable land aggravates natural hazards. When pastures are not cut or grazed, the risk of avalanches increases, and as they revert to scrub the risk of fire intensifies. In addition to heightening a number of natural risks, withdrawal from farming also affects biological diversity and landscape aesthetics. After a few years of scrub invasion, the growth can block out vistas, narrowing the horizon and increasing monotony.

In the Vosges area of north-eastern France, a mountain area hit especially hard by agricultural withdrawal, the collapse of traditional farming has led to piecemeal spontaneous afforestation, primarily by spruce trees, which first affects former communal grazing land, tilled plots and sometimes even meadows. Rough grass develops in pasture that is grazed occasionally, giving high but uneven growth, and bushes start to appear. The natural development of trees and scrub eventually produces rough woodland. The clear, orderly design that once shaped the countryside is lost, and the landscape is closed off. The restructured landscape disfigures the view, as reference points (such as valleys and dwellings) are lost and crest lines are flattened. The introduction of a policy of aid to mountain and hill farming has helped to lessen these risks.

The contribution to balanced land-use planning and development

Independently of its effects on the natural environment and the quality of the landscape, retaining upland farmers is perceived as something that is necessary both for cultural reasons and for the impact on the development of other activities. In mountain and hill areas, the farming community generally still accounts for a vital share of the overall population. Keeping an adequate number of farmers is a necessary (although surely not always sufficient) condition for attracting or holding on to other activities. Keeping these farmers makes it easier to achieve balanced land-use planning and development objectives, which include: developing areas of low population density in parallel with the development of heavily populated areas (large metropolitan areas); and preserving some sociological diversity, in particular through private family-run farms.

Country and mountain areas play a vital role in balancing today's urban, industrialised society. These aid policies try to do more than just limit gaps in income and living conditions between town and country (or mountain) areas. Rural environments offer society opportunities for integration, social innovation, productivity and another way of life, which in the future cannot fail to satisfy increasing needs.

Upkeep of the landscape and architectural heritage, the presence of farms and promotion of specialised farm produce all enhance the attractiveness of mountain areas for urbanites. Apart from a number of relatively small areas that are left virtually wild, city dwellers are drawn to an environment that has been cultivated. The interactions among agriculture, the natural environment and the needs of urban populations are not always perceived consciously, but they clearly exist. From surveys in France, it has emerged that among the qualities urbanites look for in a rural environment are: i) open spaces and greenery; ii) hospitality, authenticity and contact with locals; iii) sites conducive to leisure activities: hiking, hunting, etc.; iv) protection against the hazards of nature: erosion, forest fires, etc.

Mountain areas can satisfy city dwellers' yearnings for nature— yearnings that intensify as urbanisation spreads wider and wider. The development of these areas can be stimulated by farm tourism, which in turn is facilitated by the presence of farmers. In contrast, when tourism operators create facilities from scratch — facilities that are ill-suited to a rural environment — they usually whittle down the

attractions of the setting or indeed disfigure it, which can ultimately result in economic losses (as in the case of some ski resorts).

Even if farmers are able to obtain at least partial direct compensation for certain services other than normal farm production, this is generally not enough to provide them with a proper income and to keep a sufficient number of farms in mountain areas; aid is necessary to maintain an adequate level of amenities. Table 1 distinguishes between mountain farming services to which a direct value can and cannot be assigned. If farmers are unable to derive sufficient income from these directly usable services, it is necessary to develop a system of aid or of contracts to ensure that other amenities are preserved over time.

While the Beaufort region in the French Alps is proof that farmers can raise their income by better marketing of high-quality *terroir*[16] products and by developing agro-tourism based on the attraction of the landscape and local life, direct income is nonetheless most often inadequate, and support is required if society wants to maintain the primary amenities and contribute to balanced land-use planning and development.

4. How to measure the benefits of mountain and hill farming

Precise measurement of ecological benefits requires many criteria expressed in a variety of different units (e.g. physical indicators for pollution; inventories and mapping for the distribution of flora and fauna). Some qualitative aspects, such as the quality of landscapes, are more difficult to measure. Apprehending the overall quality of the environment by combining physical data with survey findings about user demands and the rates at which those demands are or are not satisfied might provide a more comprehensive perspective, but research on the subject has not yet advanced sufficiently. Pending the development of more precise indicators, an indirect approach is somewhat easier. Less refined indicators correlated with the production of these advantages are used and examined in order to furnish an initial appraisal of the results of the policy carried out to benefit such areas.

In respect of the landscape, for example, the focus may be on the areas to crops or grass; this will provide a measure of the area maintained by farmers and the continuation of diversified land-use patterns; in addition, if the decline in utilised farm area is slight, it will suggest that little landscape value is being lost. Similarly, an indicator of farm numbers will provide an initial assessment of farming's contribution to balanced land-use planning and development.

In actual fact, thanks to the development of the policy of substantial aid to mountain and hill farming, while the income of mountain farmers has not caught up with that of lowland farmers, its sharp relative deterioration was halted in 1973. For many mountain farmers, hope has been restored. Over the ten years from 1984 to 1994, for a significant sample of farms comprising the Farm Accountancy Data Network (FADN, developed by the European Union), the income gap narrowed appreciably: the income ratio of upland farmers to lowland farmers rose from 50 per cent in 1984 to 66 per cent in 1994; for the sample's upland farms, aggregate aid accounted for an average of two-thirds of net income in 1994 (Bazin *et al.*, 1996).

[16] A circumscribed agricultural area having unique soil and growing characteristics.

Table 1. The value of services rendered by mountain and hill farming

	Source of amenity	**Local impact**	**Value to agriculture**	
			Market role	**Form**
Direct use value	Existence of a *terroir*	Products entitled to a special label	Yes, directly	Premium prices for products
	Quality of landscapes	Space management; special farming practices	Yes, partially, via agro-tourism	· Provision of services · Landscaping contracts
Indirect use value	Protection against flooding and erosion	Land maintenance and favourable farm practices	No	Aid to sustain farmers and favourable farm practices
Ecological value	Preserving noteworthy flora and fauna	Contribution to biological diversity; presence of particular ecosystems	No	· Maintenance subsidies · Special contracts with farmers
	Contribution to balanced land-use planning and development	Presence of a certain farm population	No	Grants to retain farmers

Utilised farm area has changed at the same pace in both upland and lowland areas (down 3 per cent between 1979 and 1988); the proportion of area to grass has been stable in upland areas while decreasing sharply in the lowlands. Overall, it can be seen that agricultural withdrawal has been limited in mountain and hill areas. Even so, the steep drop in the workforce has meant some streamlining of farm practices, with substantial cutbacks in terrace cultivation and in some forms of irrigation, drainage and grassland maintenance. While the upland agricultural exodus has not stopped, it is probably more under control. Since 1970 it has proceeded at virtually the same pace as the flight from lowland farms, whereas between 1955 and 1970 the drain on the farm population was 50 per cent faster in mountain areas than elsewhere (Table 2).

Table 2. Rate of change in the number of farms (per year)

	Mountain areas	Non-mountain areas
1955 - 1970	- 3.6 per cent	- 2.4 per cent
1970 - 1988	- 2.6 per cent	- 2.4 per cent

After falling off sharply until the second world war, the overall population of mountain areas began to grow again, although the growth was heavily concentrated - especially in the northern Alps (up 50 per cent between 1962 and 1990), thanks to the rapid development of tourism and the vitality of cities like Grenoble, Annecy, etc. In contrast, the Massif Central was still experiencing a decline in population (down 8 per cent over the same period, or by about 0.3 per cent per year). For greater detail, see Table 3. A closer analysis, at cantonal level (cantons being groupings of about ten communes covering an area of some 200 sq. km.), shows that in the Massif Central large farming areas with severe natural handicaps have been maintained. These areas, generally at intermediate altitudes and far removed from large urban centres and major roads and rail services, have retained their heavy concentration on farming (which accounts for 44 per cent of employment). This situation reflects the difficulty these areas have in finding substitute activities: nearly 17 per cent of jobs were lost in these areas between 1982 and 1990, and population density has dipped to only 13 people per square kilometre. At the opposite extreme are rural cantons with tourist facilities, in which tourism has an overriding impact on overall trends, but in which the role of agriculture cannot be disregarded if the environment is to be maintained and especially its character retained (SEGESA, 1993). This analysis underscores the utility of the proposed indicators for assessing agriculture's contribution to balanced land-use planning and development (see document presented at the meeting at OECD on 19-21 June 1996).

5. Conclusion

France is confronted with an acute problem of land-use balance, since 20 per cent of its land is currently occupied by 80 per cent of the population. The medium-term outlook would suggest that the trends already noted in France will be amplified throughout Europe. Reinforcing the central areas of the European Union poses a political problem which touches upon what Title V of the Single European Act calls the "economic and social cohesion" of Europe.

Concentration of the population in highly circumscribed urban areas, along with its corollary of draining entire areas of their population, has two types of environmental repercussions. First, sociologically harmful congestion effects are occurring with the development of often dehumanised suburbs, while ecological damage is being inflicted by urban pollution and the destruction of landscapes by increasingly invasive infrastructure. At the same time, population flight from remote rural areas is also causing a deterioration, perceived all the more intensely because of the growing demands emanating from the cities. It is in this overall context that mountain policy takes on its full significance.

It was not the intention of this report to focus on results in detail, but rather to illustrate, by citing the impact of policies of aid to mountain and hill farming, the importance of contributions to balanced land-use planning and development, which is an important objective of farm policy in many OECD countries. It is by making the most of its diversity that a country can achieve balance and amenity. This is why, for ecological — or broadly environmental — reasons, many countries deem it important to be able

to maintain an agricultural population, particularly in regions such as mountain areas which have severe natural handicaps.

Table 3. Demographic and economic characteristics of the French massifs

	Population in 1990		Change 1982-90	Jobs within the area, 1990			
	Total	Density	per cent per	farming	industry	construction	other
Vosges							
Mountain	298 312	73	- 0.16	4.1	43.0	8.2	44.7
Piedmont	112 037	67	- 0.08	5.7	36.6	8.3	49.5
All	*582 002*	*79*	*- 0.01*	*5.0*	*40.6*	*8.0*	*46.4*
Jura							
Mountain	297 696	47	0.90	7.6	41.7	6.8	43.9
Piedmont	146 283	45	0.53	10.5	31.9	7.2	50.4
All	*500 832*	*51*	*0.88*	*7.9*	*38.0*	*7.0*	*47.1*
Northern Alps							
High mountain	180 585	28	1.10	3.2	16.2	8.4	72.2
Mountain	649 537	61	1.38	6.5	26.4	10.8	56.7
Piedmont	175 396	162	1.95	4.0	36.7	10.4	48.9
All	*1 652 890*	*85*	*1.10*	*3.4*	*25.3*	*8.4*	*62.9*
Southern Alps							
High mountain	123 256	13	1.00	7.0	7.1	10.5	75.4
Mountain	179 578	21	1.89	11.9	14.1	12.4	61.6
Piedmont	22 104	32	2.24	12.8	9.9	15.1	62.2
All	*560 981*	*27*	*2.01*	*8.6*	*13.0*	*11.7*	*66.7*
Corsica							
Mountain	111 549	14	0.52	15.9	6.8	16.8	60.5
All	*250 371*	*29*	*0.52*	*8.3*	*7.3*	*11.6*	*72.9*
Massif Central							
Mountain	1 731 073	34	- 0.25	15.6	23.9	7.8	52.7
Piedmont	359 496	46	0.07	14.2	20.6	7.6	57.6
All	*3 700 158*	*47*	*- 0.11*	*11.3*	*24.8*	*7.3*	*56.5*
Pyrenees							
High mountain	58 983	9	- 0.54	12.4	13.8	7.2	66.7
Mountain	272 884	31	0.05	13.8	17.8	8.4	60.0
Piedmont	62 125	73	- 0.05	10.2	16.2	8.5	65.0
All	*479 310*	*27*	*- 0.01*	*14.0*	*17.4*	*8.3*	*60.3*
FRANCE	**56 610 938**	**104**	**0.52**	**6.3**	**23.5**	**7.7**	**62.5**

1. Note: "All" includes all areas having broadly to do with mountains, less-favoured areas and areas within the mountain mass that are outside the less-favoured areas.

Source: INSEE, special breakdown of the 1990 population census.

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FRANCE: SUSTAINABLE DEVELOPMENT PLANS

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1. Sustainable development plans for farming

1 200 farmers across 59 small regions have come forward to try to describe their future plans for farming in ways that are economically, environmentally and socially sustainable. They were invited to take part in this exercise by the French Ministry of Agriculture, Fisheries and Food. The purpose was to test a new type of agreement, the sustainable development plan (known by its French initials PDD). The agreement recognises the threefold function of farmers, as producers of goods and services, both food and non-food, as managers of the environment, and as agents in rural development. From the outset, the exercise has been backed by the European Union, the French Environment Ministry, the regional and agricultural development agencies (DATAR and ANDA), and environmental groups.

Voluntary participation and teamwork are keynotes of this innovative move to promote forward-looking farming in harmony with nature and society. The result has been a new approach to agricultural development. The local characteristics of each region, and the agricultural role and environmental aspects of each farm, are identified. Taken together, these features provide the basis for plans which respond to the challenges of each locality in terms of sustainable farming. Where the plans warrant it, a variety of assistance can be drawn upon.

The proposal goes before a committee representing farming, environmental and local development interests, and then goes to the departmental farming guidance committee for approval. The local préfet will then sign a five-year contract under which the farmer can draw on agricultural and environmental assistance available in the region, and will receive training, advice and back-up services, together with a special grant. The farmer may bring in other partners to support his proposals.

2. Objectives

In 1992 the French Ministry of Agriculture, in conjunction with the Environment Ministry and DATAR, launched a feasibility study for sustainable development plans (PDDs) involving all relevant partners and with the support of the European Union, local authorities and farming organisations. This exercise, involving volunteer farmers, was particularly well received since it drew upon schemes which were under way but were in many cases less comprehensive.

In the past two years, 1 200 farmers across 59 small regions have attempted to define the future of their system of farming. They addressed the following questions: How can income, working

conditions and living standards be improved? How can the three functions, as: producers; environmental managers; and agents of rural development, be properly combined? The aim was to establish sustainable farming systems, systems that are economically viable, safeguard environmental standards and contribute to local development.

Early results from this grassroots exercise yield valuable lessons and indicate regulatory, administrative or financial approaches that can assist the development of sustainable agriculture so that every willing farmer can eventually join in. The farms will provide a reference network for agricultural training, development and research, and for the sector's other partners. PDDs reflect French farmers' moves towards the sustainable development advocated by the 1992 United Nations Conference on Environment and Development in Rio de Janeiro.

3. Methods

The feasibility study called for an analytical and practical approach tailored to small regions and individual farms. This was combined with an overall approach covering technical, economic, environmental and social aspects. Keynotes are observation, the farm family's own expectations, and involvement of other partners. A number of stages were involved: i) local analysis of each of the 59 areas, to define challenges via an assessment of strengths and weaknesses; ii) agricultural and environmental assessment of each of the 1 200 farms, by a novel method examining the farm from the economic, environmental and social standpoint; iii) building up scenarios that respond to the strengths and weaknesses of individual regions and farms; iv) devising contractual agreements between farmer, government and other partners. Each stage called for step-by-step methods described in eight general or subject-specific papers which are now available for use by agricultural training and extension agencies.

4. The contractual agreement

Farmers engaged in PDDs have worked for two years in groups and with their local partners, to produce individual plans for the future of their farming systems.

Procedure

By 1997, 800 plans will be covered by farmers' contracts with central government and, in some cases, local authorities, agencies responsible for water resources, nature parks, etc. Each proposal first goes to a group of experts on agriculture, the environment and local development. The departmental agricultural guidance committee then examines the plans and forwards to the préfet those which it considers compatible with sustainable farming.

Local partners

The various tiers of local government, and agencies and voluntary bodies, have grasped the significance of PDDs for local development. A number are becoming partners in plans, recognise that sustainable farming is a vital element in development policy, and supply financial backing.

Contractual commitments

The farmer undertakes to carry through his proposals for an initial period of five years and to share the lessons he has learnt. The government undertakes to provide the farmer with back-up while he is changing his system of farming. Back-up takes two forms: a one-off grant for taking part in the experiments, averaging FF 30 000, and vouchers worth FF 10 000 to pay for technical assistance. The vouchers can be used by individual farmers or pooled by a group to examine some experimental aspects more thoroughly. A further FF 5 000 in vouchers is available during the second year of a plan. Farmers engaged in PDDs can also qualify for agri-environmental assistance, wherever their farm is located, provided they meet the relevant conditions.

5. The "P" family's sustainable development plan

Farm: 80 hectares of farmland — 25.4 hectares to cereals and oilseed

4.7 hectares fallow

5 hectares to maize

1 hectare to beet for animal feed

44 hectares to grass

23 dairy cows + 10 young milkers/year - quota: 154 000 litres

16 breeding cows + 15 calves/year.

Farmers: Mr. and Mrs. P are 30 years old and have two young children. The couple work together on the farm, where they set up in January 1992, taking over from Mr. P's parents. The couple then decided to work together and continue as stockfarmers, notably for meat production. The land and buildings are held on an agricultural lease.

The proposals: The family started developing its proposals in 1993, including:

- **Balance between the dairy and meat sides:** in order to retain the current system of feed production, which is in line with the land's potential, the increase in milk production since 1993 entails a cutback on the meat side; lower cattle per hectare coefficient (1.14, compared with 1.64 in 1993); and more dairy cattle.

- **Improving working conditions:** taking on a half-time employee; enlarging the calf compounds; building a cowshed for the dairy cattle in 1996, incorporating future compulsory facilities; examining the possibility of keeping the 1993 quota by converting 10 hectares from arable use.

- **Building design:** ensuring that the new cowshed is in harmony with the local landscape.

- **Landscape and environment:** planting hedgerows around the grassland (animal shelter, landscape value); grassland in the area liable to flooding to be included in the local authority's wetlands

scheme (marshland agreements concluded for 5 hectares); rationalising the use of manure and waste.

6. Practical arrangements

A number of considerations underpin the arrangements for the scheme: i) the farmers involved are all volunteers; ii) group work is important. In each area, some 20 or so volunteer farmers have worked together, with technical support; iii) diversity must also be borne in mind. 59 small regions were selected to cover a wide variety of circumstances; iv) a partnership between agricultural, environmental and local development interests is valuable in working towards new solutions and mobilising support for projects; v) the need for countrywide consistency, to be achieved through common specifications and methods of operation, and some national guidance.

At national and local levels, the practical arrangements involve two committees: i) a steering committee made up of representatives of government, farming organisations, local authorities and environmental groups, provides guidance; and ii) a technical committee which monitors ongoing work, helps develop methodology and assesses projects — at local level the committee comprises specialists dealing with agriculture, the environment and local development.

The operation involves over 100 local project leaders and technicians. There is a national co-ordinating unit. Its four members come from the Ministries of Agriculture and the Environment, ANDA and the national animal breeding institute. Projects have been implemented by a range of bodies: chambers of agriculture, regional nature parks, local authority groups, voluntary bodies and so on.

7. The outlook

In 1996 the PDDs have assumed a further dimension as the contractual agreement stage has developed. While continuing the process launched with the early volunteers, the Ministry of Agriculture intends to broaden this innovative development approach by extending it to further groups of farmers and securing European recognition, and hence adding momentum to the process.

On the current lines of work, the programme anticipates: the signature of 800 PDD agreements over the period 1996-97; back-up and guidance resources for new projects; and information drives directed at farmers, development agencies, training and research bodies and the general public . This year, production systems covered by the agreements are to be subjected to impact assessments in economic, social and environmental terms. It is further proposed to: prepare the ground to broaden the scheme, in conjunction with the European Union; include sustainable development in the agricultural training curriculum, notably via the network of demonstration schemes at agricultural colleges; and assist the momentum towards sustainable farming by bringing in further groups of volunteer farmers, in particular young farmers who are just setting up. In response to farmers' requests, the Agriculture Ministry proposes to extend the scheme to around 100 new groups a year; that would cover some 2 000 farmers, equivalent to 20 per cent of those entering farming.

GERMANY: PROMOTION OF POSITIVE ENVIRONMENTAL IMPACTS OF AGRICULTURE

by
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Introduction

In the Federal Republic of Germany the introduction of Regulation (EEC) 2078/92 did not at all mean a completely new start in promoting farming methods in accordance with environmental protection requirements. During the mid-eighties most of the "old" Bundesländer (Germany-West) had already started to establish programs to encourage the use of less intensive methods of agricultural land use in certain areas in order to protect typical kinds of flora and fauna, biotopes or landscapes. These programs provided the possibility to offer contracts to farmers on a voluntary basis, in which the farmer committed himself to continue methods of land use hitherto practiced and to abstain from any increase in intensity or to reduce the intensity of land use for a certain period. In return the responsible authority obliged itself to pay a premium to the farmer covering at least the income foregone by fulfilling the contract requirements. The premiums had to be financed by the respective Länder. Only few of the old Länder had made use of the option to have these programs cofinanced by the EAGGF according to Regulation (EEC) 797/85 on "Improving the Efficiency of Agricultural Structures", e.g. Bayern with its "Landscape Maintenance Program".

The extensification program established by the EC in 1988 and applied in Germany from 1989/90 to 1992/93 also promoted less intensive methods of land use on a voluntary basis, although with the main objective of reducing market surpluses of certain farm commodities. 70 per cent of the costs of the EC-extensification program were borne by the Federal government and 30 per cent by the respective Länder governments, and 25 per cent of these costs were refunded by the EAGGF. In Germany, some 18 000 farms with a total area of about 440 000 hectares of land have participated in this program, covering roughly 2.5 per cent of agriculturally used land. About participation in the Länder programs mentioned initially information is lacking. The total financial input into the promotion of adapting farming methods to environmental requirements in the Federal Republic of Germany before Regulation (EEC) 2078/92 came into effect averaged about DM 500 million annually.

Regulation (EEC) 2078/92, established as part of the so called "accompanying measures" of the 1992 reform of the common agricultural policy, opened up new opportunities for program design and financial resources in this field. Article 2, Section 2, of the Regulation provides the opportunity to offer premiums as incentives to farmers who oblige themselves to use production methods in accordance with requirements of environmental protection and maintainance of the landscape and hence contribute to rebalancing farm commodity markets. The premiums may compensate participating farmers for income losses caused by the introduction or continuation of those production methods and also honour their contribution to environmental improvement. Among production methods eligible for promotion are: i) the renunciation of the use of chemical fertilizers and pesticides or the application of organic farming methods; ii) the reduction of the number of cattle and sheep kept per hectare of forage

land; iii) the conversion of arable land into extensively used grassland; iv) the setting aside of arable land for environmental purposes for at least 20 years; v) the maintenance of land withdrawn from agriculture or forestry.

The Regulation leaves much freedom in program implementation to Member countries. According to article 3, the promotion measures may be taken either within special programs for specific areas taking account of their particular state of the physical and environmental conditions, and of the given structure and product mix of agriculture, or as "horizontal" measures offered everywhere in the country. Member countries have to submit their draft programs to the Commission, and these are examined by the STAR Committee on Agricultural Structure and Rural Development as to whether program objectives and measures are in accordance with the Regulation. After approval they may be implemented by Member countries. The EC takes over up to 50 per cent of the total costs of the programs, and in objective 1 regions up to 75 per cent. In 1995 total expenditures of the EC for the accompanying measures did not amount to more than 2 per cent of all EC expenditures on agriculture.

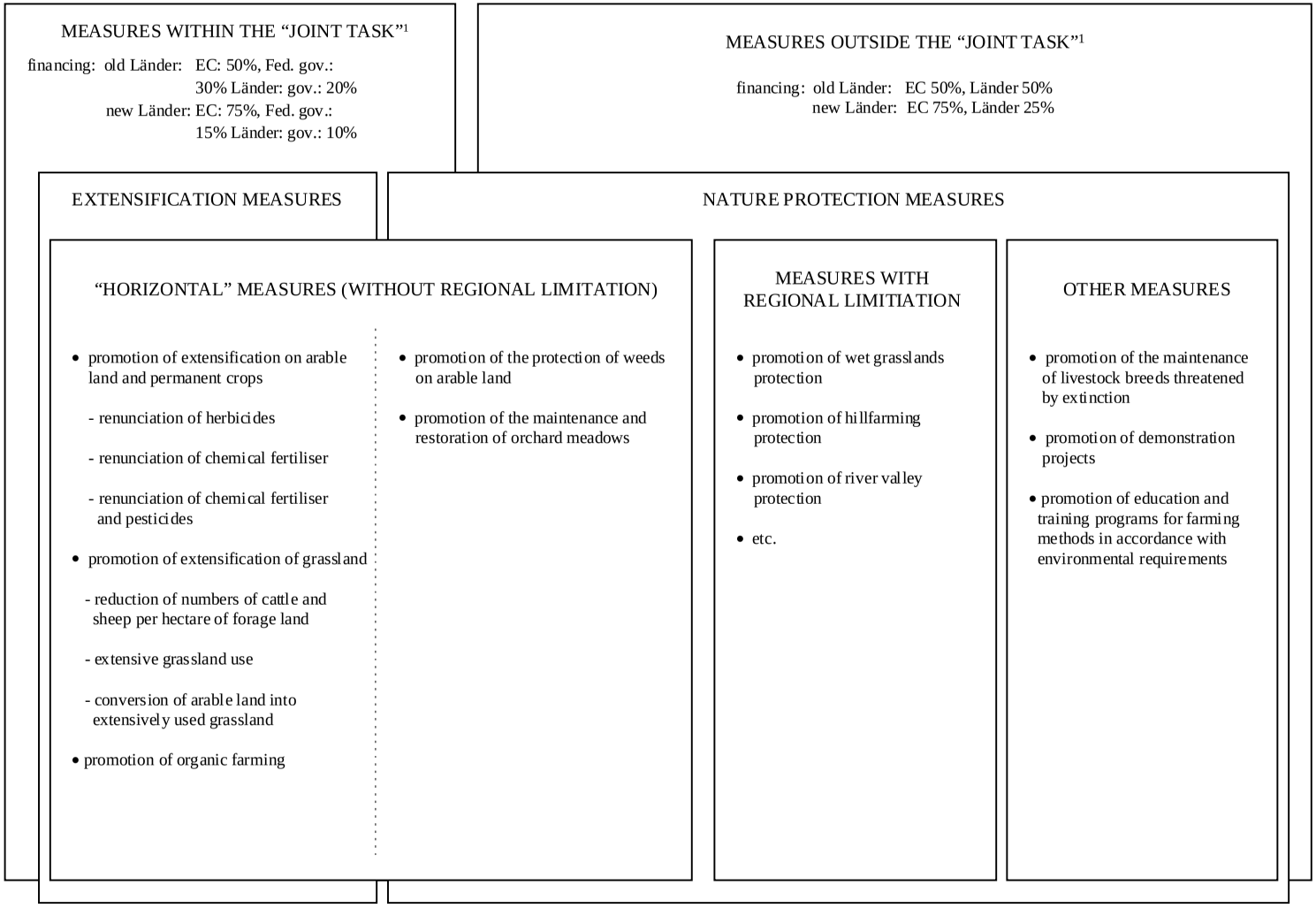
1. The implementation of Regulation (EEC) 2078/92 in the Federal Republic of Germany

In the Federal Republic of Germany the federal government and the Länder are both responsible for implementation and execution of Regulation (EEC) 2078/92. They set up promotion programs according to article 3 and execute them for their respective territories. The federal government acts as a mediator between the EC-Commission and the Länder and to a certain degree as a coordinator among the Länder. In addition, within the framework of the so-called "joint task for the improvement of agricultural structure and coastal protection" the federal government participates in designing and financing measures, from which it expects not only environmental improvements but also decreases in farm commodity market surpluses. Among those measures are the support of abstaining from the use of chemical fertilizers and pesticides, of reducing of the number of cattle and sheep per hectare of forage land and of turning of arable land into extensively used grassland. For these measures particular promotion principles have been established, including among others considerably lower premiums per hectare or per livestock unit than those permitted under article 4 of the Regulation.

The federal government participates by taking over 60 per cent of the program costs of the Länder. However, the Länder alone have to share with the EC the costs of all measures predominantly pursuing nature preservation objectives without participation of the federal government. Such measures include regionally limited programs for the protection of particular biotopes like wet grassland, hills, river valleys etc. as well as "horizontally" offered programs to protect certain weed species on arable land, orchard meadows, or livestock breeds threatened by extinction. As a whole, in Germany the Regulation has been implemented in a decentralized manner, but with some central elements. Table 1 presents some of the essential characteristics of the system of promoting positive environmental impacts of agriculture according to Regulation (EEC) 2078/92 in the Federal Republic of Germany.

Regulation (EEC) 2078/92 has been implemented without delay by most German Länder. In setting up programs according to article 3, Länder governments more or less referred to the specific shape of the EC-extensification program under their responsibility and to their own particular programs for nature preservation, which of course had to be adapted to requirements of the new Regulation. In particular, programs were quickly implemented by those old Länder which like Bayern and Baden-Württemberg had already had EC-cofinanced programs according to article 19 of Regulation (EEC) 797/85 or article 21 ff. of Regulation (EEC) 2329/91, as well as in the "new" Länder Sachsen and Thüringen, which had been assisted by the Länder Bayern and Baden-Württemberg in organizing their administration after German unification. Delays in implementation of the Regulation in

Table 1. Structure of programs, measures and financing of the promotion of agricultural production methods in accordance with environmental requirements according to Regulation (EEC) 2078/92 in the Federal Republic of Germany



1. Joint task of Federal and Länder goverments for the improvement of agricultural structure and coastal protection.

some of the Länder may be attributed to various reasons, among others to an increased scrutiny in program examination and approval by the Commission and to the ceiling of EAGGF funds provided for cofinancing. From beginning of 1995, some programs under Regulation (EEC) 2078/92 are being offered in everyone of the Länder. After implementation of Regulation (EEC) 746/96 has finally been published, a prompt approval of the remaining programs now seems likely.

During the first five-year period 1993-97, about DM 2 billion will be available from the EAGGF for cofinancing the Regulation in the Federal Republic of Germany. Together with funds to be provided by the federal and the 16 Länder governments there will be a financial volume of up to DM 3.5 billion, averaging up to DM 700 million per year. Compared to the situation before the introduction of Regulation (EEC) 2078/92 this means an increase in funds annually available for improving environmental impacts of agriculture by 40 per cent. There exist, however, large differences between the Länder. In general, the percentage increase in available funds is higher in the new Länder (former German Democratic Republic) than in the old Länder, although starting from a lower base than there.

Dividing the total funds annually available for promotion of farming methods in accordance with environmental protection requirements according to Regulation (EEC) 2078/92 in the Länder by their respective areas of agriculturally used land yields a very crude measure, which shows the average sum per hectare in the Länder varying between DM 15 and DM 250. In the new Länder funds annually available per hectare average DM 83, almost twice as much as in the old Länder, and among the latter ones, funds per hectare are on average higher in the more wealthy Länder of Southern Germany than in the poorer Länder of the North. Participation of Länder governments in funding varies among the old Länder between about 50 per cent in the South and about 30 per cent in the North, while in the new Länder it amounts to between 25 per cent in Sachsen and 15 per cent in Sachsen-Anhalt. These differences may be due to various reasons, among others to differences in experiences with former programs, in program structures and in political priorities between the Länder. The participation of the federal government seems to have contributed to some mitigation of interregional differences.

Nine out of the 16 Länder offer programs within the “joint task” with financial contribution of the federal government, of which the Länder Berlin, Bremen and Thüringen make only small use of federal funds. From 1996, the Länder Hamburg, Hessen and Mecklenburg-Vorpommern will use federal cofinancing for parts of their programs. Only the Länder Baden-Württemberg, Bayern, Rheinland-Pfalz and Sachsen have implemented their programs completely outside the “joint task” and therefore without any federal cofinancing. In those Länder which have implemented programs with financial contribution of the federal government, the part of the total financial funds available under Regulation (EEC) 2078/92 provided for these purposes averages about 45 per cent, in the old Länder about 58 per cent, and in the new Länder only 34 per cent. Of funds foreseen for these purposes within the “joint task” in 1995, 82 per cent have been provided for promoting a lower intensity of grassland use, 11 per cent for promoting organic farming and 7 per cent for other methods of extensification on arable land and permanent crops. Among Länder programs implemented outside the “joint task” and therefore without federal cofinancing, the part of funds provided for other kinds of measures is considerably higher. Thus, with exception of the more wealthy among the old Länder, most Länder have indeed used their chances of getting financial assistance by the federal government for implementing Regulation (EEC) 2078/92.

According to available information, in 1996 in the Federal Republic of Germany altogether applications for promotion according to Regulation (EEC) 2078/92 have been made for a total area of about 5 million hectares, about one third of agriculturally used land (Table 2). However, out of these, almost 2.9 million hectares have been under so-called “basic environmental promotion” programs which are offered in Bayern and in Sachsen with relatively low premiums per hectare essentially for observing “good agricultural practices”, and which cover about 85 per cent of the farmland in Bayern and 45 per cent

of the farmland in Sachsen, partly in combination with other measures. About 1.2 million hectares of grassland, one fifth of the total permanent grassland area in Germany, are envolved either in some "horizontal" extensification program or in regionally limited programs for preservation and maintenance of particular types of grassland. On about 660 thousand hectares of arable land and about 50 thousand hectares of permanent crops the introduction or maintenance of less intensive production methods are being supported.

Table 2. Agricultural environment programmes, 1994/95 (Details as at 15 April 1996)

No.	Category	Applications (number)	Area/animals (hectares /LSU)
1.	Meadow and pasture land	148 521	1 209 987
2.	Reduction of cattle herd and sheep flock sizes (in LSU)	142	3 604
3.	Arable land	104 082	660 534
4.	Perennial crops and wine	50 294	50 219
5.	Organic farming methods as per Regulation (EEC) No. 2092/91	5 588	112 864
6.	Areas of special natural interest	10 480	14 051
7.	Endangered livestock breeds	1 727	8 399
8.	Endangered useful plants	-	-
9.	Long-term set-aside (20 years)	255	546
10.	Upkeep of abandoned land	366	2 479
11.	Demonstration projects	20	-
12.	Environmental training projects	300	-
13.	Traditional land management	2 894	26 922
14.	Basic environmental promotion	135 368	2 879 249
	Total:	**460 037**	**4 956 851**

Shaded cells denote figures in livestock units.

2. Regional differences in the application of Regulation (EEC) 2078/92 in the Federal Republic of Germany

Programs put forward by the Länder in implementing Regulation (EEC) 2078/92 show considerable differences with respect to the number and types of measures included as well as to promotion conditions, particularly regarding the size of the premiums offered. This is no surprise, since the Regulation in Article 3, Section 1, explicitly foresees area-specific programs, which take into account the particular state of physical and environmental conditions and regional farm structures and agricultural production, as well as of regional environmental priorities. As for premiums intended to compensate

farmers' income losses due to program participation and to honour their contribution to environmental improvement, in Article 4, Section 2, only the maximum amounts to be refunded by the EAGGF have been fixed. Thus, a rather wide framework for implementation has been provided, within which interregional differences in the natural, structural and economic conditions of agricultural production, in the need for improving environmental impacts of this production with regard to water quality, nature preservation and landscape maintenance and eventually in the degree to which environmentally compatible farming practices are already in use, may be taken into account.

In as far as these interregional differences in opportunity costs of resources used in agricultural production and in scarcities of environmental goods are reflected in settling the premiums, an efficient interregional resource allocation may be assured and distortions of interregional competition may not occur. The creation of rents cannot be avoided as long as uniform premiums covering average income losses plus a lump sum incentive are being provided since costs caused by observing prescribed methods may widely vary between farms, even within homogeneous regions, due to differences in location, farm structure and farmers' ability. But not all observed interregional differences in premiums seem to be quite in accordance with principles of an efficient ressource allocation and a distribution of public funds matching actual requirements. This may be illustrated by the example of promoting the introduction and continuation of organic farming practices. Table 3 shows the premiums offered in the different Länder.

Regulation (EEC) 2078/92 foresees in article 4 for extensification of those annual crops for which price compensation payments are being paid a refundable premium of up to 150 ECU (≈ DM 353) per hectare, and for other annual crops and grassland a premium of up to 250 ECU (≈ DM 588) per hectare, which may be increased to up to 350 ECU (≈ DM 823) per hectare for farmers who simultaneously accept other management restrictions for the same piece of land. In those Länder, where promotion of introducing or continuing organic farming practices is being realised within the "joint task" with federal cofinancing, the premium has been fixed between DM 150 and DM 300 per hectare, and has been lowered since 1995 to DM 120 to DM 240 per hectare for continuation of organic farming. Thus, these Länder clearly have much less room for action than those who have renounced federal cofinancing. Hence, premiums offered for introduction of organic farming in the first two to three years' period vary between DM 250 per hectare in Schleswig-Holstein (with federal cofinancing) and DM 600 per hectare in Hamburg (without federal cofinancing) and for the fifth year between DM 250 per hectare in Schleswig-Holstein and DM 450 per hectare in Rheinland-Pfalz and Sachsen, which both have renounced of federal funding. Some Länder offer additional basic support for the first 10 hectares as compensation for control costs (Bayern, Hessen, Baden-Württemberg), and some pay higher introduction premiums during the first two to three years than during the following years (Hamburg, Rheinland-Pfalz, Saarland, Sachsen).

In Hessen a basic premium of DM 200 per hectare (up to DM 2 000 per farm) is being offered for joining an organic farmers' organization whereas in Länder like Schleswig-Holstein, Nordrhein-Westfalen and Sachsen membership in such an organization is taken as a non-remunerable precondition for promotion. Some Länder like Rheinland-Pfalz, Saarland and Bayern have restricted the financial volume of promotion for an individual farm to DM 35 000 or DM 24 000 respectively. In Bayern the premium is additionally differentiated according to the number of livestock units kept per hectare. None of the Länder has differentiated premiums according to differences in locational quality. A substantial part of the Länder has reduced premiums for continuation of organic farming in relation to those offered for its introduction. The differences of premiums vary between DM 5 per hectare in Berlin and DM 120 per hectare in Thüringen. Most recently, for the support of less intensive methods in arable farming within the "joint task", i. e. with federal cofinancing, the difference has been fixed at DM 50 per hectare.

Table 3. Premiums for promoting the introduction or continuation of organic farming in the Länder of the Federal Republic of Germany

Land	arable land DM per hectare		grassland DM per hectare		permanent crops DM per hectare	
	continuation	introduction	continuation	introduction	continuation	introduction
Schleswig-Holstein	–	250	–	250	–	–
Niedersachsen	240	300	240	300	1200	1400
Nordrhein-Westfalen	200	300	200	300	960	1440
Hessen[1)]	450[2)]	450[2)]	450	450	1440	1440
Rheinland-Pfalz[3)]	450	450 (550)	450	450 (550)	1100	1300
Baden-Württemberg[4) 5)]	260	260	260	260	1200	1200
Bayern[6)]	300-400[7)]	300-400[7)]	200-300[7)]	200-300[7)]	1000	1000
Saarland[3)]	250[8)]	250 (300)[9)]	250	250 (300)	800	800 (1400)
Brandenburg	255	300	255	300	1020	1200
Mecklenburg-Vorpommern	–	300	–	300	–	1200
Sachsen	450[10)]	450 (550)[11)]	260	260	1300	1300 (1500)
Sachsen-Anhalt	300	300	300	300	1400	1400
Thüringen[5)]	300	300	350	350	1200	1400
Hamburg[12)]	250	300 (600)	250	300 (600)	1190	1400 (2800)
Bremen	250	250	250	250	–	–
Berlin	255	300	255	300	1020	1200

1) plus a basic premium of DM 200 per hectare for the first 10 hectares under the provision of membership in a AGÖL-organization
2) for crops with price compensation payments DM 350 per hectare
3) maximum premium per farm DM 35 000
4) plus DM 40 per hectare for the first 10 hectares
5) under KULAP (Sachsen) and MEKA (Baden-Württemberg) partly additional promotion for the cultivation of protein crops possible
6) plus DM 80 per hectare for the first 10 hectares ; maximum premium per farm DM 24 000
7) depending on the number of livestock units per hectare
8) for vegetables DM 350 per hectare
9) for vegetables DM 400 per hectare
10) for vegetables DM 700 per hectare
11) for vegetables DM 800 per hectare
12) maximum premium per farm DM 30 000
values in brackets: premiums for the first 2-3 years of introduction

The above examples of promotion of organic farming as a horizontally offered program have shown differences in support conditions and premium levels between Länder which cannot totally be ascribed to interregional differences in opportunity costs due to locational and structural factors, but must rather be attributed to other determinants, among which differences in estimating impacts of program participation on farmers' incomes and also differing priorities for the use of scarce public funds may be of some significance. Some of the Länder may also have been motivated by the endeavour to change as little as possible former programs like the EC-extensification program in order to safeguard continuity. Be it as it may, it cannot be excluded that differences in application of the Regulation may have distortional impacts not only on competition of farmers in different regions for public funds but also on competition between regions for resource use and production.

3. A more fundamental criticism of the way in which positive environmental impacts of agriculture are presently promoted

A further aspect of the application of Regulation (EEC) 2078/92 which should be mentioned here concerns the relationship between input and result. As has been shown, the Regulation foresees provision of financial incentives for introduction or continuation of certain agricultural production methods from which a decrease in some negative effects and/or an increase in certain positive effects of agriculture on environmental goods like water, soil, climate, flora and fauna and landscape, and thus an improvement of environmental quality, is expected. Object of the measures is thus farmers' behaviour engendering environmental improvements, but not these improvements themselves. Economists as well as ecologists criticize this "action-" or "input-oriented" way of promotion because causal relationships between changes in agricultural production methods and changes in environmental quality expected from them are frequently not close enough to guarantee attainment of the aspired objectives and also because there are no incentives for farmers participating in promotion programs to be concerned of environmental improvements beyond observance of the prescribed and rewarded management restrictions.

From an economic as well as from an ecological point of view, this kind of support is less effective than "result-" or "output-oriented" promotion measures, in which: i) the level of remuneration of farmers would directly refer to the degree of environmental improvement generated by them; ii) it would be left to farmers to decide by which methods and at which costs they may generate the aspired improvement; iii) the support measure would in any case show a more favourable benefit/cost-relation than an action- or input-oriented promotion.

Convincing as these arguments may seem in principle, an attempt to put them into practice would soon be confronted with serious limitations and problems, some of which will be put forth here:

- A result-oriented promotion of agricultural production methods with improved environmental impacts may best be applied where individual farmers are exclusively able to influence the state of the environment on their farms; it may be suited therefore more for the maintenance or restoration of certain rare flora or fauna species or landscape elements on limited pieces of land than for maintenance or restoration of certain quality standards of ground or surface water, since immissions into ground and surface water cannot clearly be assigned to individual emission sources.

- With action-oriented kinds of promotion, the fund-supplying institutions have to control observance of management rules by participating farmers, which in general works best in the case of clear prohibitions or prescriptions of defined actions and which may be effectively supplemented by social control in the neighbourhood. Efficient control of improvements of the state of the environment may be realized in cases of limited pieces of land and where the answer is "yes" or "no", while an unequivocal measurement of "more" or "less" achievement of environmental improvement on large areas may not only be quite expensive but also raise methodological problems.

- Whilst with action-oriented kinds of promotion the premiums offered will be determined according to average opportunity costs of production methods to be fostered, result-oriented kinds of promotion lack a similarly practicable method of premium fixing. Basis for determining premiums would of course have to be the value of the aspired environment improvement for its users. Where benefits of environment improvements to unauthorised persons may at least partly be excluded, the price of these improvements may be determined by direct negotiations between authorized beneficiaries and farmers. Where these preconditions cannot be fulfilled, the value of environmental improvements would have to be estimated by surveys of the respective willingness-to-pay of the local population or visitors - an expensive and with respect to its potential results not even very reliable procedure.

Other methods to determince the level of premiums to be offered for certain environmental improvements will more or less approximate their opportunity costs similarly to that used in action-oriented kinds of promotion.

– The willingness of farmers to participate in action-oriented promotion programs will cet. par. always be high as long as premiums offered cover somewhat more than the income foregone due to management restrictions. In result-oriented promotion programs farmers will only be willing to participate if environmental improvements for which premiums are promised will appear within a limited time period and to some degree of certainty. Otherwise, the necessary change in production methods would be like high-risk investments, which would limit the readiness to participate of farmers who are not particularly risk-seeking and/or engaged in environment protection on moral reasons. Inadequate degrees of participation, however, may soon more than outweigh the potential advantage of higher efficiency of result-oriented kinds of promotion.

The arguments presented above may have made it quite clear, that a complete substitution of the presently applied action-oriented type of promoting improvements of environmental impacts of agriculture by a result-oriented type of promotion would not be practicable and therefore not be advisable. However, it seems definitely conceivable to supplement the promotion systems presently in practice by certain elements of a result-oriented promotion in order to improve their efficiency.

GERMANY: CONTRIBUTIONS OF AGRICULTURE TO THE CONSERVATION OF BIODIVERSITY IN CULTIVATED LANDSCAPES POSSIBILITIES - LIMITS - PROSPECTS

by
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Introduction

Since the Conference of Rio at the latest, conservation and promotion of species diversity, the so-called biodiversity, have been recognised as a global ecological challenge. For the protection of biological diversity which has evolved over millions of years should not only be assessed with ecological, economic, scientific, aesthetic and ethical considerations in mind; biodiversity is at the same time the prerequisite for future evolution.

Comprehensive strategies for nature conservation should, therefore, be aimed at the preservation or promotion of the stand of species typical of a region - not only rare and endangered species - as a genetic resource and as the basis for the conservation of the functioning of ecosystems (protection of biotic resources). As a rule, the conservation of all species of a natural area, if possible, is only feasible if their habitats are safeguarded in an adequate size and distribution simultaneously. This in turn presupposes that the protection of the resources soil, water and air is guaranteed (protection of abiotic resources). It follows necessarily from this that agriculture and forestry play a decisive role in the realisation of the above-mentioned goals since agricultural and forestry uses predominate in most cultivated landscapes of Central Europe in terms of surface area. (60-90 per cent)

In the following, first of all an account is given of how species diversity has developed in Central Europe since the Neolithic period and how the current situation of species protection should be assessed. Following that, the current framework conditions, existing options, successes and limits of species protection in today's agricultural ecosystems are represented on the basis of concrete examples before some economic requirements for a sustainable and efficient conservation of biodiversity are pointed out in conclusion. (see on this point the annex "Ecological services rendered by agriculture and their rewarding - theses, framework conditions, recommendations")

Unfortunately, it seems that politics and also large parts of society still attach less importance to our natural heritage compared with the cultural heritage. But are cultivated landscapes rich in species and of manifold shapes which go back 1 000 to 6 000 years really less valuable than cultural monuments from the Roman period, the Middle Ages or even modern times? Are animal and plant species which emerged as early as 10 000 or 100 000 years ago less important than hand-axes, paintings, sculptures or other testimonies of cultural history?

1. Effects of historic forms of use on nature and the landscape

Increase of species diversity and temporary over-utilisation of landscapes

It is common knowledge that the development of the natural landscape predominantly covered with forest to a more or less open cultivated landscape over the past 6 000 years until approx. 1800 has led to a considerable increase in species of flora and fauna in Central Europe (Fukarek 1979). The enlargement of the indigenous flora and fauna resulted from various, mainly extensive land uses which brought forth completely new types of biotopes such as, for example, meadows, pastures, heaths, xeric grassland communities and fields. On the one hand, these so-called open biotopes were settled by indigenous species of the forests, forest shelter belts, borders as well as species of natural habitats free of forests. On the other hand, plants and animals from neighbouring regions of flora and fauna could also migrate to the anthropogenic biotopes.

Despite the increase in the number of species it should not be ignored that there have also been a number of local and regional environmental problems over the past centuries. Over-utilisation and a strong decline in forests, soil devastation, erosion, heathication etc. testify to this. Thus, between 1800 and 1850, the share of forests in many low mountain ranges in Germany, for example, only amounted to 10-15 per cent in some parts (today about 40-60 per cent) while there has been a disproportionately strong rise in "wasteland" and fields.

With regard to most of the extensively used biotopes (in particular lime and silicate dry lawn, dry meadows and rough pastures) it seems, however, that contrary to the opinion of some authors (e.g. Wulf 1995) there have been none or only minor soil degrading processes compared to natural forests of corresponding sites. Soil tests bear witness to this at any rate. (e.g. Schumacher 1988, Matzke 1985, Krause 1991, Klingenstein & Krause [measuring results of 1993 to 1995], Boeckmann & Pfriender 1995). Dwarf shrub heaths on the contrary have to be judged differently since their adverse effects on the soil structure, base and nutrient supply are sufficiently known.

Evolutionary biological differentiation processes in extensively used biotopes

With the development and use of open biotopes, evolutionary biological processes had also been triggered off simultaneously which led to the emergence of new taxons. Thus, interestingly enough, the predominant number of taxons (partly endemic!) which newly emerged in the Holocene over the past 12 000 years in the central European area are tied to open biotopes (cf. Korneck and Sukopp in Hampicke 1993). This is apparently connected with the fact that the selecting site factors have a stronger effect at the places uncovered with forest than under the "compensatory" canopy of the forests. Moreover, the changed conditions of competition as well as the diverse uses through cutting, trampling, browsing etc. should have an effect, too.

Ehrendorfer (in: Heywood 1968) examined this phenomenon in the sixties already, namely by taking heather bedstraw as an example (*Galium pumilum*) in an area near Vienna which is characterised by several exposures, differences in altitude and uses. Investigations at our institute exemplified by the collective species *Rubus fruticosus* (blackberry) inter alia also furnished sound evidence for the thesis formulated above: several taxons (small species, subspecies, varieties or ecotypes), most of them dependent on open biotopes, must have newly arisen in the Holocene - also in the course of the evolution of cultivated landscapes. Thus, about 95 taxons of the collective species *Rubus fruticosus* have at present been recorded for the Lower Rhenish bay and the Eifel area. 63 of those can only subsist in open biotopes, apparently they also came into being there in the Holocene (Matzke-Hajek 1993). Actually, these and

other to some extent still undescribed taxons of different collective species (e.g. *Festuca ovina agg, Ranunculus auricomus agg., Allchemilla vulgaris agg.* etc), which can be classified as a result of the so-called microevolution in the course of the development of cultivated landscapes, should be more precisely identified with the help of DNA-fingerprinting than has hitherto been possible. Here, research initiatives should set in more strongly in the future.

If I said above that extensively used open biotopes of our cultivated landscapes are to be placed on the same footing as natural ecosystems with respect to evolutionary biology, this applies to the flora for the time being. If and to what extent this also holds true for the fauna remains to be clarified.

2. Development trends since the fifties of this century

Characteristics of intensive agriculture

Over the past fifty years, the system-inherent contribution of historic agriculture to the conservation of species and biotopes had inevitably declined to the same degree as the intensification of agriculture has increased. In many regions this development started at the beginning of the fifties until the beginning of the sixties, in other areas five to ten years later. Presumably, this development has had a more serious impact on nature, landscape and the environment than the entire interference with nature and the landscape since the Middle Ages.

Since the 70s, the adverse effects of the intensification of agriculture have become increasingly visible. Since the mid-80s at the latest, they have also become known to the wide public, thus a broad outline of them should suffice. At that time and to some extent still today, the steep increase in nitrogen fertilization, use of biocides, amelioration and land consolidation, shortening of crop rotation, large-scale livestock farming, uncoupling of operating cycles etc. have been at the centre of attention as characteristics of modern agriculture.

To some degree, the local and regional effects on nature, landscape and the environment were substantial. Regionally, they led to the loss of richly structured and ecologically significant cultivated landscapes and to the emergence of monotonous production landscapes. The effects ranged from nitrate and biocide problems in soils, waters and ground-water to air pollution and produced a large-scale eutrophication of the landscape. As a result of the above-mentioned effects, an unprecedented reduction of species diversity occurred in some regions manifesting itself visibly in the Red Lists of endangered plant and animal species.

Level of nitrogen and decline in species

Nitrogen can change natural as well as anthropogenic ecosystems in a more far-reaching manner than all other environmental factors, to some extent even irreversibly. Leaving drainage and irrigation schemes out of consideration for once, very high applications of nitrogen fertilizer have the most adverse impact on biotic and abiotic resources. In the process, the indirect effects are frequently on account of locational changes more serious than the direct ones. Thus, it is not surprising that the eutrophication - to some extent even hypertrophication - of entire regions is currently deemed the most pressing problem of nature conservation due to high nitrogen surpluses (cf. Ellenberg,1989) even though the effects of biocides and other parameters of intensity should not be neglected.

That terms such as “extensive” and “intensive” with regard to the environmental factor nitrogen should be treated in a much more differentiated way than has so far been customary is illustrated by

diagram 1 which is based on five stages of intensity (extensive to highly intensive). Highly divergent interpretations are possible according to the stage from which a comparison starts out.

A farm with 250 kg N/ha on average would call a nitrogen fertilization of 150 kg N/ha extensive, whereas the same level would already be considered intensive from the viewpoint of a farm with 100 kg N/ha. Thus, the initial level of nitrogen fertilization always has to be taken into account in extensification schemes. If this level ranges from high to extremely high, it would be more appropriate to talk about de-intensification at first (cf. Haber, 1991).

Many plant and animal species of open biotopes which used to be relatively common, but have become rare or endangered in the meantime, have slim chances of survival given a high nitrogen level since they depend on mesotrophic to oligotrophic sites (like many types of forests as well, incidentally). From that perspective it becomes understandable that the review of the Red Lists turns out even worse if broken down by regions, e.g. in intensively used landscapes. In this connection, the stand of species around 1850 constitutes an important basis of comparison for the drawing up of the Red Lists, but by no means the decisive one. For the authors of the red lists are aware of the fact that the species decline which occurred in the 20th century and, in particular, during the post-war period has been appreciably more dramatic than in the 19th century and furthermore can be documented much more precisely in terms of source material.

Most specialists agree that there has never before in the history of mankind been such a massive decline in species in such a short period of time than over the past decades and that this phenomenon is not only confined to Germany, but exists on a worldwide scale!

3. Species conservation in the ecosystems of today´s cultivated landscapes

If and under which conditions, a conservation of the still existing biodiversity is possible in the ecosystems of today´s cultivated landscapes which are marked by agriculture is shown on the basis of the following observations. In this context, the connection between efficiency in species conservation and the level of nitrogen (trophy stage) will be highlighted in particular.

Natural and semi-natural ecosystems

Natural and semi-natural ecosystems are either completely missing in many cultivated landscapes of Central Europe or their share of surface is rather low. It is, therefore, one of the most urgent tasks of nature conservation to secure intact highland moors, beech, oak, fen and river-meadow forests, rocky slopes etc - provided that they still exist - on a permanent basis and keep them entirely or in parts free from use and that in all types of landscapes. Moreover, every opportunity should be seized to increase the share of this and other natural or semi-natural ecosystems in the long term, e.g. by establishing preserves of natural forests and closed forests and by creating semi-natural riversides, succession of fallow land etc.

Extensively used ecosystems of the historical cultivated landscape

In this category, the highest efficiency with regard to the conservation of species and biotopes is given as a rule if still existing extensive uses are safeguarded in good time and on a long-term basis. This applies, in particular, to ecosystems which have traditionally been subjected to an extensive use such as dry lawns, heaths, wet and dry meadows and rough pastures, for example, which covered a relatively large

surface in many landscapes of Germany until well into the sixties. In cultivated landscapes rich in species and structures, priority should thus be given to the financial promotion of still existing extensively used biotopes over undifferentiated extensification measures provided that the protection of abiotic resources is ensured in the region. Yet, it has to be stressed again that a use on such a low level of intensity as it is, for example, required for the above-mentioned ecosystems can neither by conventional nor by integrated farming be practised economically, but just as little by organic farming which, as is generally known, cannot be equated with the historical extensive agriculture. The following consequences ensue from this:

- The above-mentioned ecosystems can only be preserved under the present economic conditions if their extensive use is adequately remunerated as an ecological service, whether via programmes of nature conservation or regional product marketing.

- Such an extensive use is only acceptable from an ecological point of view if it is tied to local farms so that the accumulated biomass can be integrated into cycles.

My own experience with the extensive use of about 600 hectares of dry lawn, heaths, limy swamps etc. (Schumacher 1992, 1995) in the Eifel area documents that under the current conditions, too, species protection can be practised successfully given an adequate use of funds, professional implementation and close co-operation with agriculture. In case of rare and endangered species substantial increases in populations have been recorded for years (see Tables 1 and 2).

Current agroecological systems

Fields

More than 15 years of experience now with the field periphery programme (Schumacher, 1980, 1984, 1994, for further literature see Hilbig & Illig, 1987, Hilbig, 1994) have shown that a high efficiency - at least with regard to the weed plant vegetation - on herbicide-free margins can always be noted when a high seed supply still exists in the soil, and less productive fields are concerned (< 70 dt/ha), frequently in special sites such as lime weathered or sandy-gravelly soils. In many regions, a marked increase in rare and endangered field weeds can be recorded, in some parts even so strong that some species are regionally or nation-wide no longer endangered (cf. *inter alia* Schumacher, 1980, 1984, 1994, Oesau, 1987).

On deep high-yielding soils (> 70 dt/ha), however, only moderate successes can frequently be attained even with an adequate seed supply since the field weeds are suppressed by grain on account of the strong shading. An improvement for the weed plant vegetation and the dependent fauna can in this case only be achieved if the starter dressing with nitrogen furthering the stocking of the young grain is dispensed with in spring or the nitrogen fertilization is reduced altogether.

This makes plain that an integration of nature conservation and agriculture on the same area, whether on margins or completely unsprayed fields is possible. Nonetheless, the limits for the protection of field biocoenoses on intensively used areas become clear at the same time. Incidentally, organic farming where in the economic interest just as much care has to be taken that the share of field weeds is kept in check is a similar case. This can be achieved by variety selection, mechanical weed control e.g. with the harrow comb and by the flame weeder method, too, if appropriate. Given a sound knowledge and experience, the weed infestation can be considerably reduced in this way even without herbicides. Nevertheless, on top of this a contribution to species conservation is made here even though at a distinctly lower level compared with the fifties.

Table 1. Increase in the number of rare and endangered varieties of plants of calcareous grassland within the rural district of Euskirchen/Germany between 1985-1994 after primary and long term cultivation by farmers (period compared: 1973-1982)

Increase	Varieties of calcareous grassland	
50-100 per cent	Epipactis atrorubens Filipendula vulgaris Gentinanella ciliata Orchis morio Seseli annuum	Dark-red Helleborine Dropwort Hairy Gentian Green-winged Orchid Seseli
> 100 per cent	Gentianella germanica Hypochoeris maculata Ophrys apifera Orchis mascula Orchis purpurea Phleum phleoides Phyteuma orbiculare Platanthera chlorantha	Chiltern Gentian Spotted Cat´s Ear Bee Orchid Early Purple Orchid, Blue Butcher Lady Orchid Purple-stem Cat's Tail Round-headed Rampion Greater Butterfly Orchid
> 300 per cent	Coeloglossum viride Coronilla vaginalis Dianthus carthusianorum Gymnadenia conopsea Ophrys insectifera Orchis militaris Orchis ustulata Pulsatilla vulgaris	Frog Orchid Crown Vetch Carthusian Pink Fragrant Orchid Fly Orchid Soldier Orchid Dark-winged Orchid, Burnt Orchid Pasque Flower
> 500 per cent	Acreas anthropophorum Antennaria dioica Hippocrepis comosa	Man Orchid Mountain Everlasting , Cat's Foot Horseshue Vetch

The situation regarding the microfauna of the fields is still more complex. It is true that, as animal ecological investigations of herbicide-free field margins (e.g. Welling 1990, Fritz-Köhler 1991, Raskin et al. 1992, Raskin 1994) have shown, a promotion of insect fauna can also be noted. High efficiency, however, is as a rule only given if the interim structures for the hibernation of many species - field margins, shrubs, hedges, groups of trees etc. are there as well.

Meadows and pastures

Extensification schemes on grassland are often viewed favourably with regard to their importance for species and biotope conservation. This assessment is based on the fact that many rare or endangered plant and animal species are tied to the various grassland communities. Presumably, previous experience made by the federal laender with the programmes of grassland extensification also plays a certain role. Yet, that the assessment is not so simple, provided that extensification is actually concerned and not the maintenance of extensive uses, has repeatedly been mentioned in the preceding chapters. For the trophic starting level and the respective soil type are of decisive importance on grassland more than with regard to farming.

Table 2. Number of individuals of selected species compared over a period of many years

Species	Area of examination	Number of individuals	
		1973-1982	1985-1994
Aceras anthropophorum - Man Orchid	Tiesberg/Hülseberg/Iversh. Schafberg/Pesch Bürvenicher Berg Griesbeuel/Alendorf	~150 ~20 ~450 23	~1400 ~530 ~1500 ~150
Coeloglossum viride - Frog Orchid	Kalkmagerrasen/Wachendorf Griesbeuel/Alendorf Schleifbachtal/Nettersheim Sistiger Heide	7 ~40 ~20 ~500	7 ~40 ~20 ~500
Dianthus carthusianorum - Carthusian Pink	Griesbeuel/Alendorf Lampertstal/Ripsdorf Tiesberg/Iversheim Wachendorfer Mooth	~3000 ~2000 ~250 ~500	~12000 ~7000 ~500 ~1500
Ophrys apifera - Bee Orchid	Bürvenicher Berg Kuttenber/Eschweiler Tiesberg/Iversheim Kalkhang/Eiservey	~70 ~50 ~20 ~80	~450 ~150 ~35 ~300
Gymnadenia conopsea - Fragrant Orchid	Froschberg/Seidenbachtal Höneberg/Ripsdorf Eierberg/Alendorf Wachendorfer Mooth	~12000 ~3500 ~5000 ~3000	~50000 ~10000 ~20000 ~3700
Orchis ustulata - Dark-winged Orchid/ Burnt Orchid	Steinacker/Alendorf Griesbeuel/Alendorf Auf Aß/Ripsdorf Kalkhänge/Gilsdorf	15 ~50 35 ~500	45 ~220 100 ~1850

Source: Author´s own stock-taking; Opitz, Möseler, Müller, AHO a.o.*

Before biocoenoses which are rich in species can regain suitable living conditions, a more or less long impoverishment phase is first of all required in the case of soils high in nitrogen. In case of heavy high-yielding soils this can take 10 to 20 years or even longer (cf. Schiefer 1984). The impoverishment of eutrophied grassland sites can only be successful if the withdrawal of nutrients occurs primarily through cutting which, as with intermediate fellings, has to be carried out relatively early at least in the first two to three years. By way of contrast, a late cutting as it is envisaged in most programmes of nature conservation prolongs the impoverishment phase. It can even lead to the discharge of nitrate in the first few years. Thus, the transition to later dates of use geared to the respective historic management is sensible only when the biomass production has markedly declined. According to the duration of impoverishment and the site (light or heavy soils) contributions to the conservation of species diversity can be made at totally different levels and with regard to certain groups of organisms in a similar way as in farming.

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* The largest number of individual plants per year were in each case used as a basis, supported by counts and/or estimates during the period of observation

As a rule, intensively used meadows, pastures and additional sowings on grassland (> 150 kg N/ha) are, due to the dense, high-yielding stands poor in species as well as the early and frequent use for flora and fauna, of none or at best minor importance. Still they can by all means be ecologically compatible, especially as regards deep, cohesive soil. In case of semi-intensively used grassland (100 to 150 kg N/ha) e.g. lolium and white clover meadows or tall oat meadows with relatively high growth rates, the contribution to species conservation for the flora and the dependent microfauna is in most cases equally insignificant. For certain meadow and wading birds this can already result in an improvement of living conditions. Here, the protection of abiotic resources is generally guaranteed.

Semi-extensively used stands (50 to 100 kg N/ha), for example tall oat and golden oat grass meadows, cabbage thistle meadows and red fescue dog´s tail pastures, which are relatively rich in species and to some extent also floriferous are basically of an average, often even great importance for species conservation. In this context, the limit of 100 kg N/ha is of particular relevance since experience shows that stands rich in species of the above-mentioned plant communities cannot last or develop above this nitrogen level.

In case of extensively managed meadows and pastures (0-50kg N/ha, to some extent with phosphurus potassium fertilizer), e.g. tall-oat and golden-oat meadows, baldmoney meadows and rough pastures with an abundance of species, which are practically confined to low mountain ranges with a higher area percentage, great importance is attached to flora and fauna as well as to the protection of abiotic resources (the latter also applies to semi-extensively used stands).

A similar rule as to dry lawns can be applied to extensively to semi-extensively used meadows and pastures. They can only be preserved on a larger surface through integration in agricultural use. However, this presupposes that the energetic feed value of the growths is not too low. My own research in collaboration with the Institute for animal nutrition of the University of Bonn (Hansen, Saakel & Schumacher 1994, Rodehutscord 1994) led to the conclusion that the feed value of meadows which have been extensively used for years with NEL values of 4.8 to 5.4 (conventional hay 5.6 on average) is clearly better than has so far been assumed (see also JILG and Briemle 1993). An integration of this feed in efficient grassland farms can by all means be deemed realistic as can be substantiated by many years of experience with the use of more than 1 500 hectares of meadows and pastures rich in species by about 150 farm enterprises (two-thirds of which are full-time farms) (Schumacher 1988, 1992 b). In doing so, one proceeds on the following assumptions: the farm has sufficient grassland at its disposal so that 25 to 30 per cent of the farm area can be used extensively while up to 75 per cent of the farm area is managed in an intensive, but environmentally sound fashion (e.g. limitation of stocking and nitrogen fertilization in case of about 1.4 livestock units per hectare).

Lasting interim structures

For a functioning agricultural landscape meeting ecological and recreational requirements, meadows rich in species and unsprayed field peripheries or fields are not sufficient as colourful as they may be. At least as important, especially with regard to the microfauna, are lasting interim structures presenting themselves as a supplement to field peripheries which are managed free of herbicides or extensively used meadows and pastures. These plots which are either not to be used or extensively used taking the shape of bank verges, borders and hedges are habitats and refuges for flora and fauna. In general, they constitute indispensable elements for the biotope system or networking in accordance with an integrated and/or ecologically-orientated land-use management (cf. Müller 1995).

Formerly, interim structures existed more or less in all agricultural landscapes. In the past few decades they have also been ploughed up and cultivated in many places. Where they still exist - even if on too small a scale - they are frequently more or less degraded by the adjunct agricultural use. The establishment of lasting interim structures could occur in the course of the compulsory set-aside operative in the European Union of currently 10 per cent of the fields and/or in the context of the "accompanying measures of the agricultural reform of the Community" (Schumacher & Münzel) as has been practised since this year in North Rhine-Westphalia. A smaller part of the areas to be set-aside could be used alternatively for rotational fallows since the self-planting exerts a positive effect on the weed flora and fauna provided that the existing nitrogen level was not too high. In case of eutrophic sites, however, an additional sowing would be advisable due to the high potential for nitrate leaching.

4. Conservation of the biodiversity of agricultural ecosystems — prospects or illusion?

The preceding chapters showed which possibilities for the conservation of biodiversity of agricultural ecosystems currently exist according to region, site and trophic level. At the same time, however, the frequently very narrow limits became obvious whether with reference to the economy or agricultural structure or conditioned by the high population density or the changes in sites which are to some extent irreversible.

If agriculture in Germany as well as in other countries of the European Union were to play not merely a marginal role as at present, but an essential role in the conservation of biodiversity, the corresponding framework conditions would have to be created. This calls above all for a recognition of the conservation and the promotion of the still existing species diversity as an ecological service and its adequate rewarding (c.f. on this point the annex "Ecological services rendered by agriculture and their rewarding - theses, framework conditions, recommendations").

Should this prove successful, the precondition would be given for agriculture to take species conservation in regions marked by a relatively high species diversity as an integral production target with economic prospects besides food production into account and not as before rather as an illusion. The previous programmes for nature conservation and cultivated landscapes of the EU-states are a first step in this direction, but they frequently require corrections of a a material and organisational kind and they are most of all in need of an enlarged financial framework.

Annex. Ecological services rendered by agriculture and their rewards: theses, framework conditions, recommendations

1. Preliminary remark

The following statements reflect the most important conclusions of the DAF meeting of the same name which took place in November 1994 in Bonn. They are essentially based on the presented papers and on the contributions to the discussion. It is true that not all views, recommendations and proposals could be addressed in the author´s revision on hand. All the same, it offers a sound basis for discussion for the urgently required social consensus on the issue of ecological services as well as for their enhanced practical implementation. Both aspects now call for further constructive efforts in the scientific community, politics and the public.

2. Definition and basis of comparison of ecological services

Those services which contribute to the conservation and improvement of the functioning of nature and landscape and specifically with regard to the abiotic (soil, water, air) and biotic resources (plant and animal species including their habitats) are referred to as ecological services. In Germany and large parts of the European Union, the definition of ecological services cannot be geared to the pattern or alternative of an unspoiled landscape with hardly any people or none at all. Inevitably, the basis of comparison has to be cultivated landscapes marked by agriculture and forestry with their supply and disposal functions which, however, according to population density show varying area percentages of ecosystems ranging from unused to extensively used and from natural to semi-natural ecosystems.

With regard to the abiotic resources, a use consistent with the current principles of "proper farming"[17] constitutes the minimum standard for farming which is adapted to the site and ecologically compatible. If the (minor) substance inputs in water, soil and air which even with proper farming cannot be avoided are to be further lowered for reasons of precaution, the measures required to this end are to be regarded as ecological services as well. With reference to the biotic resources, measures going beyond the safeguarding of abiotic resources and which - as has been well-documented — serve the conservation and promotion of the site and habitat-specific species diversity (biodiversity) are generally to be viewed as an ecological service. The conservation of the appearance of the landscape (aesthetical resource protection) or in general of the cultivated landscape etc. does not form part of the above-mentioned ecological services. The designation "services for countryside improvement" would be more appropriate in this context.

3. Examples of ecological services in farming

Ecological services can be rendered by: i) active action, e.g. the establishment and maintenance of hedges and wetlands; ii) continuation of an extensive utilisation of grassland biotopes which are rich in species; iii) extensification of a use of grassland or fields which has hitherto been intensive, but concerning abiotic resources environmentally compatible in favour of the promotion and conservation of species diversity; iv) a general abandonment of use in favour of biotic and abiotic resources, in particular by the creation of interim structures which are either unused in the long term or extensively used (field peripheries, verges of banks etc.) in agricultural landscapes, through natural forest patches, old growth and dead wood in commercial forests as well as succession areas in river meadows and on other suitable sites etc.

Ecological services for the conservation and improvement of biotic and abiotic resources could on a larger scale only be rendered by agriculture and forestry. If it is a matter of openland biotopes for the conservation of which an extensive utilisation is required, solely farms come into consideration for only they are in a position to utilise the accumulated biomass appropriately through grazing or pruning use and return it to the cycles.

A "museological" maintenance of biotopes and landscapes through farms which are merely engaged in landscape management, enterprises of garden and landscape construction or even tending troups consisting of persons doing civil alternative service and persons engaged in job-creating schemes is in the long run - except for initial tending measures and a few special cases - not only financially out of reach, it is above all for ecological reasons unjustifiable.

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[17] The term "proper farming" will be used here and in the following solely as defined by the Conference of the Ministers of Agriculture in 1993.

4. Principles and strategies for rewarding ecological services

Ecological services rendered for the protection of biotic resources are unanimously viewed as in need of a reward since all current forms of land use, environmentally compatible ones, too, - intensive as well as extensive - are necessarily more or less in keen competition with the wild animal and plant species. Depending on the level of contribution to the conservation and promotion of species diversity, a differentiated remuneration should be provided for.

In rewarding ecological services for the protection of abiotic resources, we start from the assumption that a farming which is proper, adapted to the site and ecologically compatible in the currently prevailing view does not basically call for a reward. It is only logical then that the abandonment of an improper use causing impact on soil, water and air should most certainly not be rewarded. Still, this does not preclude the temporary use of financial incentives (aids, tax breaks) in order to reach the aims of abiotic resource protection faster or to avoid competitive disadvantages.

However, there may be cases in which a rewarding of ecological services is necessary for the protection of abiotic resources. This applies, for example, if third persons are engaged in the rehabilitation of environmental damage to soil or water. We are dealing with a similar case if the maintenance of use of arable land or grassland proves necessary in areas with low precipitation and high water consumption in order to ensure a higher ground-water contribution even though soil and climate or the existing farm structures do not allow a competitive agriculture. As far as the above-mentioned “services for countryside improvement” are concerned, a similar approach to the rewarding of ecological services should be chosen. If they are rendered within the system, thus.within the context of a proper farming, they do not require any reward. If, however, measures going beyond the proper farming are necessary for the conservation of the desired landscape status for a specific region, these should, of course, be rewarded.

5. Approach to the rewarding of ecological services

The remuneration can be determined either on a result-oriented or action-oriented basis. The result-oriented assessment leads to an economically efficient use of the promotional funds since the reward is conditional on the degree of goal accomplishment. In principle, this assessment can be endorsed, but it presupposes clearly defined objectives on the part of the scientific community and/or politics and requires spot checks by specialists with a sound knowledge of species and biotopes.

At present and probably also in the foreseeable future, the action-oriented rewarding will be given precedence in most cases. This approach is calculated on the additional expenses (labour, cost of machinery) which are necessary for reaching the desired goals and/or on the financial losses caused by the requirements including, as appropriate, requisite incentives. However, it should be borne in mind that the compliance with management requirements (times of use, level of fertilization, stocking) is often difficult. In order to enhance efficiency in the action-oriented rewarding, it is now more than ever before important to take care that the desired goals or results can actually be achieved at least in the medium term so that, strictly speaking, a second check is required in addition.

All in all, the income contributions from the rendering of ecological services have to be secure in the long term and calculable for the manager of the cultivated areas so that future management contracts should provide for corresponding contractual periods. In the process, the rendering of ecological services could also be furthered in the long run through the promotion of certain farm structures (investment promotion) or the allocation of additional milk quotas without an increase in livestock density. In

rewarding ecological services by means of corresponding investment promotion farm structures which are also desirable from the perspective of nature conservation could be produced in the long run.

6. Sources of finance

At present, funds required for rewarding ecological services are in spite of existing programmes for nature conservation and cultivated landscapes only insufficiently available. This can no doubt be put down to the fact that in the past and mostly up to the present day, nature and the environment as public goods have neither in non-material nor economic terms been adequately assessed. For this reason, stepped-up efforts for an evaluation of our natural heritage are required as it has for a long term been a matter of course for our cultural heritage.

Funds could be made available by: i) the European Union within the framework of the "accompanying measures" to the agricultural reform of the Community and through the tying of future subsidies to certain ecological services or minimum standards;, ii) the federal laender, districts and municipalities, which will have to represent the key financial source since ecological services should be rendered also according to local and regional examples and guiding objectives; iii) the increasing marketing of regional products, the production of which makes at the same time a contribution to the conservation of species diversity (e.g. must from fruit of scattered fruit meadows, meat and dairy products from low mountain ranges rich in species, biosphere preserves, nature parks etc.); iv) sponsoring should open up further possibilities for the financing of ecological services.

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GREECE: POLICY MEASURES AND PRACTICES, AND ENVIRONMENTAL BENEFITS FROM AGRICULTURE

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Foreword

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Introduction

Agricultural activity is greatly related to the environment; it depends upon it, but also exerts an influence on it. Vice versa, the state of environment is greatly dependent upon agricultural activity. It is true that agricultural practices that have been historically used, have greatly but differently influenced land uses and the quality of rural environment. This is much related to priorities given by different countries as well as to social, economic and land-climatic substructure that prevailed in each one. As a result, there are many differences among regions in the rate of agricultural and rural growth and thus, the problems that must be solved are obviously different.

Although agricultural activity is a very old human activity which has greatly influenced natural environment, it is only recently that its relationship with environment has been given due consideration. However, even under these circumstances, the emphasis has been given on the identification and evaluation of the negative environmental implications arising from agriculture, while relatively low attention has been given to the environmental benefits that agricultural activity may offer. Therefore, the present seminar, aiming exactly at this rather ignored relationship between agriculture and environment, is a big step forward. It will certainly lead to a better understanding of the different socio-economic, structural and natural characteristics of each country.

The aim of this report is to give a concise picture of Greek agriculture and to identify, as well as to evaluate, certain agricultural activities that may offer environmental benefits to society. It was not intended to make a complete review of policies, measures and practices that could explore all environmental benefits from agriculture in Greece. It was also outside the scope of the present report to make a full review of the existing situation and the measures adopted concerning the country's flora and

fauna, its biotopes, wetlands and other natural ecosystems. Such an attempt would prove to be rather unrealistic.

The actual structure of the report is as follows. First, as an introduction, the background against which agricultural activity is taking place in Greece is presented and a description is given of what seems to be the most important characteristics of Greek agriculture in relation to the environment, namely the persistence of traditional extensive farming systems in many parts of the country. In Section 1 the main policy issues and three different cases are presented, showing how markets cannot sufficiently provide this environmental benefit. Section 2 gives an outline of a specific pilot program and of its main instruments used to address the afore-mentioned agri-environmental policy issues in an integrated manner. Section 3 is mainly focused on certain contradictions, even within the radically reformed CAP, their linkages with agricultural production, their compatibility with other policy measures, as well as the extent to which they can achieve the stated policy objectives. Finally, Section 4, as a conclusion, gives a discussion on the future role of agriculture in enhancing the environment and on the policy measures and approaches that are to be used in the future. In the context of CAP reform, farmers will increasingly face different market incentives, risks and uncertainties, which will result in changes in the levels, composition and location of production and in farm practices.

The background

Greece is a typical Mediterranean country in which all different types of what we use to call "Mediterranean climate" are present. The country is divided into four climatic zones, of different temperatures and rainfall distribution during the year. Furthermore, its geographic setting between Europe, Asia and Africa as well as its great variety of geo-morphological structure and its climatic variability have created a great number of biotopes, landscapes, habitats and different levels of human development. Table 1 gives a picture of the geomorphological structure of Greece and Table 2 shows the slopes of land.

Table 1. Geomorphological structure

ALTITUDE (m)	% OF TOTAL AREA
> 600	42.6
200 <...< 600	27.1
< 200	30.3

Table 2. Slopes of land

SLOPE	% OF TOTAL AREA
< 5%	38.5
5% <...< 10%	23.2
> 10%	38.3

Its insular complex contains as many as 3 000 small islands, of which 217 are inhabited, covering 19 per cent of the country's total land area. With the exception of certain big islands, like Krete, Evia, Rhodes, Lesvos and Corfu, all the others are of less than 150 square kilometres. The total area of the country is 13.2 million hectares, distributed among different uses. About 30 per cent of the total area is used as agricultural land, 39 per cent as pastures and meadows, 23 per cent as forestry, and 8 per cent as other uses.

Agriculture is an important economic sector for the country, since it still contributes by as much as 12 per cent to the GDP. Although, official statistics show that it employs over 20 per cent of its active population, one should bear in mind the high level of rural people using agricultural activity as a complementary income source**,** as well as the fact that the country's highly productive agricultural land is exceptionally small (50 per cent of the total agricultural land).

Agricultural land is more or less made of sedimentary and volcanic rocks. It has been created by disintegration mainly of calcareous earth and of conglomeratic psammites, hence, the appearance of intense soil erosion, at least in some parts of the country. Table 3 shows that the cultivated land area seems to have remained more or less stable in time, except for land under tillage, which shows a decrease to the benefit of orchards. Table 3 also shows that fallow land in Greece is of the order of 20 per cent of arable land and that the irrigated land ratio is less than 30 per cent of total agricultural land. This irrigation ratio is considered as significantly low, if one takes into account: the lengthy dry season (3-5 months) during the year, with high temperatures often reaching over 40^0C; the stream-like rivers with very low water discharge during the dry season; and the inadequate and uneven distribution of the average annual precipitation between the east and west part of the country. It is therefore obvious that, under these climatic conditions, irrigation is inevitable. Moreover, it is worth noting that, although total irrigated land area was increased between 1980 and 1991 by 223.4 million hectares (i.e. 23.9 per cent) over 65 per cent of arable crops, 70 per cent of orchard trees and 80 per cent of vineyards still remain non irrigated.

Table 3. Agricultural land use in Greece

LAND USE (in %)	**1980**		**1985**		**1991**	
	Total	*of which irrigated*	Total	*of which irrigated*	Total	*of which irrigated*
Arable Crops	59.6	26.3	59.3	31.3	58.2	34.0
Horticultural Crops	3.2	74.1	3.1	86.9	3.0	93.4
Viniculture	4.6	13.0	4.3	14.9	3.9	19.3
Orchard Trees	20.3	23.0	21.5	24.4	22.8	28.0
(Olive Groves)	(15.4)		(16.3)		(16.6)	
Fallow land	12.2	-	11.9	-	12.2	-
TOTAL	100	23.4	100	27.3	100	29.7
in '000 ha	4101.6	960.6	4030.0	1098.6	4001.3	1190.0

On the other hand, the average consumption of fertilizer units per hectare in Greece is very low when compared to other European partners; it represents the 87 per cent of the European Union average and it is 2 times lower than that of the UK, 3 times lower than that of Germany and 5 times lower than that of the Netherlands. It should be noted that, although the average consumption of Nitrogen fertilizer units per hectare was increased during 1980-90 by 26.8 per cent, the annual rate of increase during the second half of the decade was significantly lower (1.1 per cent) than that of the first one. This increased

use of fertilizers was mainly due to the subsidisation policy which was implemented until 1992. However, since July 1992, all fertilizer subsidies have been abolished and this is estimated to have led to a decrease of per hectare consumption down to the 1980 level.

Concerning livestock, the evolution of animal heads during 1980-1991 is shown in Table 4. As may be seen, the number of beef heads has been reduced by almost 24 per cent between 1980-1991 while the number of sheep and goats has been increased by 17 per cent and 26 per cent respectively. On the other hand, the distribution of sheep and goats between indoor and shepherded animal heads has remained stable during the decade (over 90 per cent of sheep and 85 per cent of goats are shepherded). Given that maximum production capacity of meadows and pastures is estimated to be around 4 000 million feeding units, while the needs for feeding sheep and goats are around 5 500 million feeding units, there is a tendency for overgrazing in certain areas to the detriment of the state of the environment. Clearly this is a major problem, especially for the mountainous and semi-mountainous areas.

Table 4. Distribution of animal heads

Animals	1980	1985	1991	Variation 1991/1980 (%)
Beef	899 100	732 934	685 000	- 23.8
Sheep	8 394 000	9 210 759	9 837 000	+ 17.2
(of which :				
- indoor	9.3%	9.3%	9.3%	
- shepherded)	90.7%	90.7%	90.7%	
Goats	4 623 425	5 201 180	5 832 000	+ 26.1
(of which :				
- indoor	19.9%	19.3%	*17.7% [1987]*	
- shepherded)	80.1%	80.7%	*82% [1987])*	

The traditional-extensive farming in Greece

The model of economic growth that was applied in Greece after World War II, was aiming at increasing the farm size level and thus, the agricultural production, the intensification of methods of producing and the decrease of agricultural active population. In other words, the model was aiming at modernising the agricultural sector. This model led to the creation of certain "pockets" of intense farming, mainly following the most easily accessible flat and coastal routes of the continental part of the country, thus leaving in the shadow of this development process the inaccessible mountainous and insular regions. It is for this reason that there still exists today two distinct models of production, namely the intensive farming system and the traditional extensive one.

It is true that the extensive farming systems in Greece are mainly due to a backwardness in the development process, and to the land abandonment that occurred during the 1960s and the subsequent ageing of the agricultural population. Presently, however, one should evaluate the viability of those farming systems in terms of regional development parameters and not on the basis of the productivity results for each farm. The intention should, therefore, be to explore all possible combinations of agricultural products and activities that could lead to the enhancing of rural development in each region, along with a balanced multifunctional and sustainable agriculture.

In trying to monitor extensive agriculture in Greece, we can distinguish three basic parameters; namely, the level of irrigation, the level of input use and the systematic plantation rate. High levels of the above criteria show intensive agriculture, while low levels imply the existence of residual hortus of "gardens" in which there used to coexist orchard trees and horticulture. Numbers, of course, differ according to regions and species. For example, 94.3 per cent of all citrus fruit trees are systematically planted. However, in the valley of Argolis this rate is close to 100 per cent, while on the Kyklades islands it is only 56 per cent. On the other hand, the rate for sour cherry trees is 40 per cent and 27.5 per cent for nut trees etc.

Among different kinds of orchard trees, olive trees comprise an interesting exception. Although as much as 83-84 per cent of them are planted in a systematic way, the olive tree is generally considered as the most extensive plantation in Greece. Out of almost 700 000 hectares that are considered to be systematically planted with olive trees in Greece, 16.7 per cent are found on the Aegean islands and 21.5 per cent on the island of Crete. On those islands, farming methods of olive trees is even more extensive than in the rest of the country. Most of those trees are planted on sloping land, using less water, low quality soil and low humidity.

In the case of arable and horticultural plantations the measuring of levels of irrigation and input use, show that extensive farming systems are applied for dried pulses and fodder plants. Irrigated cultivations like alfalfa and trefoil cannot be counted to those that are using extensive farming methods, since they are great water consumers. They can, however, be considered as contributing to enlarging farming systems, due to their contribution to plant rotation. On the side of animal husbandry, the distinction on the level of extensification is made between what is called "permanent" and "temporary" stabling, according to the origin of feeding stuff.

In the case of pastoral non–moving feeding systems, there belongs about 85 per cent of total number of sheep and 75 per cent of total number of goats, as well as about 36 000 uncontrolled cattle grazing, of which 85 per cent belong to the domestic improved and unimproved races. However, even in this case, animals graze in communal grass-land; in farms after harvest or in fallow land, and only rarely is their food supplemented with traded feeding stuffs. During winter time, animals are temporarily stabled, while during summer they are moved to grass land areas of relatively higher altitude. In the case of pastoral moving feeding systems, animals (especially sheep and goats) move to graze in distances that often exceed 50 km. In this category, there belongs less than 7 per cent of total number of sheep and 8 per cent of total number of goats, due to the interruption of European Union co-financing (by 50 per cent) of costs for moving the herd, thus resulting in negative impacts on the environment.

It should be noted however, that the morphology of the Greek land is such that even when intensive agriculture is practised in some areas, the degree of intensification is much lower than the European Union average. This is mainly due to small–scale farming that prevails in Greece. In fact, practically all plantations are interrupted and surrounded by vast quasi natural areas (hills, ravines, mountains, lakes, gulfs etc.), that are beneficial to preserving biodiversity. Even our largest plains in Thessaly and Macedonia are extremely small, compared with northern European plains, which are cultivated without interruption, hence without permitting the creation of natural micro-environments.

This report is based on the rationale that not only existing extensive farming systems are essential to maintaining and enhancing natural values in Greece, but that they are also necessary because it is difficult for nature to be managed by environmental authorities alone over sufficiently large areas in the short term. It is widely recognised, especially in the Mediterranean region, that apart from financial, administrative and human resources constraints, the social and political acceptability of transferring large tracts of land to nature conservation authorities seems limited in many areas. Therefore it is unavoidable

that agriculture is called to play a significant role in any nature conservation policy, at least in the coming decades[18].

Greece, early on, attempted to formulate a legislation formula concerning environmental policy issues, first by adding an article in the 1975 Greek Constitution and then one year later, through Law 360/76. During the 1980s, when Greece became a full member of the EU, there was an effort to harmonize both national legislation and services of State to the European Union ones, while, since 1990, national policy has given first priority to environmental issues where various peculiarities and local problems had to be reconciled.

1. Identification of specific environmental benefits

Overview of main policy objectives

While the main environmental benefit in Greece arises from the very existence of an extensive farming system, its main environmental problems arise from the cumulative effect that abandonment of agricultural activity and/or abandonment of traditional agricultural practices and cultivations, (especially at mountainous, insular and less favoured areas of the country) are bound to create. Indeed, it is exactly in these areas where traditional farming as well as a great number of important landscapes and amenities have been concentrated. However, due to their low competitiveness, such high, natural value farming systems are under pressure, either to get totally abandoned or to change into more intensive and hence less sustainable ones.

Abandonment of agricultural activity leads to a gradual deterioration and finally destruction of land terraces, to water run-offs and eventually to soil erosion. This environmental degradation (e.g. soil erosion, loss of insufficient water resources, loss of landscape amenities, loss of biodiversity etc.), leads to a spiral that results in further depopulation of rural areas. Indeed, farm population forms the backbone of rural less-favoured communities. Farmers and farmworkers currently comprise the only active group of the population with the practical skills and machinery to manage this difficult countryside for the benefit of the environment.

In any case, market alone may not provide enough incentive to farmers, either to continue their activity under adverse economic conditions that extensive agriculture may dictate, or to retain young farmers in the area. Since non-agricultural employment opportunities are scarce, a complementary to the agricultural income resource can not be offered. Therefore, agricultural policies that offer incentives for the continuation of agricultural activity and prevents abandonment constitute a critical issue that equally influences all environmental and economic parameters in the area.

In the following, there is an indicative list of main policy objectives, that can support an agricultural system able to provide environmental benefits to less favoured areas in Greece. It should be noted, however, that although each one of these main policy objectives is necessary and indeed very important, it cannot alone give a complete answer to the problems related to agriculture and environment in Greece. They need, instead, to become a part of an integrated policy scheme.

[18] International trade and nature conservation . Institute for Environmental studies. Amsterdam 1995.

Preservation of active rural population in rural areas

Total population of Greece is 10.2 million, of which 3.5 million live in the area of the capital city, Athens. Since 1951, the country has started to loose its agricultural character, although it still remains less urbanised than most of other OECD countries. It is important to note the reversing of the age pyramid, especially in the rural areas, with an average age exceeding 55 years. There are many mountainous and insular parts in the country difficult to approach, which cover over 50 per cent of total land area. Twenty per cent of the total population still live in approximately 10 000 small– and medium–sized settlements, most of which have been traditionally preserved.

The great number of small rural settlements have proved to be economically non viable and this has led to gradual depopulation and eventually to soil erosion. In fact, more than 60 per cent of the remaining mountainous and insular rural settlements of this type, already inhabited by 18 per cent of the population, are at the verge of depopulation, land abandonment and finally, soil erosion. This is a major environmental problem for the country, that affects directly or indirectly many ecologically sensitive parameters, not to consider the economic, social and cultural effects. In fact, less favoured areas of the country are relics of a valuable architectural and laographic heritage. They consist of a rare mosaic of habitats of different ecological stability. Their transformation into historical museums or cemeteries will lead to the loss not only of the Hellenic but also of the European civilisation and culture.

Three more types of ecosystems exist (apart from 8 per cent of total land area which is devoted to urban and industrial uses), among the total 13.2 million hectares of the Greek land:

- Those that are man-affected but ecologically stable, naturally settled habitats, such as forests, certain bushes and natural meadows or grassland as well as certain orchards (mainly extensive cultivations of olive, chestnut, almond, walnut trees etc.), cover about 11 per cent of total land area. In such areas, the application of sustainable agriculture permits at least a part of annual reproduction of habitat to be regained.

- Those that are unstable ecosystems of agricultural land, continuously man-affected, open ecosystems, cover about 29 per cent of total agricultural land. In this case, any management suspension that will entail land abandonment will not, in any case, automatically lead to their transformation into natural stable ecosystems, of a high level of auto–regulation.

- Those that are man-affected, degraded and ecologically unstable natural ecosystems, like certain stump forests, most bushes, dry stick areas, pasture land etc., cover about 52 per cent of total land area. Those degraded and ecologically unstable natural ecosystems generally occupy shallow, rocky, sloping and infertile land, that are considered to be marginal for forest growing. They are heavily transformed ecosystems which have finally adapted to become pasture land. If not used as pasture land, they degrade even more; they become “wild” and are finally transformed into bush-land or dry stick land which, in the dry and warm climatic conditions that prevail in the country, become seats of fire.

Hence, the major policy issue to maintain active farm population in rural areas is directly related to sustaining a healthy environment and may provide the basis for enhancing multifunctionality in rural areas.

The preservation and protection of highly productive agricultural land

Highly productive agricultural land in Greece is not more than half of the total agricultural land, mainly concentrated on plain and coastal areas of the country. Two kinds of pressure are exerted on this land: one that leads to changing of its use towards tourist activities, tourist infrastructure etc., and the other relates to degradation due to intensive farming. In the first case, the problem is especially acute on the insular part of the country, where one can find islands that are depopulated during winter, while during summer, they become overcrowded by tourists, mainly using those small areas of productive land for summer resorts. It is in those cases that agricultural products, which were previously locally produced, have to be transported from the mainland on highly expensive terms, in order to feed those over-populated areas. In the second case, intensive farming, aiming at getting highest effectiveness, is bound to lead to considerable strain upon natural resources of the area and thus towards environmental degradation. The Argolid valley represents such a case and it will be discussed later in this report.

There is, however, one more aspect that should not slip our attention; namely intensive farming on marginal land in areas where most fertile land has been used for other purposes (industrial uses, resort, infrastructure etc.). In this case, intensive farming, used to substitute fertility, again exerts considerable strain upon natural resources, while it may not render the aimed level of effectiveness. A major policy issue is, therefore, to ensure a rational allocation of land uses. In remote rural areas (e.g. islands), agricultural activity may be preserved in the context of a multifunctional agriculture and thus avoid depopulation, especially during winter. On the other hand, in countries like Greece, retaining most of the highly productive land for agricultural purposes may result in relatively higher environmental benefits than would have been the case if this land was used for other non–agricultural purposes.

Protection against soil erosion

Greece is among those European countries which face high soil erosion. According to European Union CORINE Program data, 29.8 per cent of the Greek land is under erosion. Soil erosion is the cumulative result of environmental degradation that has occurred due to both natural phenomena on one hand and human interventions on the other (i.e. bad water management, abandonment of marginal agricultural land and deforestation due to fires). Major factors contributing to the creation of natural erosion are: the storm-like rainfalls which represent a frequent phenomenon in certain parts of the country, the absence of vegetation in conjunction with steep slope geomorphology and the type of rocks encountered (mainly flysch, schist and limestones).

Natural erosion process is speeded up due to fires and the consequent pasturing of the burned land, over–pasturing, abandonment of agricultural land and/or the adoption of farming practices that do not take measures against soil erosion, thus leading to the destruction of traditional agricultural land terraces. Finally, this highly eroded land leads to a vicious circle of land abandonment and depopulation, or alternatively, to intensive use of inputs in order to return the soil fertility to its former level of effectiveness. In such areas, the maintenance of agricultural activity, in conjunction with an integrated scheme of rural development that comprises sustainable use of natural as well as of human resources, may prove to be relatively more effective in economic terms, as well as in environmental terms.

Management of water resources

Contrarily to most other countries of Northern Europe, major environmental degradation is merely due to relative scarcity of water resources, especially in the southern part of the country and much

less to pollution that is caused from intensive farming practices. As it has been already argued, the average consumption of chemical inputs per hectare is relatively low and it is expected to lower even more, given the recent abolition of all fertilizer subsidies. However, this does not mean that there are no areas that intensive use of chemical inputs is taking place. In these cases, the relevant Program on reducing Nitrogen pollution that has been implemented since 1995 is expected to show positive results (see Annex).

Although we cannot argue that there is not enough quantity of water in the country, its spatial allocation is uneven, mainly due to land morphology, geological composition and uneven rainfall distribution in space and over time. Moreover, it is important to note that over one–fourth of all surface water has its origin outside the country's frontiers (e.g. Bulgaria, FYROM, etc.). Drought which is an ordinary phenomenon in Greece, may cause scarcity of water resources. It may also cause further soil degradation, which through land abandonment of mountainous agricultural areas, may result in soil erosion.

Although generally, one–third of water resources from precipitation is lost into the sea, the other one is evaporated and the rest is percolated into the soil; in Greece, as much as 50 per cent is lost into the sea, 40 per cent evaporates and only 10 per cent is percolated into the soil. So, an intensive use of this limited amount of ground water, especially on flat and/or coastal areas, almost certainly leads to a lowering of ground water level and to water salination. According to provisional measurements, salined water covers about 30 000 hectares of agricultural land.

Taking into account the dry and warm climatic conditions generally prevailing in the country, it is not surprising that agriculture has become the major water consumer. As it is the case in most countries of the Mediterranean Basin with similar warm climatic conditions and uneven rainfall over the year, the estimated use of water for agriculture amounts to 80-85 per cent of the country's total water consumption. In this context, the rational management of water resources used for agriculture constitutes a major policy issue and it has to be dealt with along two main directions: firstly, by restructuring agricultural activity towards types of cultivation that are less water consuming and secondly, by focusing on an integrated protection scheme of water management - soil erosion - water utilisation. The pilot program of Aperathou of Naxos island that is presented in Part B comprises such an integrated approach.

Management of habitats, agricultural landscapes, cultural heritage

There is a great variety of natural and cultural peculiarities in this relatively small country, as a result of an historically very long adjustment process of human activity to the geographical variety of this area. Many interesting biotopes have been created as a result of a significant climatic differentiation, the isolation of certain areas and the geographic situation of the country among three zones (Europe, Asia and Africa). There are 27 protected areas in the country that have been designated as areas of rare ornitho-fauna according to European Union Directive 79/409/EEC. Among them, 16 are forests, protected by the respective forest regulations and 11 are habitats, or wetlands protected by RAMSAR. Furthermore, the European Union NATURA 2000 program has designated 340 habitats in the country.

Apart from those natural or semi-natural habitats, there are also many historical monuments from practically all periods of human civilisation. Among them, there have been designated over 25 000 monuments all over the country, of which more than 312 have been characterised as universally highly important. Furthermore, there is a great number of rural settlements and agricultural landscapes spread all over the country. Ten groups of areas have been distinguished as traditional architecture, in which there exist 3 260 valuable, traditional settlements. The Aegean Sea (Kyklades, Dodekanessa,

Krete), Peloponessos (Mani, Mountain of Arkadia), Ionian islands, Epirus (Metsovo, Zagoria), Macedonia, Magnesia (Pelio, Sporades) are hierarchically the most valuable among them.

The agricultural landscapes constitute the product of human intervention in nature and they have been the result of all economic activities in the countryside. They most often have to do with extensive systems of agricultural production and they are mainly concentrated in the mountainous and insular parts of the country, since those that were found in the coastal and flat areas have already been destroyed by the fast intensification of land use. They are not yet "destroyed" but are under severe pressure. It is therefore imperative to protect those remaining agricultural landscapes in Greece, especially those which constitute a link between our past, present and future cultural life, which additionally can contribute to making the countryside a pole of attraction for its population, agro–tourists and tourists.

Examples where markets cannot provide sufficient environmental benefits

It is well known, that effective farming may only take place, if it ensures a dynamic business process. Therefore, centuries-old farming systems may be abandoned or changed "overnight" in response to internal or external forces, including market developments and farm policies. Environmental benefits linked to these extensive farming systems may become irreversibly damaged in this process. There are many examples all over the world that could show this, including Greece. In the following, we present three concrete examples. The first one refers to a fertile area of Greece, namely the Argolid valley, where the effects of agricultural activity to the environment were negative, due to applied farm policies, while there is no expectation that the situation could change under market conditions.

The second example refers to a remote Aegean island, Lemnos, where viniculture constitutes a major human activity, which has been developed throughout its long history. The wine produced there is of high quality and its cultivation is greatly protecting the environment. However, in this case, the effects of farm policy did not prove able to give enough incentives to the farmer, while market conditions alone cannot ensure that vinicultural activity may continue effectively. The third example refers to how olive groves (cultivated on sloping marginal land), use highly extensive farming practices, thus offering benefit to the environment. In this case, while market conditions will certainly prove to be unable to ensure an effective production, farm policies - if not rightly directed - may also prove to be unable to give the necessary incentives to farmers to prevent them from uprooting their plantations in exchange of a high income support.

The case of Argolid Valley[19]

Argolid Valley is a highly fertile land area that produces almost the total exportable amount of Greek citrus fruits. The study that was carried out was based on the idea that farming across much of the southern Mediterranean has evolved in response to the uncertainty of natural and climatic conditions with small units, part-time farmers and diverse cropping, and that much of the European agricultural policy has been based upon criteria of efficiency which have resulted in standardisation and higher unit production. Using Argolid Valley in Greece as an example, it was shown that the adoption of policies directed to the farmers, the crop and water resources can encourage and stretch intensive monocropping practices while exerting considerable strain upon the natural resources of the area. It was also maintained that the degradation of natural resources and the decreased potential for income generation resulting from this,

[19] Article by M. Lemon, R. Seaton, C. Blatsou of Interntional Ecotechnology Research Centre, Granfiend University and N. Calamaras, consultant agronomist, MEDIT No 4/95.

have resulted in a reduced set of options for farmers and the inequitable distribution of those options among them.

During a 25-year period, there was a general movement away from subsistence and predominantly rain fed crops (cereals, vines, olives and grazing) with a limited amount of irrigated production (vegetables), towards a more intensive and less diverse agriculture based upon fruit production. This transformation towards irrigated monocropping was found to be most pronounced in the central and coastal areas, while a more diverse production system was apparent as one moved towards the peripheral zones. The dependence upon citrus production in the central plain was found to be reinforced by the high proportion of part-time farmers, alongside a pluriactive farming community. Furthermore, this visual crop transformation was accompanied by a qualitative deterioration of the water system that lead to its salination. The agricultural system did therefore enter a technological spiral, firstly for accessing water and extending the irrigated area and secondly for easing the impact of the resulting degradation.

The field work undertaken in the Argolid Valley identified three broad types of policy instruments that have influenced the emergence of agriculture in the area. These are inevitably linked, but essentially they also relate to the farmer, to the crop and to the water system. The instruments originated from different levels in the policy hierarchy, i.e. local regulations about the drilling of bore holes, national support for large scale infrastructure (the Anavalos canal system), reduced agricultural electricity prices, European Union price support and subsidies for agricultural production. It was therefore proved that agriculture in the Argolid valley has been shaped by policies that have contributed to a reduction in crop diversity and increased water dependency. These policies have taken the form of price guarantees for citrus crops that are heavy water users, technical support for accessing water and for remedial action in response to water degradation and management support for the establishment of co-operative organisations that have focused upon marketing of citrus.

The general outcome of the study suggest that socio-economic and natural characteristics of the southern Mediterranean have historically generated an agricultural system which produced a wide variety of crops at yields considerably below those of Northern Europe. Attempts to restructure agricultural production according to criteria of technological and economic efficiency without paying sufficient attention to social and ecological factors, have resulted in the removal of options from many farmers; hence, the loss of agricultural diversity, the increased degradation of natural resources, and an inequitable distribution of costs and benefits among farmers.

The case of viniculture of Lemnos island[20]

Greek Aegean islands have traditionally produced high quality wine and this has been a main economic activity for centuries. In addition, this viniculture, having been a highly extensive cultivation that used dry and sloping agricultural land, had positive effects on the environment, especially regarding the problem of soil erosion which has been very common in these islands. This situation has dramatically changed over the last years mainly due to increased use of land for tourist infrastructure. As a consequence, the active insular population gradually abandoned vinicultural land and either migrated to the mainland or was absorbed by the tourist industry.

During the same period, European Union was facing an increasing problem of surplus wine production that led to restrictive measures for all member states. According to the respective European

[20] Article by F.Hatzitheodoridis, A.Loumou, Ch.Giourga, N.S.Margaris, University of Aegean, presented during the 3rd national conference on agricultural economy in Greece, Athens, December 1994.

Union regime, the basic vinicultural policy of Greece is included in two European Union Regulations, namely R(EEC)895/85 and R(EEC)1442/88, aiming at restructuring viniculture without any further increase of land used, and decreasing land under wine cultivation, as well as wine quantities produced. In 1987, 30 per cent of the areas that were then determined as liable for restructuring VQPRD wine production, and 55 per cent of the areas that produced ordinary quality wine, belonged to the insular part of the country. As a result, a great number of vineyards of Aegean islands were uprooted, without paying much attention to the negative effects that this decision would have on the environment.

In 1990, however, it was recognised that the production of quality wine produced in certain areas of the country was lower than demanded. It was therefore decided, that an increase of vinicultural land area may be permitted. According to this decision, there was an increase in vinicultural land by 1 500 hectares, of which 1 200 hectares belonged to the Aegean islands. Furthermore, Special European Union Program on Aegean islands recognised the need for special support of VQPRD wine producers of the Aegean islands for the period 1994-97, which was implemented by R(EEC)2019/93. Although VQPRD wines are usually sold at high market prices, due to their limited quantity, their high quality and their attractive packing, wines of the Aegean islands cannot enjoy equally high levels of market prices, mainly due to marketing problems related to difficult and costly market access, bad transportation and communication.

A study on Lemnos island has shown this contradiction; namely that the application of the above–mentioned supporting measures did not give any boosting to Lemnos economy. The incentive for uprooting was so strong, that not only vineyards of ordinary wine production were uprooted, but also there was a strong pressure from producers of VQPRD wine to be included in the uprooting program, so that they could equally gain from this support measure. Even when additional support measures were decided, later on, especially for VQPRD wine producers of Aegean islands, the total income situation of Lemnos wine producers did not show any dramatic improvement.

Therefore, it would have been more effective if additional incentives were especially oriented to those farmers who ensure that they will continue to cultivate their vineyards on the remote sloping land area of the islands, using traditional extensive farming practices. Indeed, the case of Lemnos is a good example, to show the scope for directed policy schemes; not only to regions or products, but also to specific groups of farmers, if environmental benefits from a sustainable agriculture are to be gained.

The case of olive groves of the Aegean islands[21]

It has been shown, both by special studies, as well as from everyday life in the Greek countryside, that the olive tree is the first among all orchard trees that has had an important effect on the social and economic structure of Greek society during its long history; in fact starting many thousands of years ago. Highly extensive farming practices are used for olive trees, especially on islands. They are cultivated on sloping marginal land using terraces made of local stones. Thus, olive groves constitute an interesting type of ecosystem that differs from other orchard trees, mainly because: i) they continue to be relatively effective in economic terms, even when minimum farming activity is practised on them; ii) they can survive even under lack of irrigation, or soil fertility; iii) after their abandonment they may be transformed into a Mediterranean type ecosystem, even when they are planted on marginal land areas; iv) after a long time of abandonment, they may return to effectiveness, provided that appropriate farming practices are applied, and this constitutes a unique characteristic among all orchard trees; v) olive trees

[21] Ph.D. Dissertation by M. Theodorakakis, Aegean university, Lesvos 1995.

were created from wild olive trees, and therefore they tend to become wild ones again following their abandonment.

In this context, olive groves constitute an “artificial” ecosystem which, indeed, is very close to natural ecosystems, even when olive trees are still productive. This means (especially on remote islands of Aegean Sea), that retaining olive plantations is an imperative goal, both for economic, social and environmental reasons. In contrast, it would be a great loss for the environment and/or the socio economic and structure of a given society, if an olive grove is uprooted due to its low economic effectiveness. In most cases, it is better to leave this olive grove to become a “natural” ecosystem, instead of restructuring it for the sake of a support measure.

2. The pilot program of village Aperathou of Naxos Island

An integrated program for preservation of the environment was carried out at the village of Aperathou, Naxos Island. The main target of the program was water management in order to face several agro environmental problems of soil erosion, of water supply and irrigation. The village is settled on the mountainous area of Naxos at a height of 600m. It is currently inhabited by 1 040 permanent inhabitants, mainly animal farmers, instead of more than 2 500 in the early 1950s.

All Aegean islands, especially the Kyklades, are currently facing strong environmental problems; such as: i) decrease and even vanishing of natural horticultural coverage; ii) decrease or even abandonment of agricultural land (it is worth noting that until 1950, people used to cultivate cereals and there were over 7 out of 11 windmills, still working, but since 1950, when tractor machinery increased productivity in the main land, people preferred to abandon cereal cultivation and move to the capital city); iii) the destruction of agricultural terraces; iv) the exhaustion of water reserves (due to over pumping up and to bad management); v) the destruction of agricultural production due to the salination of water. There are, of course, strong natural parameters that are responsible for this agro environmental degradation, even though man intervention has been also disastrous. One major natural problem is the flood type precipitation. Although there is an annual water reserve of about 214 million m3, about 50 per cent of it escapes to the sea, 40 per cent is directly evaporated due to strong winds and the sun, and only 10 per cent remains to penetrate and enrich underground water tables.

This pilot program has been one man’s conception — that of Manolis Glezos — a visionary politician, who after a long political career as an MP, dedicated himself to what he calls “real politics”; that is, facing daily life problems in his native village, Aperathou, which he serves now as head of community. The works for the program have been carried out on a hydrological basin of about 10 km2 consisting of 5 different levels and extending from an average altitude of about 600m down to sea level.

This is a pilot program, especially for the Aegean Islands, but also for all the Mediterranean basin. The main target has been to intervene in the land vegetation watering cycle, in order to face soil erosion, to protect vegetation and to decrease the loss of surface stream water. The schedule of this integrated program consisted of works: to combat erosion by obtaining indigenous reforestation of eroded land through fencing the area, so that no pasturing is taking place (artificial reforestation would need large quantities of water for irrigation and it is, therefore, not recommended for this dry area); restoration of traditional agricultural terraces; and building small earth dams by using in situ materials (stones, soil, wood) for enriching underground water and controlling its negative effects on the land. The programme also includes water management through works on water supply (good exploitation of water springs); works for irrigating plants under (or not) coverage; works for watering the animals; and small dams for exploiting stream water altimetric difference in order to produce electricity power.

The program works have been financed by the Greek Ministry of Agriculture and the European Union (MEDSPA 91/1). Time schedule was divided in two phases. The first one was implemented between 1987 and 1990 and the second one between 1990 and 1993. The results of the program could be summarized as follows:

- During a period of 3 years there was an indigenous reforestation (of oak and palm trees) of 120-270 trees per hectare, while in areas where there was a fencing for a period of 6 years, the spontaneously grown trees have reached the height of 1-2 metres.

- The reconstructed agricultural terraces have resisted strong rainfalls that occurred in October 1994 (it rained 8 times, of which, once it reached 78 mm in one day and a second time it reached 122 mm, the latter one being reported as the maximum quantity of rain-fall in one day). These terraces have also held back the loss of agricultural land and they helped water penetration into the soil.

- The constructed small earth dams have resisted well during the strong rainfalls of October 1994. They have not only prevented water from getting lost into the sea, but they have also enriched water tables, thus contributing to the increase of agricultural production. It is worth noting that all wells that had long before ceased to give water, started to gush out again.

- The final cost was extremely low, since it included the working contribution of local farmers, who were paid by the European Union financing contribution, minus 5 per cent per farmer for infrastructure works made by the community budget. The cost of each small earth dam is thus estimated to have reached approximately $1 000.

- The total number of already constructed small earth dams is 140, while there is on–going work to use some of them to produce electricity.

- The final picture of small earth dams and surrounding works that have been constructed up until now, is of an incomparable beauty, as materials, skills and traditional knowledge of indigenous working capacity have been used for their construction.

- Parallel to the construction works, an amazing procedure of knowledge accumulation was developed. Among the numerous activities that took place in the area, it is worth mentioning the establishment of a Hydrology Practical Community School (summer courses on water management), as well as of an educational camping. In addition, there is a good link of the on–going works with competent University Departments in Greece and abroad, who sent students to study this pilot program.

- Increase in agricultural production.

In conclusion, we can say that the program has proved to be fully successful in all its targets. It did not only manage water, but also proved that there is still time to create environmental benefits out of a good management of existing life in the countryside.

3. Monitoring and assessment

As has been argued in the previous sections, the main environmental benefit from agriculture in Greece arises from the very persistence of a traditional, extensive farming system that has been applied in the course of a very long history of human activity in the area. Indeed, it was shown that certain cultivations, e.g. viniculture, olive groves etc. are good examples of how both farmers and plants have

coupled effectively with local cultural, economic and environmental conditions and have successfully adapted to the Mediterranean peculiarities. Therefore, we can assume that environmental benefits from agriculture are directly related to specific areas, population groups and cultivations.

This multidimentional character of environmental benefits from agriculture may explain the difficulties in monitoring and evaluating them. Therefore, necessary as it may be to measure them, there are relatively few that can be assigned to specific yardsticks and even fewer that can be valued. On the other hand, the case of Aperathou in Naxos island, presented above, indicates that environmental benefits from agriculture can be present if and when integrated policies, measures and practices are used to address specific problems of specific areas. However, such an integrated policy scheme should not be considered as an easy task, quite the contrary. On one side, the horizontal character of certain environmental problems has to be taken into consideration, while, on the other, it has to reconcile all different conditions prevailing in each micro-environment. This means that if we recognise that traditional extensive farming practices, as well as traditional cultivations, provide environmental benefits and, therefore, are to be maintained, it is equally important to recognise that some way of remuneration to farmers is needed which will not be in contradiction to the general agricultural policy issues.

Existing European Union regime contains general measures which affect the environment through: i) a market price support scheme under which farmers gain most from intensive farming, while those using traditional extensive farming practices are bound to gain much less; ii) measures for less favoured and mountainous areas of the country, which, although they have a rather horizontal character, they offer incentives for farmers to remain in the rural areas and this certainly constitutes a positive effect on the environment; and iii) special measures for the Aegean islands, which, although very low in quantitative terms, offer nevertheless more incentives to farmers to remain in their country place.

On the other hand, we have to recognise that the reforms of the CAP agreed in 1992 are the most radical ones so far, particularly in the arable sector. An attempt has been made to reduce the intensification effect of the main support measures for cereals, oilseeds and protein crops by transferring a part of the income support from prices to direct income payments, thus encouraging a gradual turn of European Union agriculture towards practices more friendly to the environment.

However, the recent reforms should not obscure the existence of certain contradictions within CAP. As has been shown in the cases of Lemnos and Argolid valley, the role of market forces as well as of supporting measures that are horizontally scheduled at national level, may be decisive and lead to contradictory results, if their only intention is to accomplish the objective of production control and are not seen as coherent policies in their own right.

We must recognise that policies to maintain and enhance high natural values in agriculture and to integrate environmental objectives into agricultural policy, need not and cannot be applied along with general policy objectives at Community level. Not even at national level. But, instead, it would indeed be useful to construct a strategy to protect high environmental values of agricultural systems by giving a major role to local participation. It is, therefore, important to emphasize that different combinations of policy instruments can be used resulting in a wide range of different outcomes. In this context, we can expect that even within extensive farming systems, conditions vary considerably, both within Member states and between them.

It is true that, in general, traditional farming practices are applied in less favoured areas (mountainous, remote, insular etc.) where adverse cost, economic and social conditions prevail. In those cases, farmers are facing competition from similar products, produced under much more favourable conditions. In order that those less favoured farmers continue producing in relatively less costly terms,

special measures should be taken, so that they will not be forced to abandon their land, to the detriment of the environment. This means that specifically directed policies and measures should both address the need to maintain agricultural production of specific cultivations (e.g. viniculture, olive trees etc.) of specific regions, and ensure at the same time, that this will be in compatibility with other policy measures.

4. General discussion

As we have seen, Greece is a typical Mediterranean mountainous country, with a great number of islands and a relatively small area of fertile land. Its great variety of natural as well as socio-economic characteristics, adds to the complexity of the whole European environment and calls for a more flexible approach, on the basis of different micro-environments at a national or even at a local level.

The analysis put forward in this report suggests that extensive farming systems in Greece, have a very important role to play, in enhancing environmental benefits from agricultural activity. On a national scale, the most important extensive farming systems are found on mountainous and insular parts of the country. Among different, traditional crops, viniculture and olive groves are the most well adapted to the geomorphological, economic and socio-cultural conditions prevailing in the country. They are usually cultivated on sloping and marginal land and they permit the coexistence of a variety of horticultural crops, together with the extensive livestock systems of sheep and goats, based predominantly on the grazing or mowing of semi-natural vegetation.

From the nature conservation point of view, we are concerned not only with the survival of extensive farming systems *per se*, but also with specific farming practices on specific products. Farming is a dynamic activity and farmers have to adapt to changes in the context of agricultural policy reform, to different market incentives, risks and uncertainties, which will result in changes in the levels, composition and location of production and in farm practices. This means that we have to tailor a positive policy scheme to maintain certain regional forms of production which are not competitive, while ensuring its compatibility with other policy measures. Therefore, it is essential to consider the social as well as the economic viability of farming systems on an integrated scheduling that goes beyond simple regulation.

Regions with a high proportion of extensive farming are often characterised by a lack of development in other economic sectors. The availability of non-agricultural employment in rural areas may be essential to the survival of predominantly farming communities. In the case of the Aegean islands, tourism is a complementary activity that has to be well coupled with objectives that relate to agriculture, environment and rural development.

The report has shown that an appropriate policy approach should combine the idea of policy integration, together with the idea of local participation. More specifically, the example of the pilot program of Aperathou of the island of Naxos has given impressive results on its main target to achieve water management and, through it, to face several agro-environmental problems of soil erosion, of water supply and of irrigation. Its integrated character managed to further restore the old agricultural terraces, hence traditional crops have again started to be produced for local consumption. It additionally achieved a certain degree of natural afforestation, without spending water resources.

It is worth noting that European Union authorities, that have evaluated this integrated program, have urged Greek authorities to consider this program as a pilot one. Unfortunately appropriate data for monitoring, measuring and evaluating all environmental benefits from agriculture are not available at national level. It is therefore essential to conduct further research so that local initiatives, like the one of Aperathou, may be registered and appropriately used.

Essential as it may be, however, to develop and implement such research, it will be difficult to fill existing gaps of an institutional, as well as a legislative nature. For the time being, our intention is to implement the Agro-environmental Regulation 2078/92, hoping that, through it, there will be appropriate space for further regionally and locally specified work programs. However, in implementing the above-mentioned European Union Agri-environmental Regulation to the extent required, the issue of co-financing seems to be a critical one. In the Annex below there is a list of programs submitted to the European Union authorities concerning Regulation 2078/92.

Annex. An indicative list of issues Greece is expecting to work on in the near future

1. Program on organic farming

Organic farming is implemented according to Regulation (EEC) No. 2092/91 at the European Union level, but has only very recently started to be applied in Greece. The necessary infrastructure for the marketing of these products is still at an early level of development and, therefore, the economic risk for the Greek producers of bio-farming is higher than the corresponding European Union ones.

At the moment, there is an on-going European Union program of a total budget of 4 255 MECU (co-financed by European Union - Greece by 75 per cent and 25 per cent), for the period 1995-97. It is anticipated to cover 6 000 hectares, priority given to mountainous and semi-mountainous areas of the country. The aim of the program is to enhance organic farming, together with protecting the environment. According to 1994 data, as many as 455 producers were reported to have practised organic farming on a total area of 1 350 hectares, and this number is expected to triple by the end of 1996. It is worth mentioning here, that organic farming is of great importance to Greece, regarding both the ecosystem protection and economic viability of extensive agriculture, practised on mountainous and semi-mountainous areas of the country, including the mountainous insular ones.

2. Program on reducing nitrogen pollution due to agricultural activity on the Thessaly valley

There is an on-going European Union program of total budget of 10 509 MECU (co-financed by EU-Greece, by 75 per cent and 25 per cent). It is anticipated to cover 25 000 hectares of the Thessaly Valley by 1997, priority given to the axis of the Pharsala-Larissa area and to the river side of the Penios river. The aim of the program is to protect public health, the environmental protection of Penios river and of its Delta which constitutes one of most important ecosystems of the country. The implementation of the above program started in 1995, but it has had a retroactive effect since 1993.

3. National program for the long-term set aside of agricultural land

The above program has been adopted by European Union authorities, comprising two measures: (a) creation of biotopes and natural parks in areas of ecological interest and (b) protection of bodies of water from pollution from agricultural sources. It covers the period 1996-97 and it is anticipated to cover 25 000 hectares. Total budget is 14.7 million ECU, of which 4.2 million ECU is for 1996 and 10.5 million ECU for 1997.

4. Program on biodiversity

A program on biodiversity has been submitted to the EU, according to Regulation 2078/92. It includes supporting measures for those producers that maintain buffaloes, as well as certain species of sheep, goats, cows and horses that risk extinction or face genetic degradation. In addition, the above program includes supporting measures for those farmers that cultivate plants that risk extinction or face genetic degradation.

5. Program on protecting important biotopes as well as their flora and fauna

A program has been submitted to the EU, according to Regulation 2078/92 (Dir.92/43/EEC Network NATURA 2000), which includes specific supporting measures for the most important biotopes of the country. It includes 64 biotopes among which are 10 National Woodlands, 11 Wetlands protected by RAMSAR and 19 National Forest Parks.

6. Program on agricultural landscape

According to Regulation (EEC) 2078/92, a special program on agricultural landscape is ready to be submitted this year. Among more than 36 agricultural landscapes, that have been proposed (namely, 10 on the Aegean islands, 9 on the Ionian islands, 2 on the island of Crete, and 15 on the mainland), the island of Chios offers a good example. It shows how the protection of an agricultural landscape (along with other parameters, e.g. the recent establishment of a University Department, infrastructure, telecommunications etc.), can contribute to provide "a dynamic whole" — a coherent set of opportunities for its population.

Orange Gardens of the valley of Chios

The valley of Chios consists of a unique combination of valuable architectural settlements and gardens. It was built during the 15th century by Genovean magistrates and later, by Greek rich merchants. It is a land area of 560 hectares, full of gardens, fenced by high stone walls, in order to protect citrus fruits from changes in climatic conditions. In fact, these are the first orange trees that were brought by Venetians to Greece for cultivation, during the 18th century. They are, therefore, trees of more than 2 centuries old. Along with orange trees, these old gardens include many other kinds of trees, such as vineyards and olive trees. Vegetables allow sheep to graze. Most impressive is the architectural view of this agricultural area which gives the impression of an already town-planned area.

Pistacia Lentiscuschia of Chios

Pistacia Lentiscuschia of Chios is an area of 4 000 hectares, consisting of small farms, in which the Pistacia Lentiscuschia is cultivated on terraces made by stones. It has a long history of traditional cultivation.

NETHERLANDS: EXPERIENCES WITH NATURE POLICIES REGARDING FARMLAND

by
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Introduction

The Netherlands is a relatively small country with flat landscapes, dominated by generally intensive and thriving agriculture. The country is densely populated with an average of 370 inhabitants per square kilometre (in 1993; the average population density for all 15 countries of the European Union was 89 inhabitants per square kilometre). The urbanization rate however is not very high; many people live in towns and villages. About 60 per cent of the Netherlands consists of farmland and about half of this area is grassland. There are very few extensive 'natural' areas.

The Netherlands is part of the Northwest European lowlands, but plays a special role in this region. There is a high concentration of relatively wet areas, both clayey and peaty, partially below sea level. Both the North Sea and the river systems of Rhine, Meuse and Scheldt have always been important factors in the genesis of the lower (western) part of the Netherlands. The other half of the country is sandy and was largely shaped in the pleistocene by glaciers, rivers and wind. This part is less characteristic for the Netherlands, it is in fact part of the huge lowland area that runs from the Netherlands, via Germany through Poland and the Baltic countries to the CIS.

A few thousand years ago most of Europe was covered by natural vegetation. Many authors think this was mostly dense forest, but recent research (Vera, diss. in prep.; Geiser, 1983) suggests that the natural landscape included both forest cover and open spaces, maintained in places by large herbivores. Due to the marshy situation in the lower parts of the Netherlands, the case may have been slightly different there, but on the other hand large areas, particularly certain marshlands, probably had few trees for other reasons too (Baaijens, verbal comm.).

Over the centuries, but particularly during the Middle Ages, the greater part of the original Dutch landscape was profoundly changed by land reclamations. The regular ditch patterns in the western part of the country still reflect the systematically planned approach of those days. Following reclamations and the disappearance of most of the natural herbivore community from the remaining natural areas, natural grasslands became very rare in Europe. This is why the plant and animal species dependent on open habitats, came to rely more and more on man-made, semi-natural habitats, mostly grasslands and moors/heathlands. Semi-natural habitats are habitats where the 'formation' (e.g. the absence of trees) is determined by man and his livestock, but where other flora and fauna largely reflect the natural

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circumstances. When man started fertilizing the land, these circumstances changed. Although some species of plants and animals still survive today, such areas are no longer called semi-natural.

The semi-natural landscapes in Europe were probably at their peak around the year 1900. They had become indispensable substitutes of the original habitats, without which much of Europe's natural riches would disappear. This does not deny the special values of the cultural landscape, which are certainly relevant, but adds another argument to the need to conserve such habitats. These semi-natural landscapes were in fact a by-product of traditional farming systems.

With farming activities in the past, agricultural productivity and wildlife and landscape conservation were in equilibrium. This balance has been disturbed by the rapid modernization of agriculture. The modernization of agriculture in the course of this century has created a tension between the interests of agriculture on the one hand and nature and landscape conservation on the other. Most of the values of semi-natural areas have disappeared, mainly due to fertilization although drainage, early mowing, converting grassland to arable land etc. have also had negative influences. This whole process is often summarized as 'intensification'. The situation concerning semi-natural landscapes in more southern and mountainous parts of Europe is still more positive, although in these areas nature values are also threatened by abandonment, leading to discontinuity of management, as well as intensification.

In the Netherlands, the man-made landscapes harbour four different main categories of nature values: i) semi-natural, species rich grasslands; ii) important breeding areas for "meadow birds", in fact mainly water birds; iii) important wintering areas for water birds from northern countries; and iv) landscapes rich in natural features such as hedges, plots of woodland etc. Of course these categories could overlap, occur in the same area. However, today they have become largely separated, the causes of which are the following.

Like in most of the north-west European lowlands, fertilizers are used on almost every plot of land. That is why in the Netherlands the first category i) now mainly survives in nature reserves, although a number of plants and related fauna can still be found in field margins, e.g. along ditches. The last category iv) has become rather rare too, due to rationalization of agriculture in the last decades. The two bird categories (ii and iii) however, are still important assets of the Netherlands.

Table 1. Breeding waders in the Netherlands

Species	Percentage of west- and central European population
Black-tailed godwit (Limosa limosa)	82-85%
Oystercatcher (Haematopus ostralegus)	42-45%
Lapwing (Vanellus vanellus)	24-28%
Redshank (Tringa totanus)	16-19%

Source: derived from Van Dijk *et al.* (1989).

The Netherlands is important for breeding waders, as can be seen from Table 1. In addition to the birds in Table 1, the Netherlands has 33-40 per cent of the European population of Shovelers (*Anas clypeata*). The main requirements for the protection of these birds are food availability (also for chicks) and breeding success. Special measures have become more and more necessary for these birds, which we will explain in more detail further on.

The Netherlands is also important for migratory water birds that winter in the Netherlands: geese (almost a million), ducks, swans and waders. Most of these birds breed in vast natural areas in northern Europe and Siberia, but in winter they are now largely dependent on farmland. Some important examples can be found in Table 2. Important requirements for these birds are the availability of quiet feeding areas (food as such is generally abundant in modern farmland), drinking water and roosts. Most of these species are currently thriving.

Table 2. Some examples of migratory water birds in the Netherlands

Species	Maximum number of birds	Percentage of flyway population
White fronted goose (*Anser albifrons*)	483 000	100%
Bean goose (*Anser fabalis rossicus*)	204 000	68%
Pink-footed goose (*Anser brachyrhrynchus*)	34 000	100%
Barnacle goose (*Branta leucopsis*)	138 000	100%
Wigeon (*Anas penelope*)	327 000	44%
Golden plover (*Pluvialis apricaria*)	405 000	23%

Source: derived from Altenburg *et al.* (1996).

Grassland breeding birds, called 'meadow birds' in the Netherlands, are much more vulnerable. The availability of food and breeding success are crucial factors here. Although food availability actually increases in the first stages of intensification, it later deteriorates again. At the same time, intensification leads to earlier mowing dates and increased livestock densities, leading to lower breeding success. This is why special measures have to be taken to keep at least an important part of these populations in the Netherlands. These measures include maintaining relatively high water levels and delaying mowing and/or grazing dates by means of management agreements and in the framework of nature reserve management. In addition, more than 225 000 hectares is subject to individual nest protection measures by volunteers (Landschapsbeheer Nederland, 1996).

1. Policy on valuable agricultural landscapes

Since the early 1970s, public pressure for policy instruments to redress the balance between agriculture and the environment has become more and more insistent. In 1975 the Dutch government published a policy paper on the relation between agriculture and nature and landscape conservation, the so-called Policy Document on Agriculture and Nature Conservation (Relationship Memorandum). This Policy Document describes the tension between the interests of agriculture on the one hand and nature and landscape conservation on the other and defines national policies to solve these problems by means of management agreements and land acquisition.

In the Policy Document, two kinds of areas are distinguished: managed and reserve areas. The policy for management areas is to reconcile the requirements of commercial farming with the objectives of nature and landscape conservation by means of management agreements. They correspond more or less with the Environmentally Sensitive Areas in Britain. The management that is desirable in reserve areas is incompatible with profitable farming in the Dutch situation. Therefore these areas will be withdrawn from agriculture. Their management will be transferred to a nature conservation body. Until the land has been acquired, farmers in such areas may make management agreements to preserve wildlife and landscape values during the transitional period. The policy is to be carried out on 200 000 hectares of agricultural

land with value for nature conservation. This is about 30 per cent of all valuable agricultural land in the Netherlands (in 1983) and about 10 per cent of all cultivated land. About 100 000 hectares will be designated as management areas and 100 000 hectares as reserve areas.

The Dutch government published its Nature Policy Plan in 1990. This plan sets the long-term framework for nature conservation policy in the Netherlands. The goal of this plan is to achieve a sustainable natural environment through the maintenance, rehabilitation and development of natural and semi-natural systems. The most important means to achieve this goal is the creation of a national ecological network. The national ecological network is a coherent network of areas that are already of national or international importance or which have the potential to reach this status through rehabilitation or development. The 200 000 hectares management and reserve areas are (largely) a part of the national ecological network. The Nature Policy Plan also introduced nature development areas. These are agricultural areas that offer perspectives for the development of 'new' nature areas. These areas need to be acquired and will subsequently be developed into nature areas. Nature development will be carried out on 50 000 hectares of agricultural land within the ecological network. The total area of farmland on which nature conservation will be applied thus amounts to 250 000 hectares or 12.5 per cent of the Dutch farmland. The Government Service for Land and Water Management is charged with the implementation of the management agreements and the acquisition and development of reserve and nature development areas.

2. Targets for nature conservation on farmland

Agricultural land is designated as a management area or a reserve area if it has (potential) value for nature and landscape conservation. The four main categories of valuable semi-natural landscapes were mentioned in the introduction. Semi-natural grasslands and areas rich in natural features have suffered the greatest losses, but fortunately many important bird areas still remain.

Semi-natural grasslands

Semi-natural grasslands have a great diversity of plant species, including a large number of less-common species. The agricultural use of grassland has greatly intensified since the 1950s. This intensification has led to a great loss of floral richness. The remaining botanically rich grassland is now less than 2 per cent of the Dutch grassland area (Van Dijk, 1991). These are mainly protected areas. Species-rich remnants along ditch margins are not included in this figure. Table 3 gives an indication of the intensification of agricultural use.

Table 3. N-fertilizers on grassland (kg per hectares), number of dairy cows (per hectares grassland and fodder crops and per farm), milk production (kg per cow) and concentrates (kg per dairy cow including young stock) since 1950

Year	1950	1960	1970	1980	1990	1994
N-application (inorganic)	50	100	200	285	294	298
Dairy cows (per hectares)	1.08	1.18	1.37	1.76	1.44	1.32
Dairy cows (per farm)	-	(8.9)	(16.3)	35.1	40.0	43.6
Milk	3800	4205	4340	5080	6069	6407
Concentrates	450	800	1100	2050	2243	2417

Source: derived from Korevaar (1986), LEI-DLO/CBS (1996), Van Dijk *et al*. (1995).

Studies have shown that most floral richness is found only in areas with a low nitrogen input. The most valuable grasslands have less than 50 kg input of nitrogen per hectares per year or none at all (Dijkstra, 1991; Oomes, 1983). To increase the species diversity of grassland communities, it is important to reduce nutrient supply. A more extreme extensification by reducing the nitrogen supply to levels nearer 0 kg N per hectares per year does not seem to be feasible in current agricultural practice in the Netherlands. Therefore it is very difficult to restore nutrient-poor grassland vegetation types on land in agricultural use. To achieve these vegetation types, these grasslands must be withdrawn from agriculture and their management transferred to a nature conservation body. These grasslands are or will be designated as reserve areas. In a transitional period, management agreements with the farmers may be drawn up.

There is another category of grasslands: the lightly fertilized herb-rich grasslands. A study has shown the desirability and possibility of also directing the management towards these lightly fertilized grasslands, which are becoming ever scarcer (De Boer, 1990). Management agreements appear to offer perspectives for the preservation of these grasslands. Such management agreements call for the following measures to be taken: reducing the use of fertilizers, no use of pesticides, no reseeding, no ploughing, no use of rotary cultivators and a low livestock density or use for extensive hay-making. These measures are also useful when the objective is to buffer adjacent nature reserves. In these situations the land can be designated as management areas.

Finally, it is very well possible to combine profitable farming with the preservation of plot margins. Research on the ecologicals effects of margin management give sufficient indication that this specific management is effective and model studies for grassland show that the influence of the management on the adjacent plot is limited, even in the long term.

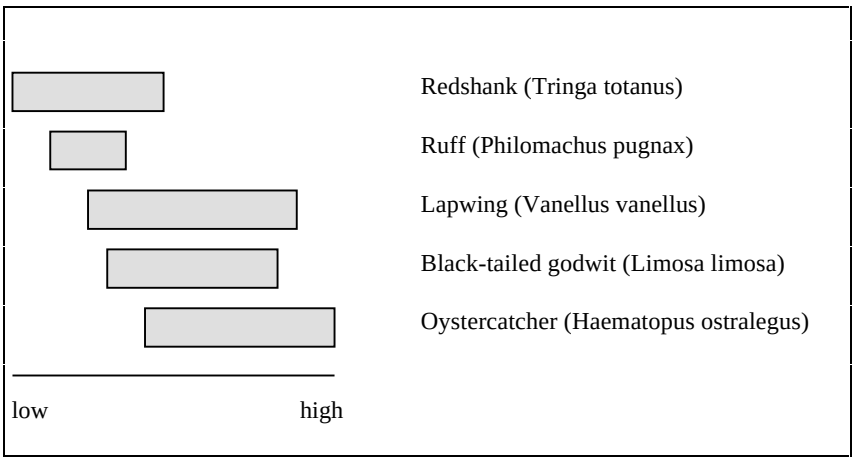
Breeding areas for meadow birds

Meadow birds can be defined as bird species that breed predominantly in grasslands. The grasslands where the meadow birds breed, are all characterized by some kind of agricultural use. In fact the meadow bird populations in the Netherlands depend on the existence and maintenance of these grasslands (Reyrink, 1987).

At the beginning of this century, there was an increase of certain meadow bird species. This was due to an increased biomass of the soil fauna following the use of fertilizers. However, in the last decades the agricultural intensification of dairy farming has caused populations of meadow birds to decrease strongly or even become endangered. The amount of suitable breeding habitat is decreasing as a result of improved drainage and high fertilizer use. This leads to an earlier grass growth in spring and as a result cattle graze earlier and mowing takes place earlier. For meadow birds this means that more eggs and chicks are lost by trampling and machinery and the period of no agricultural use during the breeding season becomes too short for meadow bird species to produce enough offspring (Reyrink, 1987).

Basically, meadow bird management is quite simple. Provided that the basic habitat requirements are fulfilled, the only thing to be done is to practice dairy farming such as Dutch farmers did in the past. Thus, the rules for meadow bird management are: maintain high water levels, limit the level of fertilization with preference for natural manure, postpone mechanical activities (mowing!) and grazing by cattle during the breeding season and ban the use of pesticides (Beintema, 1986). For each meadow bird species one can define a range of suitable agricultural intensities, between the minimum intensity needed (threshold) and the maximum intensity tolerated. This is illustrated in Figure 1 on an arbitrary scale of agricultural intensity.

Figure 1. Hypothetical range of tolerance of meadow birds to agricultural intensity



Source: derived from Beintema (1986).

The maximum tolerance of the Ruff (Philomachus pugnax) to agricultural intensity is too low to be compatible with present-day farming in the Netherlands. On the other hand, populations of less vulnerable species like Lapwing (Vanellus vanellus), Black-tailed godwit (Limosa limosa) and Oystercatcher (Haematopus ostralegus) can be maintained in farming practices with some adaptations. To maintain species like the Ruff (Philomachus pugnax), it is necessary to designate reserve areas and to develop these areas after acquisition into suitable habitats, e.g. by raising the water level.

Wintering areas for water birds

As mentioned earlier, the populations of water birds wintering in or passing over the Netherlands are very important from an international point of view. However, until now few special measures have been necessary for these birds, apart from shooting regulations and dealing with the problem of damage to crops. The reason is that the populations are generally in good shape and have even increased substantially during the last decades. Currently the need for certain measures is being considered.

Landscapes rich in natural features

Landscapes rich in hedges, plots of woodland etc. used to be common in the (often wet) sandy areas in the Netherlands. Very dense networks of hedges and rows of trees along ditches existed, comparable to those that still exist in France and the UK. However, a large proportion of these features has been destroyed during the last decades, with the modernization and mechanization of agriculture. Since the beginning of the Eighties many activities have been carried out to protect and manage the remaining features like hedges, pollarded trees etc. Both farmers and volunteer groups have carried out management work on the landscape elements.

There is one special type of landscape feature which is still common in the Netherlands: ditches. It is estimated that there is a total of 375 000 kilometres of ditches. Many ditches are important for their water ecosystems and for the ditch margin vegetations, holding both riparian plants and remnants of semi-natural grasslands. The main threats to ditches and their margins are eutrophication because of the inlet of eutrophic water and manuring/fertilization on the adjacent land and sometimes also inadequate

management. Therefore more and more management agreements are made to ensure an adequate ditch margin management.

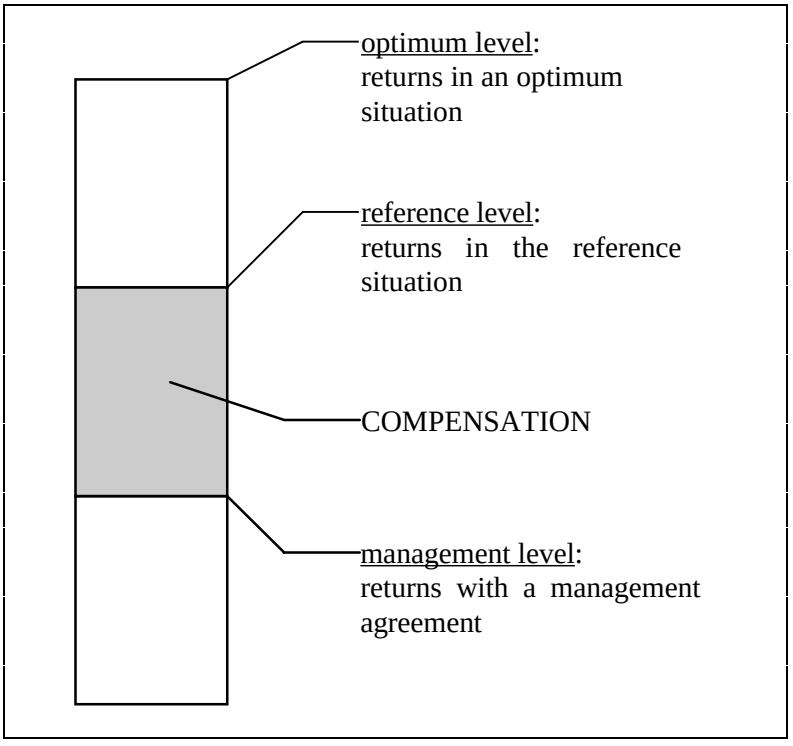
3. Implementation of nature conservation on farmland

The Policy Document and the Nature Policy Plan with respect to farmland has been further worked out in the (governmental) Regulation on Management Agreements and Nature Development, known as the 'RBON'. The RBON defines three kinds of areas (management, reserve and nature development areas). In management and reserve areas a farmer can make a management agreement with local authorities. In reserve and nature development areas the government's objective is to acquire the land. Participation of farmers in the programme is on a voluntary base.

The RBON provides procedures for designating the different areas, drawing up management agreements and buying land. The procedure for making a designation plan prescribes that the plan must be deposited for public inspection for one month, during which time all interested parties may give their opinion. When drawing up the plans, the provincial authorities are advised by a provincial commission, which includes representatives from farmers' organizations and nature conservation organisations.

Of course, management objectives must be formulated before a designation plan can be drafted. The objectives, which may vary from area to area, may concern: preservation of natural handicaps; meadow bird management; botanical management of (a) grassland vegetation, (b) vegetation of field margins and (c) vegetation of arable land; maintenance work on landscape elements; buffer management; preservation and development of a good habitat for other fauna (e.g. butterflies, partridges and badgers).

Figure 2. Returns of grassland in different production situations



Based on these objectives, management recommendations are formulated, which are combined into coherent packages of management measures. Farmers can select one or more of these packages for their farm. The package they choose depends on the management objectives. Management recommendations must meet the following requirements (De Boer *et al.*, 1987): i) they must effectively contribute to the conservation and/or development of nature values; ii) their incorporation into the prevailing farm management must not merely be possible but technically, economically and organizationally feasible; iii) there must be a reasonable balance between the cost of management (management compensation) and its effect on environmental values: a prescription with a very high compensation and a relatively minor effect must be avoided; iv) compliance with the measures should be fairly easy to control in practice. Examples of management recommendations are: no grazing or mowing of grassland before 15 June; no use of pesticides; no ploughing up of grassland; no harrowing or rolling before 15 June; no fertilizer application on a 3 metre wide margin along field boundaries.

4. Management agreement and compensation

A management agreement is a contract based on private law, that lays down the terms to be observed by the land-user and the government. It specifies the management package and the management compensation. The compensation is based on the principle that a farmer entering into a management agreement should not suffer a decline in income in comparison with a farmer who operates under similar conditions but who has not entered into a management agreement (reference situation). Thus, management compensation depends on the extent that the desired management differs from the reference farm management. As illustrated in Figure 2, the compensation is calculated as the difference between the reference level and the management level. The difference between the optimum and the reference level pertains to the natural handicaps in most management and reserve areas. These natural handicaps may be a high water level, ineffective plot distribution, etc.

The management measures do not only affect the production per hectares but also the labour requirements and the operating costs. The compensation is calculated using these three elements. To illustrate, Box 1 shows the calculation of 15 June-management on peatland. Management agreements are made for a period of five years, after which the farmer may terminate the agreement if he wishes. The government's aim is to renew contracts since sustainability in management is a very important condition for the conservation and development of nature values. In practice less than 1 per cent of all participants terminate their contracts.

5. Possibilities for management agreements

On dairy farms the possibilities for management agreements are influenced by two technical aspects: grazing and feeding. Grassland for grazing must remain available during the growing season, and special attention must be paid to the area for grazing in spring. Concerning feeding, if roughage originating from grassland with management agreements is fed to the farmer's own herd, special attention must be paid to animal performance. Dairy cows with a potential annual production of at least 5 500 kg milk are unable to ingest a sufficient amount of energy from roughage originating from grassland with management agreements (Korevaar, 1986). Therefore this roughage is suitable only for young stock and dry cows.

Box 1. Calculation compensation 15 June - management on peatland

The 15 June package consists of the following management recommendations:

1. maintain natural handicaps;
2. use plots as grassland; mow annually;
3. do not plough up, reseed or use rotary cultivators;
4. do not use pesticides except to control spots of Creeping thistle (*Cirsium arvense*), Nettle (*Urtica dioica*) and Broadleaved dock (*Rumex obtusifolius*);
5. do not roll or chain harrow between 1 April and 15 June;
6. do not apply animal manure between 1 April and 15 June;
7. do not mow or graze between 1 April and 15 June

The optimum production level in the Netherlands is 10 000 kVEM[25]. On peat soil, the so called standard decline (the difference between the optimum and the reference situation) is calculated to be 23 per cent. This means that the reference situation on peat soil is 7 700 kVEM. The various management recommendations lead to a decline in returns of 26.76 per cent. There is also an additional labour requirement for the farmer to control spots of Creeping thistle (*Cirsium arvense*), Nettle (*Urtica dioica*) and Broadleaved dock (*Rumex obtusifolius*). These extra man-hours are calculated as 1 hour per hectare. Finally, operating costs and savings, due to the management must also be considered. Operating costs are related to the prohibition on applying animal manure during a certain period. Of course these costs will only be compensated insofar as they exceed the requirements set by law! The operating savings are related to reduced grassland care (see the recommendations 3, 4 and 5) and reduced fertilizer use. Although the use of fertilizer is not formally restricted, a farmer will not apply the usual amount of fertilizer because of the prescription not to mow or graze before 15 June.

The elements mentioned above lead to a financial compensation of the management recommendations, supplemented by a reward. The reward is added to stimulate farmers to enter into management agreements. The reward recognizes that a farmer entering into a management agreement has to make other - more complicated - decisions for managing his farm.

The total compensation (per hectare per year; including a reward of 15 per cent) is:

Decline in returns:	30.78 per cent from the reference level (7 700 kVEM) is 2 370 kVEM
Extra man-hours:	1.15 hours
Operating costs:	net savings of Gld 7 (sum of costs and savings)

The price of 1 kVEM and 1 man-hour will be fixed annually. The kVEM price is based on the marketprice of concentrates in the last five years. The price of labour is based on collective labour agreements. In 1996 the price of 1 kVEM is Gld 0.36 and 1 hour of labour costs Gld 33.81. This means that the total compensation for the June 15th package is Gld 885.08 per hectare per year (1996).

This compensation does not include the first management prescription ('maintain natural handicaps'). The compensation for the first management prescription is based on the compensation in the so called Less Favoured Areas, based on Directive 75/268/EEC and Regulation (EEC) 2328/91. On peat soil, the compensatory payment in Less Favoured Areas is fixed at a maximum of Gld 260 per hectare per year.

Source: derived from Dienst Landinrichting en Beheer Landbouwgronden (in preparation).

[25] kVEM is a Dutch unit for the returns of grassland, based on energy value.

At low stock rates, the scope for entering into a management agreement is limited because there are not enough cattle (young stock and dry cows) to use the roughage. Sometimes the roughage can be sold. This will increase the scope for a management agreement. At higher stock rates the scope is limited by the amount of grassland needed for grazing the cattle in spring. The possibilities for entering into management agreements depend on a lot of farm-related factors and cannot be expressed in one standard value. In total, managements agreements with far-reaching measures may be applied to between 0 and 50 per cent of the total area of the farm (Vellinga *et al.*, 1995).

A management agreement will lead to a change in the phosphorus cycle. The grass of the first cut (15 June) has a low energy and protein content in comparison to other roughage. The hay of the first cut is fed to dry cows, heifers and calves (in this sequence). To prevent a decline in growth, compensation is needed with good roughage and concentrates. This compensation leads to an extra intake of phosphorous (De Haan *et al.*, 1995). On the other hand, research has pointed out that on farms with management agreements the mineral surplus is lower than on Dutch farms in general (De Boer, 1995). This may be caused by a more economical use of fertilizers. The same study shows that a farmer with a management agreement attains relatively good economic results (better than farmers in the same situation without a management agreement) due to a relatively high education and a good farm management (De Boer, 1995).

6. Effectiveness of management agreements

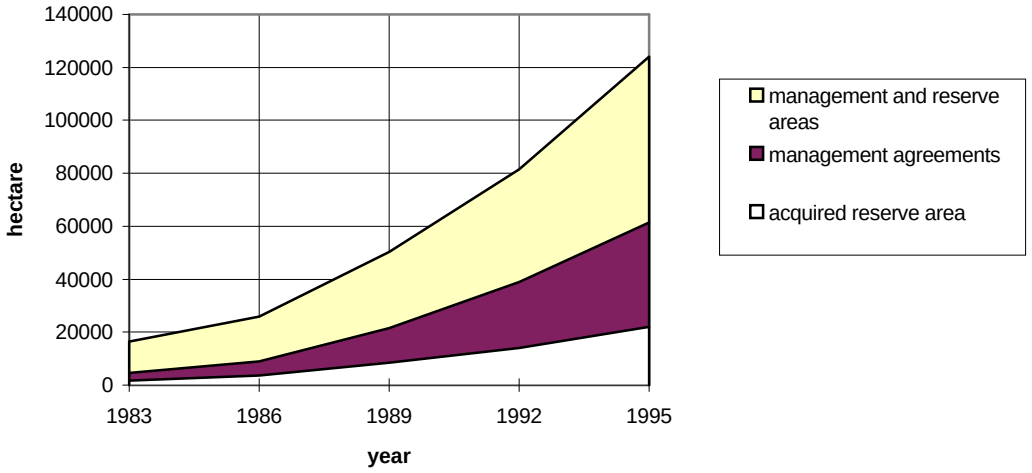
Programme effectiveness can be shown by the participation of farmers and the effects for nature conservation. At this moment about 6 000 farmers have management agreements covering about 40 000 hectares. About 22 000 hectares reserve area has been acquired. Above that about 10 000 hectares of agricultural land has been acquired in order to realise reserve areas. This is land that will be designated as reserve areas or that will be used to exchange plots in reserve areas. About 125 000 hectares of agricultural land have been designated as management or reserve areas. The target is to have all management and reserve areas (total of 200 000 hectares) designated in 1998.

Although participation in the programme is voluntary, farming communities were at first sceptical about the Policy Document. They were afraid of being forced into old-fashioned ways of farming, e.g. hampered by high water levels. It took six years before the first agreements were signed. Farmers were also afraid that participation would lead to changes in the framework of physical planning, which would lead to limitations in agricultural use. The government has stated several times that application of the Policy Document and physical planning are two independent policy strategies. The values of nature may lead to a certain function in physical planning. The same values may also lead to application of the Policy Document. The application of the Policy Document follows decisions in physical planning and does not instigate them.

Figure 3 gives an indication of the programme's progress. Recently, farmers have displayed a growing interest in the possibility of entering into a management agreement. A growing group of farmers sees countryside management as an (economic) activity, next to their other farming activities. They are convinced that a management agreement contributes to the development of their farm (Oostindie *et al.*, in prep.). To establish the effects for nature, a monitoring programme has been carried out since 1986. Several representative plots all over the country are monitored: every three years for meadow birds and every six years for vegetation. It is too early to present the definite conclusions, but a tendency can be shown.

Regarding the vegetation, a management agreement (especially with far-reaching measures), can stop the decline of plant species diversity of grasslands. The remaining valuable botanical grasslands can thus be conserved. However, most of the designated grasslands are now species-poor. In these situations a management agreement with far-reaching measures will give a certain increase in species. The results of the management will be more successful under promising abiotic conditions (e.g. grasslands on chalk or grasslands on seepage-soils). If the abiotic conditions are less promising (e.g. dry sand and clay soils), management on the basis of a management agreement will lead to lightly fertilized grassland types, like grassland communities with Yorkshire fog (Holcus lanatus) and grassland communities with Crested Dog's tail (*Lolio-Cynosuretum*) (Wymenga, 1996).

Figure 3. Progress of the implementation of the Policy Document 1983-1995



Source: derived from annual reports Government Service for Land and Water Management.

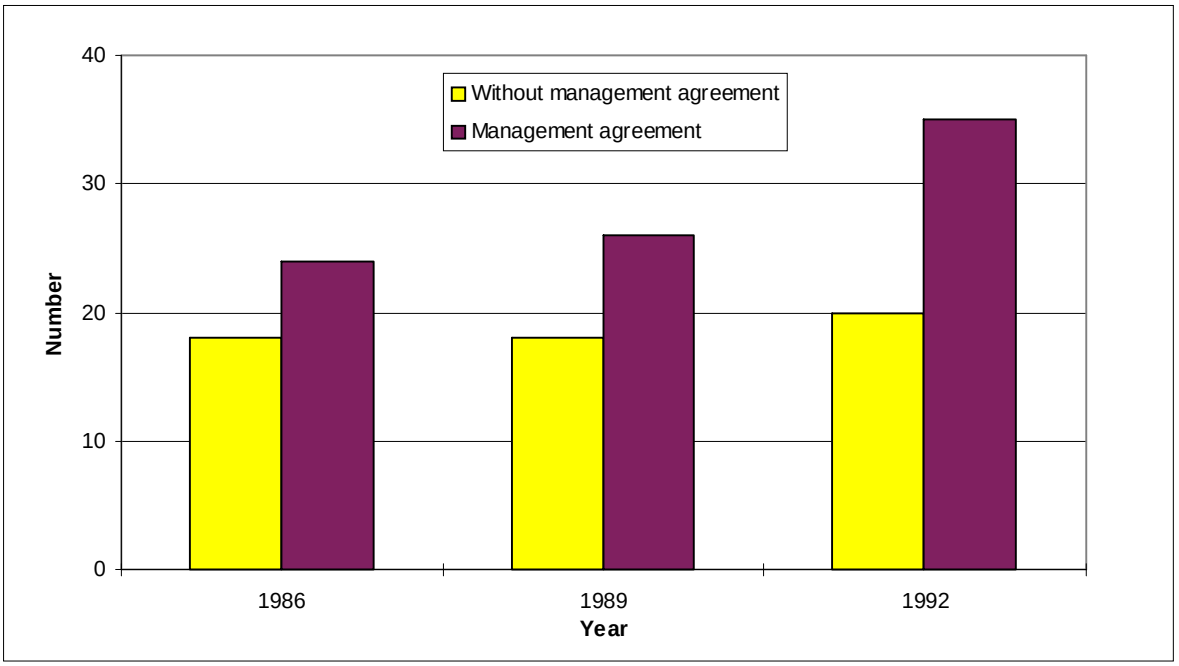
Regarding meadow birds, it can be noted that in general most species can be protected with management agreements. The Black tailed-godwit (*Limosa limosa*), Northern Shoveler (*Anas clypeata*), Garganey (*Anas querquedula*) and Redshank (*Tringa totanus*) are doing well in areas where management agreements have been made. More vulnerable species, like Common Snipe (*Gallinago gallinago*), Ruff (*Philomachus pugnax*), Corncrake (*Crex crex*) and Eurasian Skylark (*Alauda arvensis*), are following the national trend, thus also declining in areas where management agreements have been made (Wymenga, 1996). It is important to note that this is a tendency and not a definite conclusion. The period of monitoring was too short in most areas to draw definite conclusions.

Figure 4 shows an example of the positive effects of management agreements (about 400 hectares) on Terschelling. According to this data, there has been a slight increase of breeding pairs on plots without management agreements too. This may be the result of management agreements on adjacent plots (overflow), but this was not investigated specifically (Directie Beheer Landbouwgronden, 1993). More recent research has shown that such an overflow does indeed occur (Beintema, 1996).

7. New initiatives

As mentioned before, the increase in areas under management agreements is satisfying. On the other hand the programme is as yet to come into effect on 50 per cent of the designated areas. Therefore it is important to improve the programme in order to get more farmers interested in nature-oriented agricultural management. Improvement of the programme implies that the quality of the management (in terms of nature results) at least remains the same and that participation of farmers grows. Four new initiatives are discussed here: nature result payment, margin management, cloak areas and nature conservation by private landowners.

Figure 4. Number of breeding pairs per 100 hectares of the Black-tailed godwit (*Limosa limosa*) on Terschelling



Source: derived from Directie Beheer Landbouwgronden (1993).

Nature result payment

In the current system a farmer is paid for creating environment-friendly conditions (e.g. no use of fertilizer). Payment is assured regardless of whether in a particular situation nature reacts to these favourable conditions. According to the concept of nature result payment, farmers are paid for positive results only, whether or not as a consequence of their efforts. The basic idea is that payment according to this concept stimulates farmers' entrepreneurial qualities. They are free to choose how they achieve nature benefits on their land. There are no recommendations as to how to reach them. This might be a more challenging way for farmers to contribute to nature conservation. Notwithstanding the possible advantages, complications should also be mentioned. These are: the definition of nature results, the logistics of checking the correctness of farmers' statement, the risk of frustation when nature does not react the way the farmer wants it to (e.g. no nature results). An evaluation of several experiments on nature result payment has shown that the system contributes to the protection of certain (less vulnerable) species

of meadow birds and can be carried out in practice. Thus it may be useful under certain conditions to add the system of nature result payment to current systems of nature management (Mugge *et al.*, 1996).

Margin management

To be an attractive form of agricultural nature management, margin management has to fulfil at least two conditions. Firstly, it has to be ecologically effective. Secondly, the possibility of combining it with current use of the adjacent land is a prerequisite for farmers to participate in great numbers (Melman, 1994). Many investigations have shown that margins have a much higher species-richness than the other parts of the plots. Furthermore ecological results of margin management give sufficient evidence that this specific management is effective and that the influence of the management on the adjacent plot (undesired herbs) is limited. Margin management is incorporated in the RBON because of its potential ecological significance and its modest costs to the farm business.

Margin management is now possible in designated management and reserve areas. Here complete plots of land are designated. With respect to the botanical ambitions in management areas (not in reserve areas), it has to be said that in several regions these objectives can as yet be reached only if margin management is practised. In this case it will suffice if only the margins are designated as areas where management agreements can be made. Of course, margin management is no solution if the objective is to conserve or develop botanical values on the plots themselves. In areas with this objective the whole plot will still have to be designated.

Cloak areas

Another new initiative is the so-called cloak areas. This term will be explained. The current practice is that farmers can enter into management agreements for every plot in a management area. Cloak areas enable a much larger area to be designated than the area originally available for making management agreements. With this kind of designation many more farmers will have the opportunity to enter into a management agreement. On the other hand, an application for a management agreement has to be refused once the available quotum has been reached. The effect of designating in this way is that plots with a management agreement will be spread out over a larger area. The plots with a management agreement of course have the primary function of allowing meadow birds to produce their offspring. Secondly, plots with a management agreement have a positive influence on the meadow birds on adjacent, intensively used, plots. Black tailed-godwits (*Limosa limosa*) and their chicks from the adjacent intensively used plots will use the plots with a management agreement for food and shelter. (There is some offspring on the intensively used plots, but of course this is much lower than on the plots with a management agreement).

Thirdly, Lapwings (*Vanellus vanellus*) and their chicks find their food on grassland with short vegetation and will move from the plots with long grass (where management agreements are concluded) to the plots with short grass. In other words, good meadow bird management calls for a spatial variety of plots with high and with short vegetation. This is called a ‘patchwork’. Results on the ecological effects gave sufficient indication that this kind of designation is effective, especially for the Lapwing (*Vanellus vanellus*) and Black tailed-godwit (*Limosa limosa*) (Beintema, 1996). Of course, the sustainability of management on the plots with a management agreement is a condition for the conservation of the population.

Nature conservation by private landowners

As mentioned earlier, reserve areas will be withdrawn from agriculture and the management of these areas will be transferred to nature conservation bodies. This means that these areas have to be acquired by the government. Recently farmers and landowners have shown a growing interest in the management of these areas. Therefore the government has started an experiment examining the possibilies of nature conservation by private landowners. In this experiment the reserve area is withdrawn from agriculture but the owner retains ownership of the land. Landowners participating in the programme must manage the area so as to reach the objectives of nature conservation. To ensure the sustainability of nature management by private landowners, contracts will be made for a period of 25 years. The landowner gets compensated both for withdrawing the land from agriculture and for carrying out the nature management. Nature conservation by private landowners differs from management agreements in that the latter leads to modified agricultural use (the plot will not be withdrawn from agriculture), while the former requires that the plot no longer has an agricultural function. The expectation is that under certain circumstances private landowners can play a role in nature management.

8. EU: Less Favoured Areas and Environmentally Sensitive Areas

The RBON is the national implementation of Regulation (EEC) 2328/91, regarding the Less Favoured Areas (LFA) and Regulation (EEC) 2078/92, regarding the Environmentally Sensitive Areas (ESA). In the Netherlands LFAs are generally the same as ESAs, and a maximum of 140 000 hectares can be designated as LFAs on the basis of the so called LFA-Directive (Directive 75/268/EEC). These areas have specific handicaps arising from unfavourable natural production conditions, due to poor drainage and/or a poor soil quality, as well as handicaps resulting from restrictions prescribed for the preservation of the countryside. The compensatory payments in LFA's are based on Regulation (EEC) 2328/91 and are co-financed by the European Agricultural Guidance and Guarantee Fund, Guidance section. In 1995 the Dutch government paid Gld 9.0 million in compensatory payments of which Gld 1.9 million was co-financed by the EU.

The Agri-environmental Regulation (Regulation [EEC] 2078/92) aims to encourage farmers to adopt farming methods compatible with the requirements of environmental protection and maintenance of the countryside, thus contributing to balancing the market; at the same time, the measures must compensate farmers for any income losses caused by reductions in output and/or increases in costs and for the part they play in improving the environment. The RBON has been approved as a programme under Regulation (EEC) 2078/92. The management compensation is co-financed by the European Agricultural Guidance and Guarantee Fund, Guarantee section. In 1995 the Dutch government paid Gld 16.2 million for management agreements of which Gld 5.4 million was co-financed by the EU.

9. The expected effect of trade liberalization

Policy reform in the European Union is likely to take the form of some further liberalisation of trade, in the framework of the next WTO Round, subsequent adaptations of the CAP, the continuing transition from price support to direct income support (hectare and headage premiums), strengthening of the environmental element through cross-compliance and a growing role for agri-environment measures and perhaps a gradual generic reduction of agricultural support, except for those farmers with special environmental performance. What will the effect of all this be on Dutch agriculture?

Earlier we mentioned intensification and abandonment as the main causes of the deterioration in the situation of nature on European farmland. The latter, abandonment, is not very likely in the Netherlands. However, land is deliberately being taken out of production in the Netherlands, for the purposes of nature reserve management and afforestation (locations harmonized with nature and landscape interests) and nature development/restoration. Spontaneous abandonment, however, may only happen in "Waterland", a very fragmented complex of island plots north of Amsterdam. And intensification? Will this continue? The European Union Nitrate Directive as well as our national manure policy have set clear limits to inputs, so a further increase in that field does not seem likely.

However, increased global competition, in the future perhaps from new competitors in new member states in Central and Eastern Europe too, may make structural changes in agriculture necessary in order to be able to survive. Land use as such is not likely to change profoundly, but the existing number of farms will probably decrease further. Existing farms may disappear and make place for even more modernized ones. Will nature-oriented agricultural management still be compatible with such farming practices? This is a difficult question, but one meriting serious attention. The answer might lead to new reflections regarding possible solutions, e.g. the potential role of "nature production" as a source of income.

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SWEDEN: INCENTIVES FOR ENVIRONMENTAL MANAGEMENT OF FARMLAND WITH HIGH BIOLOGICAL VALUES

by
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Introduction

The total area of Sweden is 449 964 km^2, of which 39 030 km^2 are lakes and water courses. More than half of the land area is covered by forest. A quarter of the country is mountains and marshes. About 9 per cent of the land area is agricultural land. Changes in the structure of Swedish agriculture during the twentieth century have led to a considerable reduction of the number of agricultural holdings. At present there are 91 000 holdings with an average arable land area of 30 hectares. The holdings in the northern part of the country and in forest regions are often of less acreage, while holdings in plain areas in the south and central parts have a larger average area. At present 44 000 hectares of arable land is cultivated organically (including pasture 56 000 hectares). That is approximately 1.5 per cent of the arable land. The Swedish Parliament has set an objective that 10 per cent of the arable land should be organically cultivated by the year 2000.

1. The environmental situation

Losses of nutrients, mainly nitrogen and phosphorus, from agricultural land contribute to increased levels of nutrients in surface and ground water and coastal waters. Losses of nutrients from agricultural land is estimated to contribute to 30 per cent of nitrogen and 10 per cent of the phosphorus input to lakes and watercourses in Sweden. On average 17 kg nitrogen and 0.4 kg phosphorus are estimated to be lost per year and hectare of arable land. Nitrogen leaching from agricultural land is larger in the south of Sweden than in the central and northern parts of Sweden. In central Sweden clay soils are more frequent and the ground is frozen for a longer period. In the north of Sweden the ground most often becomes frozen early, which prevents nitrogen leaching. Nevertheless, there are local areas with high losses of nutrients also in the central and northern parts of Sweden.

The Swedish agricultural landscape is a product of human influence through cultivation and agricultural management. Different cultivation methods in combination with various natural conditions have created a varied landscape with high biological diversity. The agricultural land has decreased since the end of the nineteenth century. Today only 7 per cent of the land area is arable land and 1.5 cent is grazing land. Structural transformation of agriculture and abandonment of land have led to a decreased variation in the landscape.

In plain lands the landscape has become more uniform. Wetlands have been drained, ditches filled up, and other obstacles to cultivation such as “field islands” and stone walls have been removed, to a

great extent. The landscape in areas with mixed agriculture and forestry is more varied. Agricultural land has mainly been abandoned in forest regions and regions with mixed agriculture and forestry, i.e. in regions where agriculture is carried out in a smaller scale, on less fertile soils and with less profitability than in the plain lands. These areas are already dominated by forest. If the arable land is abandoned and reafforested the mosaic structure will disappear and a uniform forest region will remain. In the forest regions only 2-3 per cent of the land area is used for agricultural purposes. In the forest regions in the south of Sweden the average field size is 1-2 hectares. A large part of the agricultural land is grazing land.

The old agricultural landscape was influenced by various methods of managing mowed meadows, semi-natural grazing lands and arable land, which created suitable biotopes for many species of plants and animals. The changes and rationalisations that have taken place in agriculture during the last fifty years have resulted in reduced biodiversity in the agricultural landscape. About 20 per cent of the species in the Swedish agricultural landscape are considered to be more or less acutely threatened by extinction. Meadows and open or wooded pastures are the areas with the greatest variety of species. In the nineteenth century the semi-natural grazing land constituted 2 million hectares. Today only about 500 000 hectares remain. When it comes to mowed meadows, they corresponded to 1.2 million hectares at the end of the nineteenth century. Today there are only 3 000 hectares left. After the second world war a lot of essential biotopes were removed in order to achieve larger fields. Another reason for the impoverishment of the flora and fauna has been the use of fertilizers and pesticides. Air pollution with nitrogen also has a negative effect on the biodiversity. In recent decades abandonment of pastures and arable land resulting in overgrowing and/or afforestation has been the most serious threat to biodiversity. This abandonment of farmland has mainly taken place in the forest regions in the northern as well as in the southern parts of Sweden. Low or no profitability at all is normally the explanation.

Since 1995 Sweden has a management agreement programme to conserve biodiversity in the agricultural landscape. The framework for the programme is council Regulation (EEC) 2078/92 on agricultural production methods compatible with the requirements of the protection of the environment and the maintenance of the countryside. The overall objectives for the Swedish programme are to maintain a naturally and culturally valuable and varied agricultural landscape, to conserve the biological diversity and to minimise the negative effects on the environment caused by nutrient leakage and the use of pesticides. Other measures designed to conserve biodiversity are management agreements, legislation, information and monitoring.

2. The Swedish Agri-environmental Programme

The Swedish Agri-environmental Programme consists of three parts: i) conservation of biodiversity and cultural heritage values in the agricultural landscape as well as maintenance of an open landscape in the forest regions and in northern Sweden; ii) environmentally sensitive areas; and iii) promotion of organic production. The budget for the programme reflects the environmental policy priorities. The programme covers the whole of Sweden, but some of the measures are applicable only in certain designated areas. The objectives of the programme are: i) to conserve the biological diversity and cultural heritage remains of high value in the agricultural landscape, which have been created by long-term traditional farming practices, through appropriate maintenance of meadows, semi-natural grazing lands, landscape elements and other cultural heritage values, so that traditional and representative values of different regions are conserved for the future; ii) to conserve genetic resources in local breeds of animals threatened by extinction; iii) to restore and establish habitats to enhance biological diversity; and iv) to reduce leakage of nutrients and use of pesticides to avoid health risks and to provide suitable conditions for the flora and fauna.

Farmers who want to participate in the programme have to apply to enter into a five-year contract. The conditions they have to fulfil are quite extensive and detailed. The conditions concern the biological quality of the land as well as the management of this land. One measure concerns the safeguarding of biological values in meadows and semi-natural grazing land. These are divided into classes with respect to their environmental values. Factors important in determining the environmental value can, for example, be the occurrence of plant species that indicate long-term traditional mowing management or the share of the fields that have been affected by fertilization or liming. High biological values usually demand a more careful and labour-intensive management which justifies the higher compensation level.

The aim of the terms that correspond to the measure on meadows is to maintain a similar type of ecological impact on the vegetation that has created plant associations typical of traditional hay-making with scything. The farmer therefore needs to comply with conditions on cutting tools. The time of the harvest is important in order to let typical plants shed their seeds. Also, for grazing land the farmer is obliged to comply with management conditions on, for example, grazing, mowing and, as in the case of meadows, the use of fertilizers and pesticides is not allowed.

Landscape elements on arable land are residuals of ancient agricultural landscapes. Landscape elements function as biotopes where flora and fauna promoted by traditional agricultural practises can survive. At the same time they are historical features that reflect the history of agriculture and its farmers. Cultural heritage remnants and biologically rich habitats on arable land are physical obstacles to intensive farming. The measure on areas with biologically rich habitats and valuable cultural heritage environments aims at maintaining arable land with these valuable elements. The elements shall be managed in a way that conserves or enhances the high density and diversity of species. To qualify for the measure a certain amount of landscape elements are needed. Eligible elements are, for instance, ancient monument sites, pollarded trees, stone walls and avenues. The terms of the programme concern the management of the landscape elements.

The sub-programme for the open landscape in northern Sweden and in the forest areas aims to maintain the cultivation of hey and the semi-natural grazing lands in these parts of the country. Without this programme, these fields would be abandoned and agriculture would fall back, resulting in afforestation. This openness is very important for the biodiversity of the forest regions. One measure of the agri-environmental programme concerns the restoration or establishment of wetlands or ponds on arable land. The undertaking for this measure must be for 20 years. The objectives are to increase biodiversity, and to reduce the leakage of nitrate and phosphorus.

Information and education of farmers are very important activities. The measures mentioned are supplemented by information activities. The main target groups are farmers and landowners, and also those who do not participate in any programme. The activities include courses, demonstration farms and individual management plans for the natural and cultural values on the farms. To participate in some measures it is mandatory for the farmers to attend a relevant course on the matter.

3. Experiences

The new programme replaces two earlier management agreement programmes on biodiversity and landscape conservation. The farmers were therefore familiar with the management agreement concept. The former system, which contained fewer farmers, had the advantage of being more specific to the conditions on the individual farm. The programmes did not contain any detailed legislation. At the same time that meant less transparency of the system since the application could differ within the country. The

administrative provisions was adjusted to each holding. No special information and education activities were allocated to accompany the measures.

After joining the European Union, a comprehensive agri-environmental programme was developed, where the experiences of the earlier schemes were taken into account. The programme is developed in accordance with Regulation 2078/92. All measures are accompanied by education and information activities. There have been initial difficulties in launching a wide horizontal programme covering all farmers. There needs to be a balance between targeting the measures to ensure the best environmental effect, provide a transparent and comprehensive system for the farmers and keep administration costs at a reasonable level. It is not easy to include the management of a complex and varied biodiversity in a legal framework. The monitoring and the evaluation of the programme result will be important in order to improve and develop the measures in the future. The attendance to the programme has however so far been very good. The Federation of Swedish Farmers has supported the work and has actively participated in the development of the programme as well as in its implementation. Their support and recommendations to farmers to join the programme has very much facilitated the implementation.

The Swedish Board of Agriculture will regularly evaluate and review the whole programme and if necessary propose changes. That work shall be done in co-operation with the Swedish Environmental Protection Agency, the National Board of Antiquities and various other governmental and non-governmental organisations.

UNITED KINGDOM: ENGLISH ENVIRONMENTALLY SENSITIVE AREAS

by
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Summary

Environmentally Sensitive Areas (ESAs) are a policy instrument operated in the United Kingdom to pursue environmental objectives in designated areas of high environmental value, through the encouragement of appropriate agricultural practices. This paper explains the background to the ESA policy, and how the positive voluntary approach to conservation under the ESA scheme relates to regulatory provisions for the protection of the environment. It also covers examples of the results of recent environmental and economic evaluations of the impact of the policy in the first five ESAs introduced in 1987. Finally, it states that the policy could be adapted in the future to improve its delivery of environmental benefits.

Introduction

The ESA scheme was introduced in the United Kingdom in 1987 following the passage of enabling legislation (Section 18 of the Agriculture Act 1986) although a pilot scheme ran in an area of the Norfolk Broads in 1985-86. The main distinguishing characteristics of these schemes (compared with previous approaches) are that they are based on 5 or 10 year contracts with farmers to carry out a defined set of beneficial agricultural practices in return for fixed annual area-based payments, and are voluntary and open to all managing suitable land within targeted areas. The ESA approach has subsequently been adopted elsewhere in Europe under the European Union Agri-environment Regulation (EEC) 2078/92.

The overall policy objective of the ESA programme is to maintain, protect and enhance the wildlife, landscape and historic environmental value of the designated areas, through the encouragement of appropriate agricultural practices. Following the introduction of Regulation (EEC) 2078/92, a recreation (public access) option was added but this has not been evaluated to date and is not further discussed in this paper.

Initially five ESAs were introduced in England and two in Scotland, but the policy has been expanded subsequently and there are now 22 in England covering 10 per cent of the agricultural area, and 43 in the United Kingdom as a whole, covering 15 per cent of the agricultural area. A separate agri-environment scheme with similar basic objectives (Countryside Stewardship) covers the rest of England. ESA schemes in Scotland, Wales and Northern Ireland are slightly different from the English model, each part of the United Kingdom having adapted the basic formula to suit local requirements. The remainder of this paper concentrates on the English ESA programme.

The Government's specialist advisers (countryside agencies) have legal responsibility for advising the Ministry of Agriculture Fisheries and Food (MAFF) on the designation of ESAs, and their concerns have focused on responding to threats from agricultural changes to the environmental value of key areas. The criteria on whose basis the last 12 English ESAs were designated in 1993 and 1994 were: i) each area must be of national environmental significance; ii) each area must represent a discrete and coherent unit of environmental interest; iii) the conservation interest must depend on adopting, maintaining or extending particular farming practices; and iv) *either* farming practices must have changed or be likely to do so in ways that pose a threat to the environment; *or* the adoption of particular farming practices must be capable of resulting in significant environmental improvements.

1. The environmental benefits sought by ESAs

In the terms of the categories of amenity, habitat and ecological processes described in Professor Bromley's overview paper, the environmental benefits of ESAs are restricted primarily to the first two of these headings (i and ii). The most significant feature of the environmental interest of ESAs is that it has largely been created through traditional agricultural practices which have (as described in the overview paper by Nowicki and Wascher) led to co-evolution of wildlife communities and traditional agriculture, and also to the imposition of a distinctive landscape structure on the basic topography of the land (which in its primeval state would have been covered by forest in much of the United Kingdom).

The habitat interest of the ESA areas consists of both unmanaged areas (e.g. ancient woodlands, ponds, bogs and fens) and a range of semi-natural habitats which have been created by traditional agricultural management and are dependent for their conservation upon its continuation. The most important component is the wide range of grazed habitats central to the ESA schemes; in these areas, traditional management has involved extensive or moderate levels of grazing by stock and low levels of chemical inputs, particularly of fertilizer.

In different geographical areas, and under different environmental conditions, other more specialised management activities have combined to maintain characteristic and valuable plant community types. Examples of such communities are the unimproved northern haymeadows of the Pennine Dales which require late hay cuts in some years, the lowland grazing marshes of the Broads and Somerset Levels and Moors which require high water-levels to be maintained in the field boundary ditches, the calcareous grassland of the South Downs where grazing by sheep has been responsible for the development of botanically rich grassland, and the south-western lowland heathland of West Penwith which requires periodic burning. Other agriculturally managed components of habitat importance include heath and moorland vegetation, grazed wetland habitats and hedges.

Changing agricultural practices associated with new technology, social trends such as the reduction in farm labour, and agricultural support regimes, lead to changes in the traditional farming practices which have created and maintained these communities. For example, there has been a long term and widespread reduction in hay production in favour of other forms of grass conservation such as silage. In many areas, the availability of artificial fertilizers, broad spectrum herbicides and new machinery have encouraged the increasing intensification of grassland and increased stock numbers. Farming systems have tended to change in many areas, including for example the introduction of winter housing for livestock, changes from livestock to arable farming in many lowland areas, and a trend from beef suckler production to dairy and sheep. All of these can damage the environmental interest of key habitats, in some cases with a limited agricultural change likely to cause a serious environmental loss.

Amenity interest is provided via landscape features such as hedges, dry stone walls, traditional buildings and other adjuncts to agricultural management, which have been created by farmers for management purposes which may now have diminished or disappeared. For example, the efficiency of larger farm machinery has created pressure for increasing field sizes, and hence for the removal of field boundaries such as traditional drystone walls and hedge-banks. Again, there is a strong inter-relationship between farming practices and environmental benefits which are highly valued by the general public as characterising the specific landscape quality of each area.

Finally, amenity interest is contained in archaeological and historic features which have been maintained under traditional agricultural management. For example, the maintenance of archaeological sites under permanent grassland removes the risk of damage to buried underground features which would result from scrub or tree growth; this category overlaps with that of landscape, in that field patterns of stone walls may date to prehistoric agricultural settlements, such as in the West Penwith ESA described in more detail in the Annex. The ESA scheme does not generally seek to address off-farm environmental objectives (ecological processes as referred to in the Bromley paper) although off-farm effects may result from the general changes to land use consequential on the pursuit of other objectives.

2. Relationship between incentive schemes and regulatory mechanisms

This section explains the relationship between the ESA scheme (and comparable incentive-based policy instruments), and the regulatory provisions affecting agricultural practices in England. The impact of planning designations is limited in relation to normal agricultural practices, although restrictions apply for example to the construction of intensive animal production units, the construction, or extension of large farm buildings and some changes to the use of existing buildings, in particular, change of use for non-agricultural purposes.

The current regulatory restrictions on farming practices apply primarily to the avoidance of pollution (controls on the safe storage of farm animal and other wastes and the safe use of pesticides) and direct damage to wildlife (prohibition of harmful pest control techniques). However, regulation is also used to protect some habitats and features potentially at risk from changes to agricultural practices. These include sites of wildlife conservation or geological interest. For example, Sites of Special Scientific Interest (SSSIs) are protected by UK legislation because of their importance to the natural heritage. Owners and occupiers of SSSIs are required to give the Government's conservation agencies notice of any potentially damaging operations on their land. The agencies can persuade owners or occupiers to modify or refrain from their proposals or can give compensation if the owner or occupier agrees to retain the special interest of the site. Some farm buildings are protected against alteration or removal under historic buildings legislation. Proposals to introduce regulations for the protection from removal of hedges of wildlife, landscape or historic importance will be published for consultation.

Cross compliance can also be regarded as a form of regulatory restriction on farming practices when it involves the attachment of mandatory environmental conditions to agricultural support payments (see definitions in Baldock and Mitchell, 1995). Cross compliance measures introduced in the UK to control over-grazing and unsuitable supplementary feeding of livestock on semi-natural vegetation are described in MAFF, 1996. Various environmental conditions are also applied to arable land set aside (fallowed) under supply control arrangements, for example to prohibit mowing during the bird nesting season.

A further element in the arrangements for reducing potential environmental harm by agriculture is the series of Codes of Good Agricultural Practice (GAP) issued to farmers by the UK Agriculture

Departments. Some of these Codes are statutory, and they provide a general bench mark against which both regulatory and voluntary incentive policies can be determined. Thus, prescriptions for voluntary ESA agreements may repeat GAP requirements, but in common with the impact of other regulatory restrictions on farming practices, payments are only made for activities which go beyond GAP as defined by the Codes. Another example of this principle is the forthcoming requirement for farmers to comply with nitrate reduction measures in designated Nitrate Vulnerable Zones (under the European Union Nitrate Directive 91/676), where nitrate pollution is a problem. The measures are based upon good agricultural practice and, accordingly, will not be compensated. Conversely, farmers with land covered by the Nitrate Sensitive Areas Scheme (under the European Union Agri-environment Regulation [EEC] 2078/92) have the option of voluntarily making changes to their farming practices which go substantially beyond good agricultural practice in return for payment.

3. Detailed operation of the ESA scheme

Under the current rules of the ESA scheme, farmers and other land managers with responsibility for agricultural land are able to enter 10 year management agreements with MAFF; there is an option of termination after 5 years. A farmer receives annual payments on each hectare of land entered into the scheme. Each ESA has one or more tiers of entry, and each prescribes specific agricultural practices to be followed (these rules are known as prescriptions). The nature of each tier depends on the circumstances of each ESA, and they may include: protection and management of existing features; maintenance of stock-proof walls and hedges; traditional management of haymeadows; maintenance of high water levels in wetland habitats; establishment of arable field margins; reversion of arable land to grass; and enhancement of heather moorland.

Payments per hectare are set in the light of the criteria defined in article 5 paragraph 1(b) of Regulation (EEC) 2078/92, that is to say on the basis of the undertaking given by the beneficiary and of the loss of income and of the need to provide an incentive. Each prescription is assessed as to its individual impact on the local farming system in both physical and economic terms, taking account of any interaction between prescriptions. The effects of the total package of prescriptions for the tier (including the costs of positive works) are calculated by reference to a typical efficient farm in the area. The combination of the change in output (usually a reduction) with the changes in costs (often an increase) gives a figure for the Income Foregone.

Payment rates are based on Income Foregone after taking account of any incentives that may be required (i.e. to overcome inertia, and the need for the farmer to change his management approach) and any likely contribution from the farmer (the value of what he would have voluntarily undertaken for non financial benefits), in order to achieve scheme objectives (see Annex). Payment rates are reviewed at 2-yearly intervals to take account of changes in the economic profitability of relevant types of farming in the area, and also changes in farming practice and technology. Payment rates may be (and have been) reduced as well as increased.

The management of the scheme is primarily through professionally qualified Project Officers who are the farmers' first point of contact in most circumstances. The provision of dedicated Project Officers has proved invaluable in promoting the scheme, and encouraging and persuading farmers to make what are often radical and long-term changes in farm policy. The professional management of the scheme is the largest element in the overheads set out in Table 1. Administration, enforcement and payment is carried out by MAFF's regional organisation as for agricultural support schemes.

Table 1. Historic and forecast uptake and expenditure on ESAs

	1992/93	1993/94	1994/95	1995/96	1996/97
Environmentally Sensitive Areas					
Area under agreement (Ha)	129 358	266 458	346 391	409 962	487 922
Number of agreements	3 265	4 514	6 141	7 479	8 556
Payments to farmers (£k) (a)	10 900	16 500	20 100	29 100	32 456
Overhead costs (£k) (b)	11 108	12 212	9 995	10 410	7 995
Total ESA scheme costs (£k) (a)+(b)	22 008	28 712	30 095	39 510	40 451
Total other agri-environment scheme costs (£k)	5 356	10 151	14 182	21 411	27 627

4. Objective setting and policy evaluation

Environmental objectives have been set for each of the 22 English ESAs. They develop the environmental aim for each ESA, which is to maintain and enhance the landscape, wildlife and historic value of the area by encouraging beneficial agricultural practices. An ESA will typically have 4 or 5 environmental objectives, supported by more performance indicators; an example of how the objectives for one ESA (West Penwith) have been determined, monitoring work carried out and conclusions made is given in the Annex. The environmental objectives and performance indicators have been set in consultation with the Government's specialist advisers, and are publicly available.

A programme of environmental monitoring is carried out to provide information in respect of the environmental performance indicators, against which the achievement of the objectives can be assessed. An evaluation of the monitoring results is undertaken to inform the review of each ESA which takes place every 5 years. An evaluation of the first 5 ESAs launched in 1987 has recently been completed, and results made available to interested organisations (ADAS 1996, 1-5); in addition, a series of more detailed technical reports on specific environmental aspects of the scheme has been made available.

The length of this seminar paper does not permit a detailed description of the results of this large body of environmental monitoring work. However it can be summarised as that the wildlife conservation interest of the ESAs has in general been maintained, and in some cases enhanced, compared with the deterioration prior to ESA designation. For example, the wildlife conservation value of haymeadows in the Pennine Dales has benefited from the ESA scheme, contrasting with a general decline in species diversity in unimproved haymeadows over the period 1978-1990 (DoE 1993). Another notable example of enhancement is evidence of an increase in bird numbers in the Somerset Levels and Moors. Many other examples are described in the detailed reports.

In relation to landscape quality, the evaluation has shown that the scheme has been successful in maintaining landscape quality of the 5 ESAs studied. There was significant enhancement in 2 ESAs where reversion of arable land to grassland has brought major positive landscape changes. However, the survey work also demonstrated that it is difficult to halt entirely all detrimental landscape change within

ESA boundaries, particularly as 100 per cent uptake of voluntary schemes is unlikely to occur, and the general pattern of detrimental change is likely to continue on land not under agreement.

The objective of maintaining the historical resource of the areas was largely achieved, particularly through the increased protection offered to features through reversion of arable land to grassland. The limited losses of archaeological and historical features has usually been on non-agreement land, or caused by actions such as road building which are outside the control of the ESA scheme.

5. Economic evaluation

The evaluation work has included an economic evaluation in these 5 ESAs of the risk of changing farm practices, in the absence of incentives to maintain the management practices required under the ESA scheme (ADAS 1996, 6). The evaluation used direct interviews with a representative sample of agreements holders and non-agreement holders from each ESA. As well as collecting farmer attitudes and perceptions, the evaluation collected physical data which has allowed economic analysis of some of the effects of the ESAs. At the time of writing this work has not been completed, but the provisional results suggest that significant changes would occur if the ESAs had not come into being or were now withdrawn, farming practices would change, and as farmers responded to economic influences, many of the landscape and habitats currently protected would be lost or under threat. The survey also confirmed that farmers see the ESA as a valuable means of environmental protection and are committed to the scheme in the long term.

Attempts have also been made to estimate the financial value of the ESA scheme to members of the public. In 1993 a study was carried out of the value to members of the public of the South Downs and Somerset Levels and Moors ESAs, using contingent valuation methodology. This study concluded that the two ESAs were good value for money: the benefits of the South Downs ESA were shown to be at least five times the costs of payments to farmers in the scheme, in the Somerset Levels and Moors the benefits were at least twice the costs (Willis and Garrod 1993).

6. Interactions with agricultural support policies

Changes such as the 1992 reforms of the Common Agricultural Policy, including the introduction of arable area aid payments and sheep and suckler cow quotas, have affected the context in which the ESA scheme operates. For example the voluntary and compulsory elements of set aside as a means of reducing agricultural production can have environmental benefits, but also compete with the ESA objective of reverting arable land to extensive grassland in some ESAs.

These instruments have been modified by the European Union to provide a degree of integration with agri-environment incentive schemes. The rules on set aside of arable land have been modified to allow land entered into non-agricultural environmental management under Regulation (EEC) 2078/92 to count towards farmers' set aside requirements under the arable support regime (EEC 1995). However this option has limited applicability currently under the ESA scheme, since it does not allow land on which traditional grazing management is introduced to count towards a set aside requirement. This example illustrates how the support regimes can be modified to facilitate the introduction of environmentally beneficial agricultural practices, although the change is relatively recent and has yet to have a significant impact on the delivery of environmental benefits under the agri-environment schemes.

7. Discussion and conclusions

It is suggested that the results described briefly in this paper illustrate one way in which monitoring programmes can be used to measure change in environmental benefits directly associated with agricultural practices, albeit that these benefits are often difficult to quantify in simple terms. Economic evaluation can be used to estimate the extent to which economic pressures and changes in farming practices and technology, operating within the existing regulatory framework, would, in the absence of the ESA or a similar policy mechanism, lead to damage or loss of these key features.

At a practical level, the success of the ESA programme is due partly to the acceptability to farmers of the voluntary incentive approach, which uses persuasion, encouragement and reinforcement of farmers' cultural and social inclinations to maintain traditional aspects of the farmed landscape. Education of farmers through the ESA scheme to raise their awareness of environmental issues, for example of the conservation importance of farmed habitats, is an important element in this process. The economic evaluation work reported on here has shown that a substantial majority of ESA farmers state that the ESA scheme has increased their awareness of the environment.

The evaluation described in this paper has confirmed that in relation to the five early ESAs studied, the ESA scheme is delivering positive environmental benefits which would not be achieved in the absence of the scheme. It can be argued that mechanisms such as the English ESA scheme are a successful means of modifying farmers' activities to enhance the environmental value of landscapes which are closely dependent on the maintenance of traditional agricultural practices for their continued existence.

The operation of the ESA scheme and the supporting monitoring and research programmes (the latter not covered here) are continually adding to our understanding of how to achieve environmental benefits through the maintenance and introduction of appropriate agricultural practices. As understanding improves, schemes can be modified to maximise the cost-effective delivery of environmental benefits. Changing or new policy priorities, such as those identified in the UK Biodiversity Steering Group Report (DoE 1995) may require, for example, adjustment to agri-environment schemes to help preserve and enhance a range of priority species and habitat types. Some fine-tuning of ESA requirements is likely to be needed, and the current review of the ESA scheme will be addressing this issue.

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Annex: West Penwith ESA: an example of environmental objectives and results

1. Background to the ESA

The West Penwith ESA covers 7 176 hectares of the northern part of the Lands End Peninsula between St Ives and Pendeen in Cornwall (the extreme south-western county of England). The ESA is an historic landscape with many well preserved remains of prehistoric settlements and includes a combination of small fields, maritime grassland, cliff and extensive heathland. Reclaimed/improved fields, normally enclosed with traditional walls, are known locally as "clean" land; the unimproved and generally unenclosed heathland as "rough" land.

The main wildlife interest in the ESA lies in the heathland of the coast and inland hills. These rare plant communities (see below) are restricted to South West England, with West Penwith having one of the largest areas of this type of habitat. The outstanding examples within the ESA are of international importance. Particularly during the 1970s and 1980s, traditionally managed grassland in West Penwith came increasingly under threat from agricultural intensification. Intensification also included moorland reclamation, hedgerow removal and the decline of traditional management practices. These changes included the loss of some prehistoric field systems and settlements.

2. Environmental Objectives and Performance Indicators

A common environmental aim for all ESAs is to maintain and enhance the landscape, wildlife and historic value of the areas by encouraging beneficial agricultural practices. The objectives and performance indicators of each ESA focus on the key local priorities. Specific objectives often focus on more than one aspect of the environmental aim: thus the second objective of this ESA is to maintain the wildlife conservation value and landscape quality of rough land (mainly the south-western heath, consisting of a mix of heathers, western gorse [*Ulex gallii*] and bristle bent grass [*Agrostis curtisii*]). The scheme rules are designed to pursue this objective in an integrated way, so that one environmental aspect is not pursued at the expense of another.

Each specific objective is supported by performance indicators specifying targets to be achieved over a five year period. These are a combination of: i) overall uptake targets - usually in the form of a percentage of a type of eligible land that should be under agreement (e.g. "75 per cent of rough land is under Tier 1 agreement"); ii) targets that relate only to agreement land (e.g. "10 per cent of non-stockproof walls and hedges are renovated under conservation plans"); iii) environmental impact indicators which relate to the desired result of imposing ESA management agreements on various types of land (e.g. "vegetation that is characteristic of rough land does not deteriorate"). All environmental impact performance indicators relate specifically to agreement land.

In general, where the protection and enhancement of existing semi-natural habitat is desired, the scheme is managed with the objective of achieving uptake on the majority of the eligible land. However, where the objective is to alter the balance between different land uses but not eliminate one entirely (for example the reversion of arable land to extensive grassland, or of improved permanent grass to rough grazing) then the objective of the scheme will be to achieve a more limited change. The following are the objectives and performance indicators for West Penwith which were set for the period 1992-97:

- Objective 1: to maintain the historic value and landscape quality of existing small-scale field patterns. 75 per cent of "clean" land is under Tier 1 agreement. There is no reduction in the total length of walls and hedges.

- Objective 2: to maintain the wildlife conservation value and landscape quality of "rough" land. 75 per cent of "rough" land is under Tier 1 agreement. Vegetation that is characteristic of "rough" land does not deteriorate.

- Objective 3: to maintain and enhance landscape quality through management of characteristic elements. There is no loss of weatherproof traditional farm buildings. 50 per cent of agreements have a conservation plan. 10 per cent of non-weatherproof traditional farm buildings are renovated under conservation plans. 10 per cent of non-stockproof walls and hedges are renovated under conservation plans.

- Objective 4: to maintain and enhance archaeological and historic features. There is no loss of recorded archaeological or historic features. There is no increase in the risk of damage to such features from agricultural operations. 10 per cent of conservation plans include provision for positive management of archaeological or historic features.

3. The Monitoring Programme

Full details of the monitoring programme and its results are described in the four reports which have been made available to interested organisations (ADAS 1996 1-4). The landscape monitoring programme looked in detail at the landscape elements within the ESA. These included land cover types (such as grassland, heathland and bracken [*Pteridium aquilinum*]), linear features (such as walls and hedges) and point features (such as traditional barns and gates). The wildlife value of the ESA was assessed primarily from botanical surveys of rough land involving detailed assessments of vegetation at 29 randomly located sites. The historical monitoring work was based on information collected by detailed ground survey on changes in the condition of a sample of 29 historical features from the county sites and monuments records compiled by the local authority's Archaeology Unit.

4. Results of Monitoring and Conclusions

93 per cent of the eligible area is under agreement after four years of the scheme. This high take up has helped to maintain the historic value and landscape quality of existing small-scale field patterns and to maintain the wildlife conservation value and landscape quality of "rough" land. Overall, the wildlife conservation value has been maintained. There has been no overall change in the total area of bracken with one sample site demonstrating good cultural control by grazing and trampling. Heathland burning has now been brought under control by the implementation of a grazing/cutting/burning strategy covering all rough land areas. The conservation of heathland has maintained a range of specialist insects and birds including an internationally important population of stonechats (*Saxicola torquata*).

Overall, there was an improvement in the condition of traditional stockproof boundaries and this has helped to enhance the landscape quality of existing field patterns. There has been an increase in the number of traditional granite gateposts used, probably due to farmers' increased awareness of these important features. Greater control of heathland fires has ensured that they have had a minimal impact on the landscape. The high level of scheme take-up has conferred a high degree of protection to many historical features, particularly to underground archaeological remains, by removing the risk of land

improvement. No loss of features was recorded. Overall, the historical resources of the ESA has been maintained. Future implementation of the grazing/cutting/burning strategy over the remaining roughland areas will help to enhance historic features by gradually reducing the obscuring effect of scrub growth.

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NORWAY: ENVIRONMENTAL BENEFITS BY AGRICULTURAL LANDSCAPE

by
Ministry of Agriculture, Oslo

1. Background

What conditions are we facing in Norway?

Harsh climate and sparsely populated countryside

Norway is the most northern country in Europe, and agriculture is carried out farther north than in any other country world-wide. A harsh climate limits the agriculture production possibilities. In addition, land area suitable for agriculture is relative small compared with other OECD-countries, although Norway's mainland extends from 58'N to 71'N, a total distance of some 1 750 km. Our country has arctic and sub-arctic characteristics. Geographical location and climatic conditions play a significant part in determining the basic settlement and agricultural pattern.

Norway is also the most sparsely populated country in Europe, after Iceland, with a population of 4.2 million. The population density is 13 people per square km, compared to the EC average of 145 per square km. Sparse population makes many areas vulnerable for depopulation. At the same time settlement all over the country is important for the utilisation of the resources. Measures have therefore been established to make it attractive to live in rural areas. The urbanisation have thus passed on more slowly in Norway than in many other countries. Vital villages and small communities are to be found all over the country. People in Norway have a close relationship to nature and the agricultural landscape. Grounded on long time traditions the public's right to free access to natural areas is a statutory rule in Norway. Statistics shows that about 80 per cent of the population take part in out-door activities.

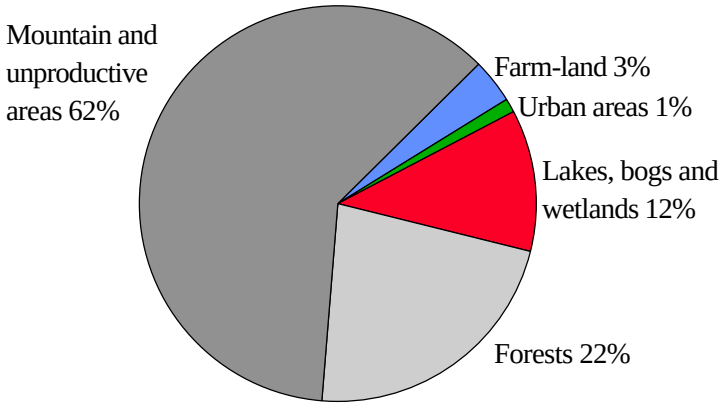
The Norwegian topography, nature and climate conditions limit the land area suitable for settlement and farming. In order to achieve a sustainable utilisation of the land area and nature resources it is aimed: 1) To maintain the basic nature of the settlement pattern, and 2) To maintain and develop social structures and services for the rural population, which will secure social and economic living standards consistent with those in the rest of the country. In this context it has been important to provide people with income possibilities and welfare scheme in line with those available for other groups of society. It is recognised that the agriculture sector will be a main contributor in these efforts.

Scattered and limited farm-land resources

The total agricultural area is approximately one million hectares, which is less than three per cent of the total land area, showed by Figure 1. Our self-sufficiency in agricultural products is less than 50 per cent measured on a calorie basis. Sugar is for example not produced in Norway. However, agriculture

forms the main basis for economic activity and hence for settlement in many areas. In one out of four municipalities, agriculture directly and indirectly represents more than half of the employment. From a national point of view, it has thus been important to secure existing farm-land and maintain an active agriculture throughout the whole country.

Figure 1. Land use in Norway



Even if urban areas represent a small share of the land use in Norway, they are competing with agricultural areas and valuable biological resources. Urban expansion has to some extent resulted in loss of high productive farm-land and rare nature. One has therefore enforced a strict soil-protecting policy. The main aim is to take care of areas with high and variable environmental qualities and improve the opportunities for people to experience and value the agricultural landscape.

Small-scale farming

Because of mountains, lakes and forests the farmland is divided into scattered and relatively small plots, some of which are very hilly. Only limited areas have fairly wide stretches of flat land. The average farm size is 10 hectares of cultivated land and the average forest property is 56 hectares. The farm structure is also a result of strong historical and cultural traditions associated with farm ownership in Norway. By statue, the oldest child has the first priority to take over a family farm. In addition, dividing and uniting of agricultural holdings are regulated by laws. This has had a great influence on how the agricultural landscape appears today.

Since ancient time it has been common to combine agriculture with other industries like fishery or forestry. The agriculture has been carried out on an all-round basis, which also is the most common today. Relative many agricultural holdings are part-time holders. Grass is the most important crop and covers more than 55 per cent of farmland. About 35 per cent of the farm area is used for cereal production, and the remaining land used for other fodder crops, potatoes and vegetables. Milk and meat production are the cornerstone of Norwegian farming. However, the sizes of the stocks are small compared to other countries.

Farming is carried out throughout the country, even in the most northern regions. In northern and western Norway, and in the mountainous regions the production possibilities are limited. In these

areas dominates grass-based livestock production. Cereal production is concentrated in the relatively flat regions of eastern Norway and some in south-western and middle part of Norway.

Despite small farms, agriculture is stimulating economical activities and employment, especially in less favoured areas. Small farms, harsh nature conditions for farming, and regional policy concerns have resulted in a comprehensive support system to provide farmers the same income opportunities as other groups in society.

What can be perceived by the conception agricultural landscape?

An unlimited range of perceptions, from...

Farming is important for the development of the cultural landscape. Even if no one sector in the economy will be solely capable of shaping and maintaining the whole cultural landscape, agriculture will be an important contributor as it is based on land use. In a country dominated by forests and mountainous areas like Norway, farm land is demanded because of its contribution to variation in the landscape picture.

The agricultural landscape might be perceived in many ways and views. There will be many different perceptions of the conception agricultural landscape, not at least among countries within the OECD. However might the agriculture landscape be perceived as a landscape with distinctive characteristics of farming or appreciated impact from agricultural practices.

The agriculture landscape undergoes a dynamic process of change, depending on shifts in technology, economy and human needs. Structure and practices within agriculture will influence the living conditions for plants and animals. The landscape will also be shaped by nature itself. The agricultural landscape is therefore an object of a perpetual evolution caused by changes in factors, processes and environmental state.

...the overall view, to...

The broadest perception of the agricultural landscape may be based on rural values and culture, using the terminology «countryside». This strengthens the emphasis on agriculture as a founder of national identity. Moreover, may the agricultural landscape be assessed on basis of its overall aesthetic, picturesque and timeless qualities. The agricultural landscape turn then to be a sphere for recreation, a place to look at and to move freely in for e.g. travellers and holidaymakers. However, the perceptions of what is a «good» and a «bad» landscape will differ among people. In addition, in a production-resource-view, the agricultural landscape should also be considered as a food producer. The agricultural landscape are therefore a multi- commodity producer.

...the single elements

From the starting point in the above paragraph one could elaborate a whole range of perceptions to an opposite one. For example, watching a landscape at distance and being able to sense single objects may be two different experiences. The single elements of an agricultural landscape may be valued on basis of the nature's biological and historical features, like the amount of species, habitats, relics, antique buildings, stone walls etc. Because this (single) elements tend to be viewed as elements of the society's total capital stock, the preservation and conservation of these are highlighted.

2. Rationales

Why focus on agricultural landscape in Norway?

Shift of the agricultural policy, especially to...

The agricultural landscape in Norway is highly linked to the escalation plan for agriculture which was adopted by the Parliament in 1975. The main objective was to promote a certain level of production, especially of staple farm products. In addition it was important to provide farmers the same income opportunities as other groups in the society. In order to utilise the country's resources in the best possible way and to stimulate scattered settlement it aimed at regionally production, mainly with increasing cereal production in the south-east and more labour-intensive production of milk and meat in the less favoured areas. The policy gave the farmers incentives to increase their production by using different support measures, especially price support. The policy also resulted in increased use of inputs and lead to a greater pressure on the nature and biological resources.

Within the framework of the GATT negotiations, the Parliament set new guidelines for the agricultural policy in 1993. The overall objective is to create a more marked oriented agriculture. More cost-efficient production is to be promoted by changes in farm sizes, and greater market orientation is to be stimulated by addressing demand as an incentive for production. The support level is to be reduced. More emphasis is to be given to the development of a sustainable agriculture. The regional policy aspect of agriculture is still given high priority and funds are granted to develop new farm-related economic activities.

The revision of the national agricultural policy which brought forth the escalation plan in 1975, introduced a new objective concerning environmental needs and resource conservation. There was a focus on the need to reduce pollution from agriculture, to economise with energy and as far as possible reserve cultivated and cultivable land for agriculture production. Then grants for new cultivation, drainage and channelling of streams underground were reduced, and instead special measures to reduce run-off and pollution, especially from point sources, was implemented.

This agri-environmental policy proved to be insufficient over the 1990s. Now the focus on sustainable production and consumption make it necessary to shift from reacting on environmental damage to prevent it. In Norway we have currently divided the agri-environmental policy into four subjects: i) area and nature resource management; ii) environmentally friendly production and products; iii) pollution and environmental strains; iv) environmental knowledge and skills.

...respond to environmental challenges

The Norwegian agricultural landscape as it appears today has been formed by hundreds of years of use, in which agriculture has been the primary activity and contributor. Though the landscape today in some cases may be a result of over-drawing and exhaustion for some periods, these have not caused severe damages to the natural environment. Increased intensity during the 1980s resulted in loss of ecological diversity and characteristic landscape features, as in many other western countries. In addition, resulted removal of natural vegetation and access passages to recreational areas in reduced opportunities for public to have nature experiences. It has therefore been necessary to stress the importance of natural environment, cultural landscape and recreational activities in our existing agri-environmental policy.

From an environmental point of view one can use many different arguments to focus on the agricultural landscape. Some arguments can be derived from international agreements like the

Rio-convention of biological diversity, while others can be related to local culture, identity and individual life. In Norway we tend to emphasize: biological and ecological values; aesthetic, cultural and historic values; and values related to human health and welfare.

...respond to production challenges

International agreements, hereby within the OECD and WTO systems, aim to reduce subsidies and trade barriers, and to create a better balance between supply and demand. Choosing non-production linked subsidies instead of production linked subsidies is a well used path. Focus on agricultural landscape might be an appropriate mean to success in such a strategy. By connecting the payment to maintenance of the landscape, the farmers income will depend less of the outcome of the production and more of environmental efforts.

It is an increasing recognition that the agricultural landscape is an important resource in order to create new activities and secure income in the rural areas. Rural development which take the agricultural landscape into consideration will have a broad range of opportunities. Generally speaking the landscape can be used to satisfy: demand for environmentally sound products (food and non-food); demand for recreation and leisure activities; and demand for knowledge and skills related to ecology, culture etc.

Why not rely entirely on the market mechanism?

Agricultural landscape = a public good

Landscape can be considered as a public good like many other environmental benefits. Use of the market mechanism requires a well-defined ownership without a free public access. Agricultural landscape is however up to a point accessible for the enjoyment of all. In addition, its value cannot be entirely determined by ordinary market price. Partly because the agricultural landscape certainly represents values for further generations who cannot be present at market place to bid in regard to their perception of the values, and partly because the agricultural landscape represents values that are of little value for the individual but are of great value for the society in its entirety.

Inadequate incentive and redistribution systems

Even if we are capable to establish a market for goods provided from the agricultural landscape we would face conditions which can deteriorate the effectiveness and efficiency of the market mechanism: In a landscape-market, e.g. within the tourism sector, a payable product will usually be composed of contributions from many activities and land-owners, but often only a few proprietors will have a market-incentive and an opportunity to make money out of it. For example, a hotel can utilise the agricultural landscape in its promotion and as part of its whole product-offer, without the individual farmer sensing the demand and profiting on it.

Cultural and legal limitations

In order to shape a market regarding the agricultural landscape we are facing an another constraint in Norway: From ancient time the public has been in the right to walk about in the woods and fields which are subject of private ownership. This right also includes the opportunity to take a halt, bath, pick wild berries etc. Since 1957 this right has been a statutory rule. Even if it is possible to charge for

access to specific worked-up areas, this right limits the opportunities for farmers to make money out of the agricultural landscape.

3. Performance

Which policy instruments are used?

A combination of legislative, economic and administrative measures

Environmental questions, especially regarding the agricultural landscape, is of a complex nature. Different measures are therefore necessary. As mentioned above, environmental considerations and measures have acquired increasing importance in agricultural policy in Norway. The main principle in the policy is to integrate environmental considerations into all kinds of measures in order to satisfy the need for comprehensive solutions. In addition, measures are targeted towards specific purposes to promote cost-effective actions. In sum, this constitutes a comprehensive policy which cover all agri-environmental objectives.

The Norwegian policy is founded on a broad range of measures which we categorise into legislative, economic and administrative measures. Generally speaking, in fields with absolute and long-term interests regulations are regarded necessary, while financial support are used to encourage environmentally sound production and providing of environmental benefits. In addition, to promote implementation of new environmental innovations, we give priority to free or subsidised guidance and research and development (R&D).

The policy is founded on the willingness and commitments from the farmers more than on compulsory measures. The main policy instrument, such as target prices, regional and structural support and environmental programmes are negotiated annually between the Government and the two farmers' unions and laid down in the Agricultural Agreement. The Agreement must be approved of the Parliament, which also grants the funds necessary to implement it. In recent years an increasing share of the support through the Agreement has been shifted from support linked to production to support independent of the amount produced.

The differentiated set of measures necessitates an extensive administration and control systems to ensure that the policy is carried out efficiently. The public agricultural extension service is responsible for implementing agricultural policy at the local level. It is localised in all eighteen counties and almost all municipalities in Norway. The extension service provides a close mutual relationship between governmental authorities and farmers which gives rapid implementation of agricultural policies and measures.

General support measure to take care of overall perspective

Our topographical and climatic conditions brings forth economical disadvantages which necessitate financial support to carry on active agriculture throughout the whole country. However, to obtain general support farmers have to comply with different environmental regulations. In effect, we make use of a carrot-and-stick approach to take care of the overall environmental perspective.

The Acreage and Cultural Landscape Scheme was introduced in the late 1980s and replaced a more production-oriented subsidy. It is aiming at turning agricultural policies and payments in a more

sustainable direction, both ecologically and economically. All arable land, sown grassland and fertilized pasture is eligible for the payments. Farmers have to apply to obtain it.

The payments are encouraging the maintenance of farmland in production. In order to secure environmental considerations and to avoid damages to the existing landscape the following obligations have to be fulfilled: streams and rivers should not be canalised or channelled underground; open ditches should not be closed; forest margins and other areas of fringe vegetation should not be ploughed up; stone walls, clearance cairns and remnants in fields should not be removed; land grading is not to be undertaken; paths are not to be closed or tilled; and fringe vegetation is not to be sprayed with chemicals. If farmers do not fulfill any of the requirements, the payments might be withdrawn for up to 3 years.

Furthermore, farming cannot be in conflict with laws like the Land Act, the Cultural Heritage Act, the Nature Conservation Act, the Pollution Act etc. For example, a forthcoming provision of the Land Act will line up requirements regarding environmentally friendly farming. In addition, farmers have to comply with provisions such as: a minimum of 0.4 hectares of spreading area per animal manure unit; all cows and cattle should out for grazing for 8 weeks (from 1997); and have a plan for the fertilizer management (from 1998).

The Acreage and Cultural Landscape Scheme are differentiated by type of crop, localisation, and farm size. In 1995 the budget was NKr 2 900 million ($445 million). In average this amounts to about NKr 32 000 ($4.900) for a middle-sized farm, but it must be mentioned that preferences are given to small farms in remote areas of Norway. On the average the payments found about 1/10 of the revenue on each farm.

Specific support measures to take care of special concerns

In certain areas requirements and measures have to be more vigorous than in others to take care of the environmental values. Several specific measures have therefore been established in order to secure cost-effectiveness and targeting. To obtain these kinds of measures farmers have to sign an agreement with the local agricultural authorities.

The Extended Support to Landscape Maintenance and Development was introduced in 1991. In 1996 the budget is approximately NKr 36 million ($5.5 million). The aim is to maintain and develop the agricultural landscape as a public good where it can not be reckon by ordinary production. The payment takes form of annual payments or investment grants and are conditional upon management agreements. Farmers are not allowed to use fertilizer or pesticides if they receive payment, unless it is a part of the management plan. Eligible measures are: conservation of biological diversity; improvement of public access throughout the country-side; preservation of cultural relics, ancient monuments and the surrounding areas; and upkeeping of areas characterised by traditional agricultural practices.

The applications for payment exceed the budget. The main priorities are decided by a consultative group on county level. Agricultural and environmental authorities as well as the local farmer unions are represented in the group. Utilitarian value for the public, collaboration with other organisations, synergy and linkages to other projects are prioritised issues.

The rural and farm buildings is important elements for the preservation of the agricultural landscape. The Grants for Restoration of Listed Buildings should give financial support for these efforts. Priority is given to the oldest buildings. The budget is NKr 20 million ($3 million) for 1996. It is required that restored buildings are used for agricultural purposes. Granting could also be considered from

an aesthetic/cultural heritage view. The measure is to be integrated in the Extended Support to Landscape Maintenance and Development from 1997 due to administrative reasons.

A new measure was launched in 1996: The Environmental Adaptation Programme is to promote a change from grain production to extensive farming based on grass production (or other crops which give good erosion control) on land susceptible for soil erosion. The farmers must sign a contract for the program and will receive a annual payment for the contract-area. Use of fertilizer is restricted and use of pesticides is forbidden. In addition, tillage each year is not to be accepted. For the first experimental period the budget is NKr 5 million ($0.7 million).

The Environmental Adaptation Programme takes a step further than the Grants for Amended Soil Management. The objective of the latter measure is to encourage amended soil management routines and/or sowing of vegetation in areas particularly susceptible to erosion. The budget for is NKr 115 million ($17,7 million) for 1996. To be approved for payment cereal areas are not to be subject to soil management in the autumn, e.g. ploughing, and/or counter-erosion vegetation have to be sown. Besides reduce erosion, this measure will effect positively on the autumn agricultural landscape.

Finally two traditional measures can be mentioned. The support scheme for Grants for Improvement of Environmental-Technical Facilities is established to prevent erosion, runoff and pollution from agriculture. It has been important to improve the storage facilities for manure and silage. Recently, other eligible measures have been added, like establishing of hedgerows/windbreaks, vegetation zones, sedimentation ponds, constructed wetlands etc. Measure's impacts on landscape, biodiversity and recreation value will be given increased priority in the future. The budget for is NKr 75 million ($11.5 million) for 1996.

Grants for Summer-Mountain Farming aims at encouraging the upkeeping of a traditional milk production in mountainous regions in order to conserve the agricultural landscape by grazing of cows and cattle and using of agricultural buildings. Each summer farm can be granted with NKr 9.500 ($1 450), which is a relative small amount compare to the extra expenditure involved.

Measures on voluntary basis

Norwegian agriculture is as in most other countries obliged to fulfil a whole range of requirements and regulations. The responsibility of the follow up is now to a larger extent been transferred from the authorities to the farmers by the introduction of quality systems and planning tools. These are to be established on farm level.

In 1993 a scheme named Environment and Resource Plan (ERP) was launched. It will be one element of the total quality system. The ERP is meant to be a tool for farmers to take environmental considerations and contain detailed schemes for tillage, use of fertilizing and pesticides, landscape, biodiversity etc. The Norwegian Farmer Union is involved in the implementation, supported by governmental funding. For 1996 the budget is about NKr 5 million ($0.8 million).

Another measure is the Area Scheme, which is tried out in some selective counties since 1993. It is a extended version of the Extended Support to Landscape Maintenance and Development. Substantially, it should be considered as a tool for local/regional planning, aiming at collaboration and comprehensive solutions. Actions like preservation and conservation could be supported if they are part of a overall plan for a specific area, developed and conducted by the land owners and other local interest groups. The measure is to be evaluated in 1996.

Which control and monitoring systems are used?

Governmental authorised supervision

All measures granted have to be in accordance with the general directions given by the Government. The Ministries have to draw up objectives/goals, follow-up criteria and control system to each of the measures in charge. In order to gain a legal basis for the follow-up and control all farmers have to sign an agreement when applying for grants. The agricultural extension service on the county level is to a great extent responsible for the supervision. All measures are object of a randomised control in terms of that 5 per cent of all farm annually are visited by authorised controllers.

To help administration of the measures some central registers are established. Data inside this registers provides some basic statistics. Additionally we have developed report systems for more detailed information about the specific measures concerned. This information jointed with data from the monitoring programme described below are object of a overall and comprehensive assessment for policy purposes.

Combined extensive and intensive monitoring

In Norway we have good experiences with national surveys of erosion and run-off in co-operation with R&D institutes. In order to gain a more comprehensive picture of state and trends of the agricultural landscape the Ministry of Agriculture and the Ministry of Environment are in process of developing a programme for monitoring of the agricultural landscape. The monitoring programme is to be designed for long-term existence with consideration to cost-effectiveness and simplicity.

The programme will provide information on the current state and trends of the agricultural landscape as well as to the following of specific fields of interest: ecosystems, cultural heritage, accessibility for the general public, and infringement by urban development. Monitoring methods are being developed to ascertain trends and state within these fields of interest, and to analyse this in relation to the changes in farming systems and in spatial structures within the landscape.

The programme will be based on: extensive methods using sampling techniques, and measuring a few indicators on spatial relations, and structures in the landscape; and intensive methods in designated reference areas with measurement of several variables, and with analysis of processes and mechanisms behind the effects on the fields of interests. Farming systems will be ascertained based on observations of cultivated plots as well as existing databases for farming incentives/support. A component of the programme will be storing and analysing data.

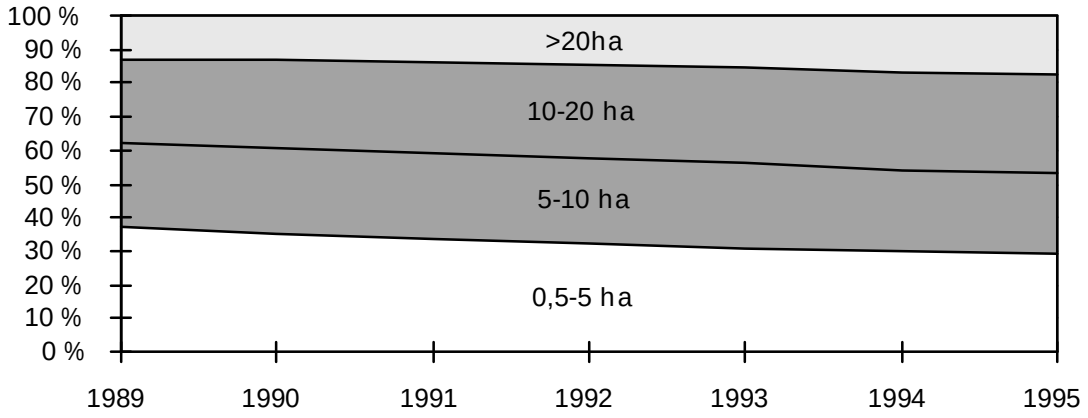
Suitable indicators are needed to measure the landscape. The development of indicators within the programme are at present narrowed to: distribution and size of solitary cultivated plots; distribution and size of depicted uncultivated areas/patches with emphasis on their significance the natural heritage; spatial resolution or scale of landscape; and technical structures. These indicators will be scrutinised in successive comparisons with other variables from the reference areas and from other databases.

Which environmental consequences are caused by the policy?

Preservation of a varied landscape and biodiversity

Figure 2 indicates that small-scale farming in Norway is continued, although there is a development in the direction of slightly larger farms. In 1995 the agricultural land per holding was approximately 12 hectares, and the number of holdings was approximately 85 000.

Figure 2. Holdings by size of agricultural area in use (per cent)



Research indicates that the distribution and sizes of fields and the appearance of natural corridors, buffer zones etc. effect biodiversity. Unfortunately, we have no nation-wide statistics which could ascertain fact about these issues yet, but the monitoring programme described above will expectantly do. A national survey has still suggested 104 agricultural landscapes to be of particular environmental value.

Many of the 33 000 known plant and animal species known in Norway are living in the agriculture landscape. Surveys imply that some of these are endangered or vulnerable. Continuation of agriculture provides living conditions imperative for many of the existing plants and animals. Meadows and pastures represent habitats of great biodiversity. Approximately 60 per cent of the agricultural land is used for mowing or grazing in Norway.

Conservation of cultural heritage and traditional modes of agriculture

The agricultural landscape includes many traces of ancient living from prehistoric and medieval times. These are a crucial part of our cultural heritage. Agriculture might sometimes be essential in order to conserve cultural relics and surrounding areas. However, specialisation and changes in modes of agricultural production could bring damages to these cultural (and environmental) values. The requirements tied to the Acreage and Cultural Landscape Scheme are established to prevent such damages.

The farm buildings represent important elements in the landscape and as a part of the cultural heritage. Approximately 900 of 2 500 scheduled building preservations are attached to farms. Restoration

is expensive. The Grants for Restoration of Listed Buildings are established to help the funding of preservation efforts. In 1995 374 preservation works was supported within the budget of NKr 15 millions.

Summer-mountain-farming is an example of an old Norwegian tradition. In the past grazing off-farm was essential to help the fodder situation, but now summer-mountain-farming is also considered as important to conserve mountain landscape and uphold old farming practices. The number of summer farms in Norway has been constant; around 2 000 in recent years.

Maintaining of open-space areas and rural countryside

Registered agricultural areas in Norway has been stable for the last 50 years. Statistics show a slight increase during the recent years. The increase applies for all parts of Norway. The total agricultural area in use was in 1995 1 102 000 hectares, which was 0.2 hectares per capita. The transfer of agricultural areas to non-agricultural use was about 1 000 hectares for 1995.

The Acreage and Cultural Landscape Scheme is important as it prevents field abandonment and discontinuation of agricultural because of its income effects. This scheme has however, coupled with other inducements, in some cases been resulted in cultivation of new land and endangered habitats like moorland and cultural meadows. Cultivation of new land will thus be forbidden in sensitive areas by a coming regulation.

The process of abandonment and centralisation has brought socio-cultural dimensions and new values into consideration. The agricultural landscape is now to a larger extent than earlier connected to natural and cultural experiences, national identity etc. Even if these values of nature are problematic to quantify studies indicate that people assess the open-spaced landscape positively, especially the picturesque one, and they reveal some willingness to pay for these values.

Promotion of less-intensive agriculture production

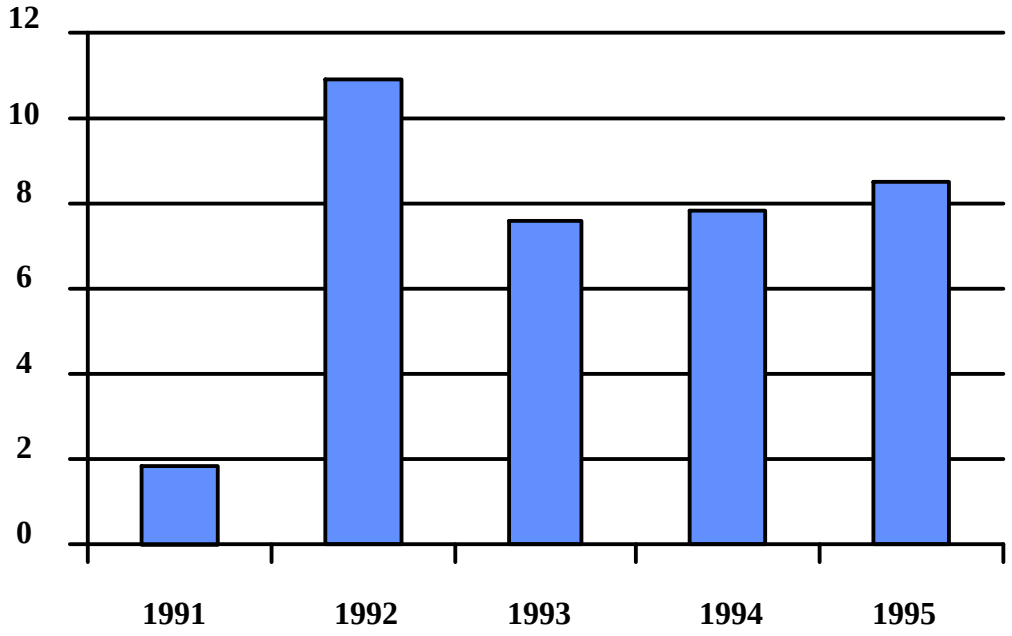
In general terms the measures directed towards agricultural landscape can be said to have a positive effect on the environment the grants are not linked to produced amount. The statistics show the that the use of phosphorus (P) has decreased substantially in the period from 1985 to 1995, while the use of nitrogen (N) has been stable. Total sales of pesticides estimated as kilogram active substance have also decreased. In addition, research indicates that the erosion and run off of nutrients has decreased as our follow up of the North Sea Declaration.

Provision of recreation facilities

Studies show that traditional walking is the most common utilisation of the agricultural landscape among people in general. To enhance the public accessibility in terms of routes and trails/paths considerable efforts has been given to public accessibility through the Extended Support to Landscape Maintenance and Development, shown by Figure 3.

An increasing number of farmers turn to tourism as a source of additional income in Norway. About 1/10 of all actions granted by the Extended Support to Landscape Maintenance and Development were directed towards tourism etc. in 1995. A connection between landscape management and businesses complementary to agriculture could encourage the conservation of appreciated features in the landscape to some extent.

Figure 3. Spending on public accessibility through the Extended Support to Landscape Maintenance and Development in million Nkr (6,5NKr=$1)



4. Experiences

What seems to be the key success factors?

Comprehensive solutions

The agricultural landscape is, as described earlier in this report, shaped by many different elements, processes and activities. From a policy point of view, it certainly is difficult to isolate problems, causes and effects in order to designate detailed and isolated measures for preservation and maintenance of the landscape. In policy-making one have to deal with the whole spectre of landscape perceptions. We have therefore not given any precise definition of agricultural landscape, but instead emphasized connections between various measures.

A comprehensive approach have enabled us to take advantages of synergy of mutual measures. Investments in accessibility and recreation facilities may be a waste of money if derelict buildings deteriorate the landscape experience. This demand a conjunction of measures. In that connection the well developed co-operation between agricultural and environmental authorities in Norway have to be mentioned. This enables us to pursue a comprehensive policy and utilise resources in an efficient way.

Local decision making (bottom-up)

A resource and cost effective landscape management require possibilities to form local policies within a national frame, because of the tremendous range of local variations. Flexibility in measures and projects are thus essential. Of course, local and governmental interests can be divergent in some cases. Therefore it is important to have some national priorities. However, a bottom-up approach seems to be essential if new ideas and practices is to be successfully adopted. Interest, commitment and leadership coming up from the local level by willingness and «self-government» are important ingredients in the policy implementation.

Local decision making is also valuable because it helps to qualify projects. In Norway, several financial measures give priority to collaborative projects. This help us to secure that the projects are rooted in the local community. In addition, local roots are easing the completely funding of projects because the local community as a whole has an interest to invest money into them too.

Understanding and knowledge

The complexity of landscape management demands knowledge about why and how things should be done. First of all, sufficient awareness and interest for landscape reproduction have to be developed among farmers and other people/groups in the local communities. An appropriate landscape reproduction scheme has also to be adapted into the local context, in terms of local identity, traditions and farming systems.

In addition, both consultants and farmers have to possess assured knowledge to be able to make the rightful choices. This demands basic and applied research which provides objective scientific knowledge, as well as effective communication between researches and the users. Moreover, cross-disciplinary studies is advantageous because it forms a basis for common efforts and co-operation between agricultural and environmental authorities.

Active farming

Conservation of the landscape in a long-term perspective has to be related to active farming. An overall specialisation in landscape management will probably not be efficient. It will produce an artificial landscape. In light of that, we are striving to find farming systems and businesses which could provide environmental benefits, employment and profit at the same time.

Agriculture's positive effect on environment, regional development, settlement and utilisation of rural resources can be of direct and/or indirect nature. In general, the agricultural landscape is viewed as a public good provided by farming practices and paid through subsidies; in Norway especially by the Acreage and Cultural Landscape Scheme. However, to establish a dynamic approach to landscape management we think it is helpful to link reproduction of landscape to rural development in a broader context. Nevertheless, market imperfections make it necessary, to some extent, to support activities also in this kind of view.

Planned management

In a new situation with new challenges and different schemes and regulations, the need for developing plans at national, regional and local levels increase. National and regional plans are needed to

give strategies, priorities and guidelines. In Norway a national registration of valuable agricultural landscape has been carried out as mentioned above. The purpose was to obtain a basis for management strategies for cultural landscapes. However, these kinds of national plans can not cover all local variations and challenges.

In order to obtain a cohesive landscape management it is important that the landscape dimension is subject to the planning on the operational level, i.e. in municipalities and on farms. Even if we are too short to integrate landscape dimensions into the communal planning we consider this as a crucial aspect. When granting funds, we therefore give priority to actions which are derived from plans.

What might be the conclusive implications

All policies have to be designed, pursued and evaluated within the appropriate context, whether it is of ecological, economical or socio-cultural nature. Among OECD countries the conditions will differ substantially. While abandonment and afforestation of farm land is considered negative in Norway because of our scarce agricultural areas, the opposite could be true other places. This demands a nuance approach regarding agri-environmental questions.

In this case study of agricultural landscape we have tried to show the range of environmental benefits which could be derived from agriculture. Some of these benefits are linked to visual amenities, other to the number and quality of habitats and cultural relics, and another to biophysical/ecological implications of farming practices. This complexity appears also when we consider effects from a single measure. Establishing a vegetation zone could contribute to a pleasing landscape and create advantageous living conditions for plants and animals as well as to reduce the erosion and run-off.

In order to take care of the whole spectre, agri-environmental policies ought to be based on a broad perception of what environmental benefits are: Not only the biophysical dimension but also socio-cultural and welfare dimensions should be on the agenda, according to the conception of sustainability. Another premise for the policy should be the recognition of the fact that environmental assets tend to be local rather than global goods; i.e. a beautiful landscape picture, animated flora and fauna, unpolluted soil, water and air are of higher value for the individual when presence in the vicinity than in remote regions.

Our agri-environmental policy was to a great extent initially focused upon reduction of erosion, pollution, use of fertilizers etc. In light of new market challenges and challenges tied to sustainable production and consumption this policy has gone through a successive evolution with focus on totality. Our philosophy can now better be illustrated with the phrases prevent-instead-of-repair and preserving-by-using. This bring forth some positive attitudes to the environmental struggles, and we witness now a new enthusiasm among both farmers and bureaucrats.

As reported we have a various spectre support measures in Norway. Our main instrument is the Acreage and Cultural Landscape Scheme which replaced the former price support. The scheme supports farms in both central and peripheral areas by paying them to retain land in agricultural production. Because of the environmental regulations/ requirements tied to the payments they are often considered as a collective payment for environmental benefits provided by agriculture.

With the Acreage and Cultural Landscape Scheme we have chosen to change the price relationship. It makes it possible to reduce the intensity in farming in general. Even though the subsidy level has remained quite the same, this strategy lay the foundation of a more sustainable agriculture in a

large-scale term. It should here also be noticed that high level of payments as well as withdrawal will increase farmer's interest to meet and fulfil the environmental regulations/requirements given to the payments.

Though the implementation of this scheme has been beneficial from an environmental point of view, we have also experienced the necessity of specific measures to address specific environmental problems. Even though payments for the specific measures have been significantly increased the recent years, they still comprise a small part of the total budget. This have to be seen in light of emphasis onto cost-effectiveness and targeting for the measures. Creating interest, knowledge, systems and structures all require time. The policy has therefore been to develop the specific measures incrementally, in a justifiable way.

To sum up, agricultural landscape concerns one of a complex nature. A broad range of measures have therefore been established to meet the challenges which we are facing. In Norway agriculture plays an important role in the preservation and conservation of the cultural landscape, while it at the same time produce food and contribute to employment and income in rural areas. The support measures established are acreage support to compensate disadvantageous conditions in terms of difficult typography, harsh climate, sparse population etc., and investment grants to encourage environmentally friendly production and provisions of environmental goods. Evaluations indicate that this policy is cert efficient in achieving primary agri-environmental objectives. In addition the policy seems to not causing any significant trade distortions.

SWITZERLAND: GOVERNMENT POLICY TO STIMULATE ENVIRONMENTAL BENEFITS

by
L'Office fédéral de l'agriculture, Berne

Introduction

By producing food, agriculture satisfies one of the most basic of human needs. When done according to the principles of sustainable development, this also enriches nature and contributes to the development of a cultivated landscape that is varied and well suited to local ecosystems. Switzerland's topography enhances the way agriculture diversifies the landscape. The development of agriculture and, with it, the evolution of the countryside, is dictated by economic, social and cultural factors.

1. The tasks of agriculture

The Swiss Constitution sets forth the tasks of agriculture. The constitutional article that was ratified by the people on 6 June 1996 (Annex 1) sets the stage for a new thrust to Swiss agricultural policy. It was the fruit of changes from without, due primarily to society's shifting values. A focus on the supply and safety of food has increasingly been giving way to public concerns over the origins of foodstuffs, production techniques, environmental impact, farm produce prices and the costs of agriculture. As the Confederation gradually abandons its policy of price supports in the agricultural sector, farmers will be increasingly subject to market forces and will have to become more responsive to consumer demands. As a result, those forces will leave a greater mark on the rural landscape.

The Confederation strives to maintain a competitive agricultural sector, based on small, individual farms, to work the land. Under the new constitutional article, agricultural policies must be such that agriculture, by producing in ways that are environmentally friendly, beneficial to animals and responsive to the market, makes a significant contribution to: supplying the population with food; maintaining the natural foundations of life; maintaining the countryside; and keeping the population geographically decentralised. Agriculture is thus recognised as being multifunctional.

2. Environmental benefits associated with agriculture

The new farm policy promotes agriculture that is sustainable from an economic, social and environmental standpoint. It should limit harmful effects on the environment and optimise the environmental benefits associated with agriculture. These benefits are as follows:

- **Safeguarding the countryside, villages, buildings and pathways:** Farming keeps the landscape open and halts the advance of woodlands, which would cover the entire country if left in their natural state. The landscape retains a cared-for appearance, along with its characteristic pattern of

small farms and patchwork plots. Farming also affords protection against certain natural hazards (avalanches, landslides, forest fires, etc.). By ensuring that the population is geographically decentralised, it keeps villages alive, preserves culturally significant country buildings and maintains a diversified rural landscape. It also serves as a counterweight to slow the spread of construction zones.

- **Maintaining the natural foundations of life**: Agriculture has both beneficial and harmful effects on the abiotic environment in that it affects the quality and quantity of water, soil and air. One considerable benefit of agriculture is that it acts as a buffer in the carbon cycle.

- **Preserving the biological diversity of rural areas:** As it has intensified, agriculture has put a lot of pressure on many natural environments. But to maintain or create new farmland habitats where flora and fauna can thrive is a key to biological diversity.

- **Eliminating waste:** Household waste must be recycled. Agriculture, by using some of this waste as fodder, compost and sewage sludge, helps put it to good use; to eliminate it in these ways is less harmful to the environment than to incinerate it. Nevertheless, such practices depend primarily on consumers: by refusing to let organic farming use sewage sludge or to allow cash animals to be fed on waste that contains meat, consumers can dictate farm practices.

3. Government policy to stimulate environmental benefits

Switzerland's three-pronged agri-environmental policy involves, in descending order of priority: i) research, training and extension to heighten farmers' awareness of environmental problems and propose solutions thereto; ii) financial incentives to stimulate farming practices which provide environmental benefits associated with agriculture; iii) authority to issue mandatory directives. All three measures are used to stimulate environmental benefits.

4. Action programme and main financial incentives

The leading incentives (item ii of agri-environmental policy) are described below. While a number of these measures serve more than one objective, they are listed below according to their greatest impact.

Protect the biophysical and ecological environment

Objective

By producing in ways that are particularly environmentally friendly, the farmer reduces the environmental load of phosphorus, nitrogen and pesticides and safeguards biological diversity, while preventing physical effects that could be harmful to the soil.

Instruments

Switzerland's agri-environmental programme provides support for forms of production that are particularly environmentally friendly. A raft of measures need to be applied to the whole process of farming, such as a balanced farming plan for fertilising substances, erosion prevention measures, mulching

in winter, restrictions on pesticide use and preserving and creating semi-natural environments. The programme is accompanied by an economic and environmental assessment.

Keep the population geographically decentralised

Objective

Swiss agricultural policy supports an agricultural system based on small, individual farms, in order, *inter alia*, to maintain a geographically decentralised population structure and preserve the traditional countryside.

Instruments

Structural improvements: The purpose of modern land improvements is to create optimal structures that will be sufficiently long-lasting, as well as a context conducive to farming and to the protection and utilisation of the land, consistent with the local population's right of self-determination. The Confederation encourages structural improvements through grants, for which community projects get top priority, and investment credits. Today's co-ordinated approach to land improvement makes it possible to undertake comprehensive projects to manage and develop the countryside (Annex 2).

Additional direct payments: These contributions are allotted on a per-hectare and per-farm basis so that agriculture can perform its assigned tasks and services to society, such as ensuring that the population is geographically decentralised and preserving the countryside.

Preserve agriculture in marginal areas

Objective

Switzerland has long been concerned about the abandonment of land in certain marginal areas, particularly in the mountains, and by the impact of this on the quality of the landscape, the wealth of flora and fauna and their role as protection against natural disasters. The Swiss Government keeps extremely close track of farming conditions and the hardships that face people living in such areas.

Instruments

Aid for mountain farmers: Introduced in 1959 for mountain areas, the contributions to the expenses of livestock holders offset the high cost of milk production in disadvantaged areas. They provide a decisive financial boost, especially in high mountain areas, and help keep those areas inhabited and farmland cultivated.

Aid for hard-to-farm land: Since 1980, farmers working land that is hard to cultivate can receive federal assistance. This aid is awarded for the exploitation of sloping or steeply sloping land, as well as for mountain summer grazing, so as to encourage utilisation of Alpine grasslands.

Stimulate the economy of mountain areas

Objectives

Agriculture is closely intertwined with other sectors of the economy. In mountain areas, it is handicapped not only by farming conditions but also by the fact that, in most regions, the economic potential and standards of living are lower than in lowland areas. The mountain economy and mountain farming are therefore dependent on co-ordinated promotion of tourism, industry, crafts, agriculture and forestry.

Instruments

Aid to investment in mountain regions: The Confederation is authorised to provide financial support for the improvement of mountain infrastructure. To this end, each region is required to formulate a development programme. Federal subsidies help offset the disadvantages affecting all economic sectors and improve the living conditions of mountain populations.

Sales promotions: Through nationwide recognition of registered designations of origin and geographical labels, the Confederation can promote sales of specific farm produce, much of which is from marginal areas.

Maintain biological diversity

Objective

By ratifying the Convention on Biological Diversity, adopting the Declaration of Leipzig and its Global Action Plan, Switzerland has pledged to conserve the genetic resources of agriculture and to use them in a sustainable manner. At the national level, the Nature and Landscape Protection Act requires that indigenous fauna and flora be maintained.

Instruments

Environmental contributions: Contributions for environmental compensation help make it possible to create or maintain a variety of natural environments which are important to both genetic and scenic diversity. Such extensive and low-intensity grazing, bracken harvested for bedding, country hedgerows and copses, flowering meadows and traditional orchards. When a given environment contains exceptional flora or fauna, additional funding is provided.

Fund for the preservation and management of the countryside and traditional landscapes: This fund was created at the time of Switzerland's 700th anniversary in order to finance projects that failed to meet the usual requirements for subsidies such as repairing irrigation channels, shingled roofs, terraces, drystone walls, etc.

Gene banks*:* Nearly 17 000 varieties, lines and populations are preserved by public and private organisations. Off-site preservation is co-ordinated by the Swiss Commission for the Preservation of Cultivated Plants.

Recognition of local varieties: Subject to certain conditions, local varieties may be marketed even though they are not listed in the national catalogue of varieties.

Recycle household waste

Objectives

By developing systems to collect waste that is sorted at the source, and by maintaining high levels of quality for sewage sludge and composts, the necessary conditions are created for using this waste in agriculture as either fodder or fertilizer.

Instruments

Sorting household waste at the source: Sorting enables two million tonnes per year (60 per cent of kitchen waste) to be converted directly into pig feed. For the collection of other organic waste, separate quality standards can be set and are higher than those applicable to sewage sludge.

Limits on application: Application of sludge and composts is limited and controlled (five tonnes of dry matter per hectare over three years for sludge, 25 tonnes over three years for composts), in order to ensure that they may be applied for a long time to come.

Quality control: Strict quality control makes it possible to recycle as much of this waste as possible. Currently, 40 per cent of sewage sludge and 65 per cent of composts are utilised in agriculture.

5. Outlook

Switzerland has planned a variety of priority actions for the future:

- Application of the Swiss Landscape Scheme (CPS): CPS is a federal government programme that in 1997 will harmonize all areas of policy intervention in order to achieve optimal protection of nature and the landscape. Through this programme, agriculture has pledged to protect a number of sites, such as 65 000 hectares of virtually wild land in the plateau area of Switzerland.

- National strategy for the conservation and sustained utilisation of plant gene resources in agriculture: preserving biological diversity, both on- and off-site, along with the sustained utilisation thereof, has long been a matter of concern in Switzerland, but until now there has not been enough co-ordination at national level. The countrywide strategy should provide that co-ordination and highlight current shortcomings.

- Maintaining local varieties on farms: a suitable approach has to be developed.

- Preserving endangered local species from extinction.

- Assessment of environmental measures, along with updating of tools and, where necessary, creation of new ones: an extensive programme to assess environmental contributions is currently under way.

- Regional programmes to preserve fauna and flora: A regional approach is necessary to establish rural areas in a near-wild state in order to enhance their effectiveness in preserving fauna and flora.

Annex 1: Article 31, Sec. 8 of the Federal Constitution

- The Confederation shall ensure that agriculture, through production that is both sustainable and market-oriented, contributes substantially to: i) providing the population with guaranteed food supplies; ii) preserving the natural bases of existence and maintaining the countryside; iii) geographic decentralisation of the population.

- In addition to the mutual assistance that agriculture could be required to provide and, if necessary, in derogation from the principle of freedom of trade and industry, the Confederation shall encourage small, individual farms that work the land.

- The Confederation shall formulate measures so that agriculture may perform its multifunctional tasks. Among its powers and responsibilities are to: i) supplement farm income through direct payments intended to provide fair compensation for services rendered, on the condition that proof of compliance with environmental requirements be submitted; ii) encourage, by means of economically viable incentives, forms of farming that are particularly in harmony with nature and that are beneficial to the environment and animal life; iii) enact requirements governing disclosure of the origin and quality of foodstuffs and of the methods and techniques used to produce and process them; iv) protect the environment from damage associated with the excessive use of fertilizers, chemicals or other additives; v) encourage agricultural research, extension and training and provide investment grants; vi) enact provisions to consolidate rural land ownership.

- For these purposes, the Confederation shall provide general resources and appropriations specifically earmarked for agriculture.

Annex 2: Rural land-use planning and development

1. The timeliness of today's land improvements

Land improvements have been carried out throughout the ages, and historically the term has always had an essentially agricultural connotation. Today, however, the scope of land improvements has expanded to encompass comprehensive projects intended to maintain and develop the countryside in its entirety. Rural areas comprise all of the land that shaped and maintained by man outside urban areas. They are part of man's cultural heritage and are vital to human life and that of fauna and flora. We are dependent on them for water, food and raw materials. They are also the site of varied infrastructure, such as roads, dumps, etc. Finding overall solutions for the use, organisation, planning and development of rural areas requires plans for broad-based co-operation among all of the interest groups present in each community.

2. Co-ordination plans lay the groundwork for co-ordinated rural planning and development at the local community level

A community's co-ordination plan comprises all aspects of its spatial development, such as natural reserves, water distribution networks and community infrastructure. In some cantons, it is community master plans ("plans directeurs communaux") that provide this co-ordination. Projects stemming from a co-ordination plan and serving a variety of purposes may be consolidated into a comprehensive project to be carried out in stages, in order of priority and as financial resources permit.

3. Today's land improvements involve comprehensive projects to develop the countryside

Such comprehensive community projects, whether they involve land consolidation or not, have a number of objectives: to keep agriculture strong, protect nature and the landscape, maintain croplands and develop the countryside. Such projects can maintain, and in some cases intensify, networks of biotopes and protect water resources and soil. They encompass all infrastructure that needs to be created, renovated or extended (e.g. buildings, roads, paths, conduits, purification plants, tourist facilities, etc.) and restructure the land according to requirements for its use. They help create a viable, healthy and diversified countryside in which agriculture, nature, the landscape and other factors can co-exist and develop in harmony. Many conflicts of interest can arise, and they have to be settled or made bearable. Consultation and the participation of all parties involved lead to solutions that are optimal for private landowners and the community alike.

4. Comprehensive solutions to closely intertwined problems are environmentally beneficial, well accepted by society and financially advantageous

People tend to have preconceived notions about land improvements. While the expression is frequently associated with the drainage of wetlands, to make such a connection is as fallacious as the equally widespread claim that farming and protecting nature are incompatible. From the second world war until the end of the 1970s, the goal of land improvements was essentially agricultural. The improvements were an important component of farm policy: at the time, it was necessary to intensify and rationalise production in order to boost self-sufficiency and ensure that the population was fed. Today, with hindsight, a number of excesses can be criticised: projects were often carried out to the detriment of a rich and diversified countryside and natural environment.

5. Land improvements achieved the goals society had assigned them at the time

New problems have forced our society to develop a policy of land-use development and preservation of the environment. Agricultural policy has had to be reformulated and redirected: the goals of protecting nature, landscapes and water resources and planning for land-use development have taken on greater importance. This trend is likely to continue in the future.

6. The objectives of land improvements now stem from broader goals

Today, society expects agriculture to perform a great diversity of tasks (see the seventh report of the Federal Office of Agriculture): supply food; utilise and maintain the natural bases of existence; preserve and maintain croplands; and contribute to the economic, social and cultural life of the countryside. To meet these requirements, existing structures need to be adapted and new ones put in place. In the past, land improvements were already being used to lay the groundwork for structural change and new forms of production. Today, still other challenges can be met through the formulation and execution of comprehensive community projects. (Note: such projects do not necessarily have to be circumscribed by the political limits of communes. Depending on circumstances, they can apply to portions of a given commune or to a number of communes, if not to an entire region.)

7. Comprehensive community projects can achieve the new objectives

The purpose of the new agricultural policy is to develop multifunctional and environmentally beneficial agriculture throughout Switzerland. The new production methods encouraged by the Confederation will reduce the volume of output and afford greater protection for nature, the landscape, water resources and soil. Comprehensive community projects provide effective support for Switzerland's multifunctional agriculture by creating optimal structures and favourable conditions that address new concerns. Only viable farms can meet the objectives of multifunctional agriculture, which means to: meet the population's food needs when imports are disrupted and maintain a sufficient production capacity; supply wholesome, high-quality food at attractive prices; maintain an agriculture based on small, individual farms and help ensure that the population is geographically decentralised; and protect and maintain croplands and protect the environment, plants and animals.

In designing projects, increased emphasis will be put on cutting operating costs and lightening farmers' workload, rather than attempting to maximise output. Moreover, efforts will be made to enhance the ability of farms to respond flexibly to changing economic conditions. Such flexibility is crucial to the policy objective of making Swiss agriculture subject to market forces and international competition.

In practice, comprehensive community projects can produce the following results: i) restructure farms; ii) consolidate plots; iii) make farms and hamlets accessible and connect them to running water and electricity; iv) improve access to meadows and fields; v) adapt the groundwater regime to needs; vi) assign the best farmland to farming for the long term. In the rural construction sector, which is indistinguishable from land improvements, it is also possible to achieve many beneficial results: i) rational farm buildings are being constructed; ii) existing buildings and facilities are being updated and brought in line with legislative requirements (for the protection of animals, water resources, etc.); iii) housing conditions are being improved; iv) community buildings are being constructed.

Today, the main goal of protecting nature is to preserve habitats. Endangered species of plants and animals need sufficient space, stable natural cycles, a healthy environment and bridges between their respective habitats (ecological networks). Comprehensive community projects involving land consolidation provide a suitable vehicle for maintaining, protecting and structuring biotopes. Land consolidation makes it possible to separate protected areas from areas that are reserved first and foremost for agriculture, but also to create and interconnect biotopes.

Legislation on the protection of nature and the landscape functions primarily through obligations and prohibitions, and needs to be supplemented by land consolidation if land ownership and land usage are to be reconciled in the best possible manner. Land consolidation facilitates the exchange and redistribution of plots for the common good, and particularly the protection of nature and the landscape. In this way, the authorities can avoid having to resort to the unpleasant solution of expropriation.

8. Comprehensive community projects are a suitable vehicle for achieving environmental compensation and creating networks of biotopes

Networks of biotopes are obtained by creating environmental bridges, refuges and relays. In land consolidation, nature protection goals are achieved by attributing the necessary plots to the relevant community organisations or landowners. Soil performs a variety of functions that are crucial to plant, animal and human life. It is simultaneously a habitat and a regulator and base of production. As the elemental component of the landscape, it reflects our culture in a dynamic manner.

9. Comprehensive community projects help protect soil

Protecting the soil means protecting it against pollution, excessive erosion and compaction. In comprehensive community projects, it is possible to scale back erosion by: altering the form, size or orientation of plots; changing the system of tracks and paths; regulating water; creating networks of biotopes. Keeping erosion in check will ensure that soil remains fertile for a long time. Setting up buffer zones can protect water from undesirable substances. By managing rivers and streams with environmentally sound techniques, habitats can be recreated and linked, infiltration abetted and self-purification capacity enhanced.

10. Comprehensive community projects help protect water resources

Protecting the soil and protecting water resources are closely intertwined. Soil acts as a filter for drinking water and thus determines the quality and quantity thereof - two characteristics that are crucial over the long term. Since groundwater is our chief reservoir, it is essential to protect it from soluble substances that affect its quality. Land consolidation is the appropriate vehicle for co-ordinated establishment of protection areas in which soil is restricted to agricultural use.

Countrywide land-use planning ensures that all activities are co-ordinated at all levels - national, cantonal, regional and communal. Comprehensive community projects ensure that the various interests involved are co-ordinated and weighed carefully when land-use planning objectives are carried out. Today this is an unavoidable requirement, given that community projects frequently engender conflicts, as in the case of road or railway projects. On the one hand, landowners object and seek to defend their rights, while at the same time various interest groups make their own, often divergent, demands. People involved in land-use planning must always bear in mind that land consolidation very often makes it possible to avert expropriation.

Comprehensive community projects offer a host of advantages by co-ordinating the planning and execution of projects of benefit to the public: i) local development; ii) roads, cycling routes, paths for pedestrians and hikers, car parks, railways; iii) supplies of water and energy; iv) water purification, dumps; v) sporting and tourist facilities; vi) measures to maintain and revitalise built-up areas and the countryside. Such projects enable different interests to be weighed carefully when projects are assessed; the parties involved to take part in preliminary research; land to be acquired more easily and the necessary land consolidation to be carried out to meet public needs and to extend and renovate existing infrastructure; costs to be divided up among the parties involved; overall financing, incorporating subsidies from the Confederation, the cantons and private interests; execution in phases, as financing permits; apportionment of costs in proportion to benefits derived.

UNITED STATES: THE ROLE OF AGRICULTURE IN PROTECTING BIOLOGICAL DIVERSITY

by
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Introduction

The Nature Conservancy (TNC) is an international, private, non-profit conservation organisation dedicated to preserving plants, animals and natural communities that represent the diversity of life on Earth. TNC preserves biological diversity by protecting the land and water needed for species survival. Founded in 1951, TNC and its members have protected over 9.3 million acres of land in 50 states and Canada. In some circumstances TNC transfers land to other public and private entities; however, TNC owns more than 1 400 preserves which constitute the largest private system of nature sanctuaries in the world. TNC has assisted similar partner conservation organisations to achieve protection of approximately 44 million acres in Latin America, the Caribbean, the Pacific Basin and Asia.

In 1995 TNC's membership surpassed 820 000 individuals. In addition, the Conservancy receives support from over 1 500 corporate sponsors. TNC spent over $81 million on land acquisition in 1995 and $112 million on conservation operations to scientifically inventory, study and manage TNC-owned land as well as support conservation activities which assist other private landowners. TNC's acquisition priorities are based on scientific inventories that determine the location and rarity of species. The inventory and cataloguing of data is conducted by a nationwide network of Natural Heritage Programs. The Natural Heritage Programs were developed by TNC. Now, under most circumstances, these are owned and managed by state governments.

For the first forty years of operation TNC believed that creating nature preserves to protect habitat for rare and endangered species would be adequate to protect biological diversity. Nature preserves were established like fortresses in the landscape-an attempt to divorce them from the land use and management practices surrounding them. Despite some significant success, it became frighteningly clear to TNC scientists during the 1980s that species endangerment was accelerating. They began to realise that enduring species protection could not be accomplished at the scale of most nature preserves, but rather must be initiated at a much larger ecosystem level.

In addition, as more information became available it became apparent that some of the most imperiled species were associated with aquatic systems, such as rivers and streams - places TNC could not purchase. Adding to the complexity of the situation is the fact that the only strategy for protecting many aquatic species is to improve water quality by changing harmful land use practices on a watershed scale.

In the early 1990s TNC developed a new paradigm for the protection of biological diversity. It is rooted in the philosophy that the only way to stop losing species and to successfully sustain biodiversity over the long-term is to work at the ecosystem scale and engage the willing participation of other private and public landowners to protect critical habitat. TNC continues to acquire key tracts of land for permanent protection. However, over the last five years TNC has invested heavily in creating partnerships with other private landowners, local, state, and federal government agencies and other non-governmental organisations to leverage all our resources into a protection strategy that is larger than the sum of each of the individual parts.

Many of the ecosystem level projects initiated by the Conservancy are nested in watersheds or landscapes dominated by agriculture or ranching. The Conservancy is working with and learning from farmers and ranchers with the goal of helping them protect the biological diversity on or near their lands. We recognise that in many cases these land uses and these landowners are our best allies. They share an ethic of land stewardship that although sometimes defined differently from ours, shares the common desire to take good care of the land.

The four case studies prepared for this paper represent examples where agricultural or ranching activities serve as a useful tool to achieve the protection of biological diversity. Each case study will review why TNC is interested in conservation at each site, the role of agriculture or ranching in the protection strategy, and the public policy framework that exists to support or impede progress.

1. Agricultural land protection, a buffer for natural area protection: the north landing river, Virginia

In 1728, pioneering naturalist William Byrd surveyed the boundary between the states of Virginia and North Carolina. After traversing the wetlands of Southeast Virginia, he described them in his journal as a "green sea" because of the undulating, tall, green reeds, or canebrakes that "stretched as far as the eye can see". Originally, the "green sea" extended over 600 square miles of Virginia. Today, because of urbanisation and conversion to agriculture, only 20 square miles remain in thin strips around the North Landing River, The Northwest River and the Great Dismal Swamp. It is a unique and biologically rich place, the northern limit of a complex natural community that once extended from Virginia to the Gulf of Mexico.

Four of Virginia's rarest natural communities exist in this unusual area. They include: wind-tide freshwater marshes, Atlantic white cedar swamps, canebrakes and pocosins (peat bogs dominated by shrub thickets). At least 32 rare plants grow along the North Landing River. The marshes and woodlands attract waterfowl and are critical resting and feeding habitat for migrating neotropical songbirds. One of Virginia's largest heron rookeries is found along the River.

In 1988 the Virginia State Chapter of TNC made protecting the "Green Sea" Wetlands a top priority. A series of acquisitions, management agreements and cooperative projects with other agencies has created a ten mile protected corridor of over 8 000 acres of wetlands and uplands on the west bank of the North Landing River. Despite the extensive land protection along the River it became clear to TNC that other issues must be addressed to achieve sustained protection of the ecosystem. In particular, we identified protecting water quality and stopping the rapid conversion of agricultural land to suburban development as two factors that were absolutely critical to success.

Agriculture

In the 1970s and 1980s Virginia Beach was the fastest growing city in America. As the city's population exploded, its agricultural base shrank by 50 per cent. During that time the area lost about 30 000 acres of some of the most productive agricultural land in the state. This conversion of land not only threatened one of the three top economic activities in the area (military and tourism are the other two), but it was eroding the open space and natural "buffer" that protected the North Landing River.

Losing agriculture to urbanisation creates many problems. Over half of the value of U.S. farm production comes from areas on the urban fringe. Patchwork suburban development makes it impossible for adjacent farmers to continue their activities thus accelerating the decline of agriculture. Studies show that conversion to urban uses is usually more costly to local units of government than had the farms remained. (This is because providing public services to the suburbs costs more than the taxes the new suburban residents generate.) Farming is often less detrimental to water quality than suburbanisation; Runoff from household hazardous waste such as motor oil, increases in impervious surfaces and lawn care chemicals can all lead to a decline in water quality. Finally, agriculture forms a buffer around natural areas that provides additional habitat as well as aesthetically pleasing open space.

TNC, along with other organisations with farming and conservation interests, formed the ad hoc Southern Watersheds Committee. The coalition recognised that something had to be done to help sustain agriculture as an economically viable local industry. One of the big pressures facing farmers was increasing property taxes due to spiralling land values caused by development. In addition, the allure of high land prices was a large temptation to farmers who could never make that kind of money growing corn, tomatoes and strawberries.

The Virginia Beach Agricultural Reserve Program

The Southern Watersheds Committee began looking for a market-based solution to the problem. They came up with the idea of creating the Virginia Beach Agricultural Reserve Program (ARP). The program is based upon the purchase of residential, commercial, and industrial development rights by the City of Virginia Beach. The benefits of the program include: ii) it is strictly voluntary, the farmland owner decides whether or not to participate; ii) the farmland owner is compensated for the sale of development rights to his land which can provide immediate working capital; iii) land is taxed for its agricultural value, rather than development value, thereby lowering property taxes; iv) land can be transferred to heirs at the lower agricultural values thereby lowering inheritance taxes; v) it is easier for beginning, young farmers to purchase farms and break into the business; vi) it encourages the community to manage growth in an economically and socially meaningful way; vii) it reduces the amount of infrastructure the local unit of government must provide and maintain; viii) it helps support agriculture-related businesses by maintaining farming as a viable industry; ix) it protects the aesthetic quality of the community which attracts tourism.

In May of 1995, the City of Virginia Beach passed an ordinance to establish the Agricultural Reserve Program. Fundamentally, the program works very simply. The City pays a landowner for the value of the development rights for their property (the difference between the land's use value as a farm and its market value if developed). In return, the landowner agrees to a conservation easement which restricts the use of their property to the terms of the easement (which in this case is for agricultural purposes).

The program is initiated by the Agricultural Advisory Commission which determines how much funding is available and then advertises for applications to be submitted. An interested landowner submits an application to the city for consideration. The farmland is then numerically ranked by the Commission, based on a number of criteria. The ranking is an important method for prioritising acquisition. The five basic categories for evaluation include: Quality of the Farmland (Productive Capability); Circumstances supporting agriculture (e.g. proximity of parcel to other farms with easements); Likelihood of conversion to non-farm use (Development Pressure); Environmental quality (e.g. proximity to streams etc.); Proximity to historic features, scenic value and application frequency.

After the Commission determines how many parcels can be purchased with available funding, it authorises appraisals for the top-ranking applications. The Commission then submits their recommendations of top-ranked applications for easements to the City Council for approval. The City Council votes to approve the purchases and then directs officials from the City to negotiate a price for the development rights. When an agreement is reached between the City and landowner, the conservation easement is written, approved and the purchase offer is made. Offers are made in sequence starting with the highest priority acquisitions. The process takes six months.

One concern of many farmland protection programs relates to unforeseen changing land use and the problem that protecting specific parcels may not make sense in the future. Under the Virginia Beach program, after a minimum of 25 years a landowner can ask for a review by the City Council to consider an application for repurchase of the development rights. If the City finds that because of changed circumstances the development rights should no longer be reserved, it can approve the repurchase at the current market value.

The Easement does not prohibit the landowner from selling the farm, changing their farming system or developing a complementary small business that does not adversely affect the agricultural potential of the property.

Policy discussion

In 1981, the "National Agriculture Land Study" brought attention to the fact that prime agricultural land throughout the United States was threatened by residential development. Since that time, policy makers at the local, state and federal level have attempted to create policy frameworks to encourage protection. It is generally acknowledged that the most effective programs for farmland preservation are conducted at the state and local level.

The Purchase of Development Rights program used in Virginia Beach is just one of many mechanisms that have been used to protect farmland. Other mechanisms include: the passage of "right-to-farm" laws which protect farmers against legal action by suburban neighbours; agricultural districting and tax breaks designed to tax land for its agricultural value as opposed to its development value; zoning restrictions which prevent development on agricultural land; and, Transfer of Development Rights programs where two zones are established, an agricultural zone and development zone, and a developer can purchase the development rights from a farmer in the agricultural zone in exchange for increasing the density of residential development in the development zone.

All the aforementioned programs have advantages and disadvantages. In the case of the Purchase of Development Rights program one of the biggest barriers to implementation is funding. In the case of Virginia Beach the city decided to pass a 1.5 per cent property tax increase to generate $3.5 million dollars a year to fund the program. The city purchases zero coupon, 30 year bonds. The city then pays the

landowner interest over 30 years until the bond reaches maturity. After 30 years the landowner receives a balloon payment for the easement.

In 1996 the United States Congress passed the Federal Agricultural Improvement and Reform Act. It is federal legislation which establishes agricultural policy for the next seven years. Within the Act is a new Farmland Protection Program. It directs the United States Department of Agriculture (USDA) to protect between 170 000 to 340 000 acres of land over the next three years and authorises $35 million to do so. The legislation directs the USDA to protect farmland through the acquisition of easements or "other interests in land". It is the hope of many in the conservation community that the money authorised under the program will be given to qualified state or local programs as a matching grant to enhance their efforts rather than used to acquire federal easements. Local programs often receive broader public support and can be cost efficient. How this program will actually be implemented will be determined by the USDA as a part of writing the "rules" for the program.

Sources for this case study include: Linda Lundquist, Director of Protection for the Virginia Field Office; *The Virginia Chapter News, Spring 1996, Winter 1994*; "Virginia Beach Agricultural Reserve Program: A Proposal for Safeguarding Virginia Beach's prime agricultural lands in Southern Watersheds by the ad hoc Southern Watersheds Committee, 12/22/94 (Principal author: Mary Heinricht).

2. The Darby Bioreserve Project: successful conservation through partnership

When the first European settlers entered the Darby Watershed in Central Ohio in the 1800s, they encountered a dramatic landscape teeming with a wide variety of plant and animal life. The aquatic resources at the time included over one hundred species of fish and forty species of molluscs. The river valley was characterised by towering bottomland hardwood forests and tall grass prairie and oak savannahs in the uplands.

Amazingly, in 1996 the diversity of fish and molluscs inhabiting Big Darby Creek has not changed radically. This is in spite of the fact that 80 per cent of the terrestrial area of the watershed has been converted to production agriculture dominated by a corn and soybean rotation and the remaining 20 per cent is half in residential uses and half in pasture and woodlands. In other locations throughout the Midwestern United States this level of aquatic biological diversity has been lost. However, a unique combination of geology, hydrology and socio-economy have conspired to make the Darby one of the healthiest aquatic systems of its size in the Midwest and ranked among the top five warm freshwater habitats in the region by the Ohio Environmental Protection Agency.

TNC is interested in protecting the Big Darby Watershed for a variety of reasons: It has a large concentration of rare species - fourteen species are classified by the state or federal government as "endangered" and 28 "threatened" or "potentially threatened"; the aquatic system is ecologically salvageable; and, there is broad local, state and federal support to protect the river.

In every project area, TNC identifies the "stresses" (actual or potential problems) which must be addressed for the long-term success of the project. In the Darby Watershed there are eight priority stresses. They include: sedimentation (due to agriculture and residential development); nutrient enrichment caused by livestock, lawncare fertilizers, septic system failure and stormwater run-off; alteration of flow because of channelisation, subsurface drainage and impervious surfaces; alteration of riparian habitat (i.e. removal of trees along the riparian corridor); chemical contamination from agriculture, industry and residential activities; changes in water temperature caused by removal of riparian vegetation and elevated temperatures associated with run-off; reduction in

fecundity of fish and molluscs due to a combination of impaired water quality and biotic factors; and, increases in alien species.

Agriculture

Although agriculture in the Watershed could be a potential threat to the quality of the aquatic ecosystem it may have played a significant role in its survival as well. This is because agriculture has had less of a water quality impact than other contemporary land uses. Human activities such as urbanisation and industrialisation can have significantly greater impacts. These activities have led to water quality impairment in other areas of the Midwest and the decline of similar watersheds.

Because agriculture involves 80 per cent of the land use, its impact on the Watershed is not benign. It is the major source of nonpoint pollution, such as sediment, which is considered the most significant threat to the long-term survival of the system. Agricultural activities are the source of other stresses including: nutrients, altered flow regimes, habitat alteration, chemical contamination and changes in water temperature. Despite these problems TNC considers agriculture to be an ally in the protection of the aquatic system. Agriculture has been a good neighbour to date and the farmers in the watershed have demonstrated a commitment to solving agriculturally generated problems. Also, like the North Landing River project in Virginia, agriculture is an important buffer to the river and a superior land use to residential or industrial development which is presently threatening the Watershed.

The Darby Partnership

The principal strategy for protecting the Darby Watershed is based on working with a wide array of public and private partners to identify and solve resource problems. Since 1991, the Ohio Chapter of TNC has helped to facilitate and promote the work of the Darby Partners, a group of more than fifty public and private agencies and organisations that share the common goal of maintaining the exceptional quality habitat of the Darby Watershed.

Associated with the Darby Partnership are two critical groups who are crucial to success. The first is Operation Future Association, a non-profit agricultural organisation made up of farmers. The group received a grant from the W.K. Kellogg Foundation three years ago to "empower the agricultural community of the Darby watershed to implement economically and ecologically sound land use practices." From a founding membership of six farmers, Operation Future has grown to over 150 members who farm more than 50 per cent of the critical acres along the corridors of the Darby Watershed. Creating an entity that farmers trust, that can provide information on resource conserving technologies and serves as a sounding board for farmers concerns and ideas has been a key component to the overall success of the effort.

In 1991, the Darby Watershed was designated a "Hydrologic Unit Area" by the United States Department of Agriculture. This designation galvanised the vast array of public agencies with jurisdiction over the river to work cooperatively and focus resources in such a way that they can achieve maximum benefit. Referred to as the Hydrologic Unit Field Staff, the agencies represent a full complement of expertise that can solve resource problems. Their efforts have included: promotion of conservation tillage; installation of grassed waterways, windbreaks, filterstrips and streamside forests; promotion of streambank protection; implementation of animal waste management programs; promotion of fencerow enhancement; education and outreach programs; pesticide use and application education; acquisition of conservation easements; and, long-term scientific monitoring. Since 1991, the public and private

participants in the Darby Partnership have attracted over $14 million dollars in grants and loans to solve resource issues.

Policy discussion

The convergence of a number of factors have created the successful partnership that exists today in the Darby Watershed. Some are directly linked to policy issues, while others can only be attributed to attitude and luck.

Farmer interest

Given that farmers play a critical role in the environmental quality of the Watershed it was fortunate that they decided to get directly involved in efforts to understand and protect the river. Interestingly, it did not necessarily have to happen this way. Initially, the agricultural community was sceptical and concerned about the attention given to the river by TNC, the Ohio Department of Natural Resources and others. The presence of TNC, as an organisation interested in the protection of endangered and threatened species, created concern among some farmers that federal regulations intended to protect endangered and threatened species would be imposed on their farming operations. The farmers in the Watershed had two choices, they could resist efforts to protect the river or they could figure out a way to work cooperatively. Fortunately, about this time money became available from the Kellogg Foundation to help start the Operation Future Association. Kellogg gave the grant to TNC, as an existing non-profit, with the idea that TNC could provide technical assistance in creating a new non-profit organisation for the farmers. The Kellogg money has allowed farmers in the Watershed to create a positive entity that can help explore new resource saving farming technologies (such as no-till agriculture) and provide a forum for credible information exchange. In addition, the fact that TNC has been willing to help Operation Future get started and to listen to what Operation Future has to say has been helpful in establishing a positive, constructive working relationship.

Focused government resources

The designation of the Darby Watershed as a Hydrologic Unit Area(HUA) by the United States Department of Agriculture provided the forum for building a constructive, cooperative public partnership. It also infused the area with critical public funding and technical expertise. Although it is obvious that federal and state agencies should work together to deliver government programs in a coordinated and complementary fashion, this is often not the case. In fact, in the worst examples, programs compete with one another or are implemented in a geographical patchwork which fails to provide maximum environmental value per dollar spent. Under an HUA designation the various agencies of the USDA are directed to coordinate their activities. Fortunately, in the Darby Watershed, staff from the USDA agencies, with particular leadership by the Natural Resources Conservation Service (NRCS), have willingly worked together. The HUA designation served to attract other state and federal partners as well. The result has been the creation of a harmonious mosaic of expertise and funding that can solve a variety of resource problems.

As the Darby Partnership has evolved “teams” have been formed to address specific problems. A good example is the Livestock Management and Stream Exclusion Team. This group was created to specifically address livestock issues. Their activities include identifying livestock production farms along the streams, working with producers to implement “best management practices” such as off-stream watering devices and the construction of fences to exclude livestock from the riparian corridor. The Darby

project has also received a beneficial boost of $9.3 million dollars of low-interest money to implement pollution control technologies through the "Water Pollution Control Loan Fund". This money is made available through a federal grant to the state pollution control agency. The state, in turn, makes the money available to landowners in specific geographic areas for pollution control activities. As a condition for receiving the low-interest loan the landowner must develop a whole farm plan for their property in cooperation with their local Soil and Water Conservation District and the NRCS. The money is managed through private banks.

Local, state and federal funding through numerous public agencies has been an essential part of the protection program. Without partial public funding of the conservation treatments needed to address sedimentation, riparian corridor restoration and protection, and other land treatment programs environmental improvement would not have happened. It is generally believed that economic incentives to inspire improved land use work better in motivating farmer behaviour than laws and regulations.

Congress has recently authorised $2.5 billion dollars annually for various conservation programs as a part of the Federal Agriculture Improvement and Reform Act. This demonstrates a clear commitment by Congress and the American public to conservation. Unfortunately, despite this seemingly huge amount of money committed to conservation it is not enough to meet the environmental needs everywhere in the country. One solution to maximise the dollars spent is to focus efforts in areas where there is a high priority environmental need and where partnerships exist to coordinate action.

Favourable economic conditions

The combined efforts of the partners working in the Darby Watershed has had measurable favourable results. According to the USDA-Natural Resources Conservation Service, the erosion rate from silty soils in the watershed has been reduced by 25 per cent; gully erosion has been reduced by 695 tonnes; and, the overland transport of sediment has been reduced by 35 500 tonnes.

One of the most significant factors leading to a reduction in sedimentation in the Watershed is the widespread adoption of no-till agriculture. Under a no-till system a farmer reduces the amount of tillage on the farm and retains high levels of crop residue on top of the soil. By reducing the amount of disturbance to the soil and maintaining high levels of organic matter, infiltration is increased, soil is less exposed and the erosiveness of the field is reduced. The advantage of this type of farming to the farmer is that it is less costly in terms of labour and petroleum. In the initial two years of no-till crop yields may drop, however, overall it has been demonstrated that in the Darby Watershed this form of agriculture is profitable.

TNC recognises that the best way to gain acceptance of certain conservation farming systems is to demonstrate their profitability or to create a market for that particular product. Presently, TNC in collaboration with the Natural Resources Conservation Service and other partners, is developing a business proposal for the creation of an enterprise which would dry, market and distribute alfalfa hay. Hay is recognised as a soil conserving crop, that if grown in strategic areas of the watershed, can help reduce erosion on sensitive land and permit a farmer to make a profit. Identifying a market for alfalfa hay and promoting it for sensitive areas is one of the strategies TNC will pursue in the Watershed.

The factors that make the Darby Watershed protection effort work include a public, private partnership which combines human and financial resources to maximise environmental benefits; willing participation by farmers in the watershed to achieve conservation; and, the profitability of no-till

agriculture. The long-term strategy of the Darby Partnership will be to continue to promote and implement conservation technologies and policies that will guarantee the health of the aquatic system.

Sources for the case study include: "The Darby Bioreserve Project", 1996 Draft Plan prepared by The Ohio Chapter of TNC (Teri Devlin, Principal Author); Wes Beery, Agriculture Coordinator, personal conversation.

3. The Nebraska Chapter of TNC : managing for biological diversity in an agricultural landscape

The State of Nebraska is in the agricultural heartland of the United States. In 1990 it ranked fourth in total agricultural receipts for the nation. The Eastern, and more humid part of the state, is farmed in row crop agriculture of soybeans and corn. The Western part is largely dedicated to cattle. Rather than fight the economic and cultural forces that define Nebraska the state chapter of TNC has actively developed protection strategies that incorporate agriculture as a partner.

The two projects under discussion in this case study use two different approaches to agriculture to accomplish the TNC's mission. At the 56 000 acre Niobrara Valley Preserve in North Central Nebraska, the grazing of cattle and bison are used to manage and restore native prairie and provide a model for good stewardship. Grazing also generates revenue for the protection, management and restoration of the riparian corridor, wetlands and woodlands that are an integral part of the Preserve. The Niobrara Valley Preserve is an economically self-sustaining operation.

In the South Central portion of the state, where TNC seeks to protect critical habitat for migratory sandhill cranes, shorebirds and waterfowl, the approach is different. Along the Platte River the dominant land use is row crop agriculture. TNC recently acquired 174 acres of agricultural land to enhance habitat along the Platte River and to showcase compatible agricultural activities.

Agriculture

Niobrara Valley Preserve

Since the inception of the Niobrara Valley Preserve in 1980, the staff of TNC have pursued a two-fold mission. They have developed and applied management techniques that encourage and sustain biodiversity and, to the extent practicable, they have adapted those techniques to fit within the economy and culture of the Nebraska Sandhills and the Niobrara Valley.

Basically, the preserve uses cattle and bison grazing to both manage the prairie and generate income. TNC leases 40 000 acres of the preserve for cattle grazing. Sustaining biological diversity is the primary goal of this project, therefore grazing is managed to enhance the prairie grasslands. It is also important that the ranchers who lease land from TNC maintain a profit as well, therefore lease rates are determined with this goal in mind.

In rural communities local property taxes are extremely important. The local taxes support schools and other public services. One problem often confronting rural communities is a very small local tax base. Therefore, even though TNC is a non-profit organisation and is not obliged to pay local property taxes the Niobrara Valley Preserve remains on the tax rolls. It provides approximately $80 000 per year in local revenue.

Bison, a large native herbivore, have been re-introduced at the Preserve in an attempt to restore the natural processes that influence the Sandhill Prairies. The Great Plains of the United States, which includes the prairies of Nebraska, co-evolved with the bison. However, in the 19th Century wild, free-ranging bison were virtually eliminated. The management regime integrates bison and prescribed burning to restore the original natural forces which shaped the landscape.

The bison are not only an essential element in the restoration of the landscape, but they have proven to be economically profitable as well. Raising bison for meat production is a growth industry in the United States. TNC has a genetically well-managed disease-free herd. Therefore, the annual sale of surplus animals in addition to fees from cattle grazing leases permits the Preserve to be economically self-supporting.

Although the woodland along the river corridor constitutes only 20 per cent of the preserve's acreage, it contains the richest concentration of native plants and animals. Eighty per cent of the rare or unusual species that occur on the Preserve are restricted to the riparian woodlands. TNC staff believe that the woodlands may yield another opportunity to develop environmentally important and economically beneficial management opportunities.

In addition, the ecological integrity of the riparian woodlands has been compromised by the expansion of eastern red cedar. In the absence of fire (which has been suppressed in recent history) eastern red cedar overtakes hardwood and pine woodlands and outcompete desirable native species. TNC staff is currently analysing economical and environmentally benign methods of removing red cedar while also working in partnership with government agencies to identify potential markets for sale of the wood and associated wood products. It is the goal of this effort to create an economically viable model that can be used by other ranchers to manage eastern red cedar and improve the biological diversity of the riparian woodlands.

Platte River demonstration site

The Big Bend Reach of the Platte River— an 80-mile stretch in South Central Nebraska — is a natural resource of international significance. It supports an assemblage of native birds that is without parallel in North America. Each spring, an estimated 500 000 sandhill cranes linger for a month on the Platte, feeding and resting in preparation for the arduous nesting season farther north. Thousands of people visit Nebraska in the spring to witness this incredible natural phenomenon. One study estimates that visitors to the region add more than $15 million to the local economy.

It is TNC's long-term goal to protect ten sandhill crane roost sites-unvegetated sandbars in the river and adjacent feeding areas in the wet meadows and agricultural fields-of approximately 2 500 acres each. TNC is working with a variety of partners to achieve this goal. Currently, 10 000 acres have been protected-approximately a third of the goal.

In 1994, with financial assistance from the Nebraska Environmental Trust (public funds generated through the sale of lottery tickets) and the ConAgra Foundation, TNC acquired a 174-acre tract of farmland adjacent to the Platte River. TNC is working with the University of Nebraska Institute of Agriculture and Natural Resources (IANR) to establish a demonstration site which will feature economically viable sustainable agriculture and wetlands and riparian restoration. The Platte River Demonstration Site is an attempt to show that habitat protection, agriculture and ecotourism can be mutually supportive activities.

During the next five years TNC and IANR scientists will implement and monitor a number of land use activities on the property. The project hopes to demonstrate that: i) crop rotations can improve ground water quality while maintaining profitability; ii) native wildlife respond to diversification of agricultural production; iii) farmers can maintain profitability while managing for landscape diversity that encourages biodiversity; iv) alternative crops exist that can yield a profit and enhance biological diversity. One of the primary agricultural changes will be the conversion of the row crop agriculture to alfalfa, pasture and native grasses. Management will include rotational grazing. The farming and grazing practices will be analysed for profitability. It is a very important goal of the project to design a farming system that insures an adequate income for the farmer while enhancing habitat protection. It is a belief of TNC staff and our partners that habitat protection can proceed in a way that incorporates people and their economic activities as a part of the protection mix.

Policy discussion

Niobrara Valley Preserve

Protecting critical habitat in an intensively farmed and ranch environment poses significant challenges. The Nebraska Chapter of TNC recognises that success depends on developing protection strategies that integrate habitat conservation, agricultural production and economic sustainability. The biggest factor contributing to the success of the Niobrara Preserve is not public policy at all but rather market forces. It is phenomenal good luck that raising and selling bison can be a profitable activity in the current marketplace. The money generated from the sale of surplus animals when combined with the income generated from grazing leases has permitted the Niobrara Valley Preserve to be an economically self-sustaining operation.

One area of public policy that is important to many of the environmental/agricultural efforts underway at TNC is the identification of markets for agricultural products. In some cases, TNC is attempting to market items on the basis of special environmental qualities, i.e. produced in an environmentally sensitive manner or “green marketing”. In other instances, we are seeking more traditional venues. TNC usually attempts to find partners to help with economic development issues because the majority of our expertise is in the protection of biological diversity. In the case of the Niobrara Valley Preserve, efforts are underway to identify and develop markets for wood products derived from eastern red cedar. The Niobrara Preserve is working with the local North Central Resource Conservation and Development Council, a local advisory group sponsored by the USDA/Natural Resources Conservation Service to assist in this effort.

The United States Department of Agriculture offers a variety of programs to assist in rural development. One program in particular, “The Alternative Agricultural Research and Commercialization Program” is designed to assist in researching, developing, commercialising and marketing new nonfood, nonfeed uses for traditional and new agricultural commodities. TNC is not involved with this particular federal program; however, its existence demonstrates that policy makers recognise the need for the diversification of agriculture and the importance of new market identification and promotion.

In 1995, TNC established the Center for Compatible Economic Development to explore various ways of developing and promoting sustainable economic opportunities in project areas. It is an acknowledgement on our part, that market forces can be one of the most important agents for change in land use management and human behaviour.

Platte River Demonstration Project

The Platte River Demonstration Project illustrates the importance of partnership, public and private funding and entrepeneurism in promoting change. The success of the project is directly tied to the wide variety of expertise and financial resources that have played a role in this 174-acre experiment. Farmers lead a life full of risk due to factors out of their control (such as weather). Therefore, most farmers are disinclined to change agricultural practices without some certainty that the change is either economically neutral or profitable. Demonstration projects combined with public outreach can be an important educational tool. In the case of TNC's effort, the parcel of land acquired for this project was strategically situated to provide maximum benefit for the cranes, ecotourism and experimental farming. The partners involved in this effort all bring essential ingredients for project success.

Public funding is an essential component of the project. Funds generated from a Nebraska State Lottery are dedicated to a Nebraska Environmental Trust Fund which in turn disburses grants to support environmentally beneficial projects. Money from the fund has been used to acquire property and support a demonstration of sustainable agriculture at the site.

Unfortunately, public funding for conservation and environmental protection is never adequate. However, because TNC is a charitable, non-profit organisation, we can often attract private dollars to a project as well. The US tax code permits a tax deduction to individuals and corporations who make a charitable gift to TNC. Many corporations establish Foundations as the vehicle for disbursing funds. In the case of the Platte River Demonstration Project, TNC was able to attract an additional $175 000 for the effort from the ConAgra Foundation. The ConAgra gift not only provided an important economic boost, but linked one of the largest agribusinesses in the United States to an important conservation effort. Their involvement helps legitimise conservation and the work of TNC in the community.

Another key element of the project is the involvement of the University of Nebraska, a publicly funded college. It brings the expertise of an agricultural school, new technology and additional credibility to the effort. This project will help stimulate much needed research in the area of economically viable sustainable agriculture technology. The principal factors that contribute to the success of protection efforts in Nebraska include: land management that preserves, restores and protects biological diversity while maintaining profitability; public funding that facilitates experimentation with agricultural systems that are compatible with the protection of biological diversity; partnerships with respected agri-business, educational institutions and government agencies; and the development of new, economically viable technology that permits a landowner to earn a profit while protecting critical habitat.

Sources for this case study include: *The Nebraska Chapter Newsletter*, Winter 1995, Spring 1995, Winter 1996. Personal communications with Al Steuter, Director of Science and Stewardship and Suzanne Winckler, Director of Communications.

4. The Malpai Borderlands Group: the power of private sector conservation

This case study does not describe a TNC project. It is an example of a private sector initiative that leads the way to conservation and the pivotal role that cooperation and support from other private organisations and public agencies can play in supporting the effort. The Conservancy acts as one of fourteen cooperators in a support role, following the lead of the local ranchers who have created a non-profit organisation called "The Malpai Borderlands Group." TNC believes that this project holds great promise for other agricultural landowners who want to bring both environmental health and economic stability to their communities. It is a reminder that voluntary solutions can work and that

private landowners, such as the ranchers in the Malpai Borderland Group, should be rewarded with policy incentives to help restore and protect the landscape in which they live.

The Malpai Borderlands Group has been a catalyst for cross-agency coordination, as well as for attracting leading scientific research in the area. It is an example of a hybrid effort-involving cooperation between agencies, conservation organisations and private landowners- that is springing up throughout the United States with promising results. In this instance it is creating a "Working Wilderness" in one of the most biologically diverse lands in America. The Malpai Borderlands Group is a grassroots, landowner-driven organisation, attempting to implement ecosystem management on nearly one million acres of virtually unfragmented open space in South-eastern Arizona and South-western New Mexico on the Mexican border.

The elevation for this area ranges from 3 800 feet, which is characterised by desert scrub and tobosa grasslands, up to 8 500 feet, which features Arizona Ponderosa Pine and Douglas Fir. Within this diverse area of mountains, canyons and valleys are numerous riparian corridors with Sycamores and Cottonwoods. It is referred to as the "Sky Islands" country, where the temperate world meets the tropics, where cactus grows at the foot of pine trees. It is inhabited by storybook creatures-elegant trogons, desert tortoises, coatis, javelina, desert bighorn sheep, pronghorn, jaguar and a host of neotropical migratory birds.

Agriculture

Perhaps the most remarkable thing about this huge landscape is that fewer than 100 human families reside there. Except for two small wildlife preserves, it is cattle ranching country. Most of the cattle in the region are English breeds crossed with Brahma. When climate conditions are "normal" the average use is one animal unit per fifty acres. Ranching has been the predominant land use in the region for over one hundred years, and supplies much of the economic base of the area.

The diversity of the land ownership is nearly as great as the country itself. It is a patchwork of ownership which includes 53 per cent private and 47 per cent made up of State Trust Land in New Mexico and Arizona or public land managed by the United States Forest Service (USFS) or the Bureau of Land Management (BLM). On the surface, little has changed since the turn of the century when many of the ranching families homesteaded the area. It was a time when survival of the fittest set the carrying capacity of the land for people and their livestock, although not without cost to the land. Today, however, change is in the works.

Rancher Non-profit Created

In 1990, several area ranchers met at the Malpai Ranch in the San Bernardino Valley (the ranch is named after the volcanic malpai rock prevalent in the area) to discuss mutual concerns such as rangeland health, the future of ranching and the fate of the open space it protects. Over a two-year period they added a few scientists and environmentalists to the dialogue. Eventually, they drafted a "Malpai Agenda," which addressed two major concerns: first, the threat of fragmentation of the landscape due to ranchers leaving the livestock business and selling their land for development. The second, was the declining productivity of the land and loss of biodiversity caused by the suppression of fire and the encroachment of woody species. They felt that inevitable result of the free market would lead to conversion of the landscape from ranching to 20-acre ranchettes. It was not the future they wanted.

In the beginning the Malpai Borderlands Group was not sure what changes were needed, however, they felt action should be driven by good science, contain a strong conservation ethic, be economically feasible and be initiated and led by the private sector. They knew the public agencies should and must be involved, but as partners rather than in the traditional role as "service providers" with the Malpai Borderlands Group as clients.

In 1993 the Malpai Borderlands Group was established as a 501(c)3 nonprofit organisation. The goal statement of the Group reads as follows: "Our goal is to restore and maintain the natural processes that create and protect a healthy, unfragmented landscape to support a diverse, flourishing community of human, plant and animal life in our borderlands region. Together, we will accomplish this by working to encourage profitable ranching and other traditional livelihoods which will sustain the open space nature of our land for generations to come."

Policy discussion

Ranchers, who ultimately formed the Malpai Borderland Group, decided that restoring the health of the grassland would be a key strategy to reach their goal. They were a catalyst for the development of the first fire plan in the region, ending over 80 years of fire suppression. Planning for and implementing the reintroduction of fire required teamwork and coordination between two states, four private landowners, two BLM Districts, two state Land Departments, the USFS, two state Wildlife Departments, the state offices of the U.S. Fish and Wildlife Service and international coordination with officials in Mexico. The area covered by the plan includes a Wilderness Study area and complies with federal and state regulations which include: the National Environmental Policy Act, the Endangered Species Act, and the Antiquities laws. The plan was completed in a quick time frame of eight months. Communication, rancher-to-rancher and rancher-to-agency, has increased on fire-related issues. As a result, thousands of acres have benefited from a more thoughtful response to fire. Another positive result is that thousands of dollars in fire suppression costs have been saved.

The preparation of a fire plan led to the formal establishment of the Malpai Borderlands Group. Associated with the group are the various cooperators which include many ranchers in Cochise and Hidalgo counties, the public agencies involved with preparation of the plan, the two state offices of the United States Department of Agriculture/Natural Resources Conservation Service, the Hidalgo County Soil and Water Conservation District, The Whitewater Draw Natural Resource Conservation District, the Desert Laboratory of the University of Arizona, TNC and the Animas Foundation.

The Group also works with a Science Advisory Committee whose members come from a variety of Universities and government agencies. In just a few short years research has progressed from literature to the establishment of experimental plots on different sites within the working area. All sites are chosen with the full consent and cooperation of the landowner, or in the case of state and public land, the lessee or permittee. Most of the research will center on different approaches to addressing woody species encroachment. A vegetative survey is being conducted as well.

One issue of concern in the Malpai Borderlands region relates to the protection of federally protected endangered and threatened species. If these species are to survive over their entire range, then private landowners should be actively and willingly involved. Voluntary efforts to protect habitat and species are far more acceptable to private landowners than restrictions and actions prescribed by law. The Malpai Borderlands Group and the ranchers in the region have demonstrated their commitment to voluntary efforts.

For example, during a recent summer drought, one rancher in the Group hauled a thousand gallons of water a week to one of the stock ponds on his ranch to keep a population of the threatened Chiricahua leopard frog alive. The Malpai Group helped the family to establish permanent water at the site. The permanent water not only created a home for the frogs, but enhanced the rancher's grazing management by establishing a dependable source of water. The Group is working with herpetologists, the Arizona Game and Fish Department and the rancher, using funds from the State Heritage Program to establish a second permanent source of water. In another example of the value of voluntary cooperation, this spring a Mexican jaguar was sighted by one of the ranchers in the Group. He called a meeting of all the different agencies to show them pictures of the cat and to help initiate a coordinated planning project to protect it should it stray into the borderlands again.

The enthusiastic participation and cooperation of personnel from numerous local, state and federal government agencies in developing coordinated solutions to address the problems identified by the Malpai Borderlands Group is a sign of the momentum created by this positive, private, voluntary effort. The primary frustration felt by the Malpai Borderlands Group now is the turnover of key personnel and the time it takes to bring new personnel "up to speed" on the effort. It is hoped that over time, as familiarity with the project grows, this problem will be overcome.

President Bill McDonald says that "the group feels good about where we are at this time, but we are realistic about the enormous challenges ahead. One of our principals calls what we are doing "God's work". If by definition that is work that brings good people together for a noble cause, then "God's work" it truly is." The success of the Malpai Borderlands Group is rooted in the fact that the local community, represented by the landowners, drives the effort. In a political climate where the traditional positions on land use issues are polarised the Malpai Borderlands Group has put itself in the "radical center". It is a powerful example of creating change through cooperation and private action.

Sources for this case study include: 'The Malpai Borderlands Group: Ecosystem Management in Action", Bill McDonald, Spring 1996. Personal communication, Wendy Glenn, Malpai Borderlands Group.

5. Conclusion

Agriculture can play an important role in the protection and restoration of biological diversity. The role can be direct or indirect. The Niobrara Valley Preserve in Central Nebraska is an example of a project where the grazing of bison is critical to the restoration of the Sandhill Prairie. The added advantage of this agricultural activity is that generates income to support the Preserve.

Agriculture plays an indirect, but pivotal role in Virginia Beach, Virginia and The Big Darby Watershed. In both cases agricultural use of the land is a preferred land use to residential development. The agricultural land provides an important buffer to the respective rivers and riparian corridors TNC seeks to protect. Economically viable ranching in the Malpai Borderlands of Arizona and New Mexico helps to maintain one million acres of unfragmented habitat over a biologically rich and diverse area. The grassland management activities designed to enhance the forage value of the range will help to restore and maintain biological diversity as well.

TNC's private sector initiatives are greatly enhanced by the work of public agencies and the targeting of government programs. The public agencies provide technical expertise that is often expensive or unavailable to locally grown conservation initiatives. A key factor of success in many TNC project areas is willing cooperation among the public agencies. Avoiding jurisdictional battles and permitting

flexible program implementation that accommodates local conditions is extremely important. Equally important are the public dollars that are used as incentives to encourage environmentally sound management practices, underwrite farmland protection programs and provide money for planning and management.

There are two other factors that characterise successful projects. One is strong local leadership, a quality which can never be predicted or mandated. The other is economics. Where resource protecting technology is profitable change happens quickly. Government programs that fund innovation and technology research, provide grants for new product development and market identification are critical to identifying economically feasible and environmentally sustainable technologies and products.

6. Acknowledgement

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UNITED STATES: WETLANDS CONSERVATION

by
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The American experience in wetlands conservation holds valuable lessons for any nation seeking a productive agriculture in harmony with a healthy land. Those lessons include: i) changing public attitudes about the value of wetlands; ii) finding the right mix of voluntary and regulatory approaches to conservation; iii) bringing together programs and authorities that were established individually and for specific purposes and making a cohesive set of policies and programs that is affordable and acceptable to society; iv) coordinating the work of different federal agencies toward a common goal;v) looking beyond one resource at a time to a better understanding of natural systems; vi) coping, as a society, with a contentious issue such as wetlands, balancing public and private interests to ensure the long-term sustainability of our natural resources.

The wetlands story still is unfolding. We still have much to learn about refining our technology, policies, and programs to protect these diverse and complex ecosystems, all the while respecting the economics of farming and ranching and the private property rights of landowners. But, on the whole, our partnership of government and the private sector has performed well, and we are excited about the future of wetlands conservation.

This case study examines the pursuit of agricultural wetlands conservation in the United States from the perspective of the Natural Resources Conservation Service (formerly the Soil Conservation Service), a technical-service agency that has been working with farmers and ranchers since the early 1930s. It examines the objectives of our national policy, the programs that we have used, our success to date, the challenge of measuring success, and our vision for the future. But, first, it is important to understand the context in which the wetlands issue arose — the much broader context of environmental pressures on American agriculture.

1. American agriculture and the environment

Agricultural lands cover much of the United States. Rangeland, forest, cropland, pasture, and farmsteads make up about two-thirds of the continental United States. As in most developed countries, American agriculture has evolved to fewer but much larger, more intensively managed, and more productive farms. Between 1982 and 1991, for example, overall farm output per unit of input increased by 26 per cent. Because of their vast extent and the intensity of their use, agricultural lands are potentially the greatest source of many natural resource problems. Yet, from an environmental perspective — and given the imperative to produce food, feed, and fiber — well-managed agriculture is a more desirable land use than most others.

Economically, cropland, grazing land, and woodland support a food and fiber industry that exceeds our domestic needs and accounts for a considerable percentage of the U.S. gross domestic product and civilian jobs. They also support a vast recreation industry — hunting, fishing and wildlife observation — benefiting landowner and public alike. Environmentally, our agricultural lands are of inestimable value. They are our principal watersheds. They help control the natural cycles of water, oxygen, nitrogen, and carbon, and they moderate the climate. They help clean the air and provide biodiversity. And they offer esthetic and other intangible values.

Farmland preservation is now a major issue at the urban-rural fringe areas, where land values accelerate the transition from a natural landscape to a paved one. Most Americans agree that it is better to have a cornfield than a shopping center, a meadow than a superhighway. Last year, a national public opinion poll of attitudes towards agriculture and its role in natural resource conservation revealed that Americans give individual farmers the highest rating for environmental caretaking. The agriculture industry in general got the second highest rating (Larsen and Colsher, 1995).

Indeed, American farmers and ranchers have made substantial, documented environmental progress over the last half-century — in soil erosion control, animal waste management, and the protection and conservation of water supplies. In no small way this progress is due to the voluntary soil conservation movement on private lands, which arose after severe drought and economic depression in the 1930s combined to produce devastating wind erosion over a significant area of the Great Plains. But regulation or the threat of regulation has been a catalyst for environmental progress also.

In the 1980s, American society — concerned about agrichemical use, nonpoint-source pollution of water, and food safety — began to look at agriculture with a regulatory eye, which until then had been focused primarily on industries contributing to point-source pollution. Comprehensive farm legislation, which the Congress revisits every 5 years to guide USDA policies and programs, has included conservation requirements since 1985, with growing attention to soil, water, wetlands, and wildlife habitat. And, although the new farm law passed this year was crafted in a less regulatory political climate, the fundamental conservation requirements remained in place, demonstrating that while the American people do not want over-regulation, they do want producers and other environmental stewards to protect the nation's natural resource base.

When asked in last year's national opinion poll how government might deal with agricultural natural resource problems, Americans put voluntary protection with government incentives and assistance as their first choice. They also agreed, however, with the principle of withholding benefits and payments or imposing fines or other penalties when producers refused to protect the environment. More than half of those polled indicated that they believed there would be more regulation of agriculture 10 years into the future, and most felt that farming's impact on natural resources should be regulated in the same ways as the impact of manufacturing and industry. It is within this context that wetlands conservation has become one of the most controversial agro-environmental issues of our day.

2. The wetlands conservation issue

There are about 157 million acres of wetlands and deepwater habitat in the United States, excluding Alaska. In the continental United States we now have only about half of the wetlands that existed 400 years ago — the result of a long-standing belief that the only good wetland was a drained wetland. For example, two of the nation's founders — George Washington and Thomas Jefferson — formed a company to try to drain the Great Dismal Swamp in southern Virginia and northern North

Carolina. The Swamp Act of 1860 gave federal lands to states willing to drain wetlands. And even into the 1970s, the U.S. Department of Agriculture cost-shared the drainage of wetlands.

The legacy of wetlands degradation is considerable

In the East, millions of acres of drained wetlands are now poor-quality agricultural land. Commercial and residential development continue to reduce agricultural and forested wetlands. Because of drainage and nonpoint source water pollution, many wetland and aquatic wildlife species have declined in this area. In the South-east, less than 60 per cent of the original wetlands in the lower Atlantic Flyway still exist. And the remaining wetlands are declining in quality because of nutrient loading, altered hydrology, and urban encroachment. The health of the Florida Everglades has been a major public issue.

In the south-central and south-western states, the loss and decreased quality of existing wetlands and associated upland buffers in areas such as playas (seasonal depressional wetlands), saline lakes, and riparian corridors have resulted in declining wildlife populations. Significant loss and degradation of estuaries along the Gulf of Mexico have occurred because of saltwater intrusion from canal construction and development, geologic subsidence, and developmental pressures along the coast. In the Midwest, where nearly 60 per cent of the rural land is cropland and pasture, prairie wetlands at one time covered nearly one-fourth of the total surface area. However, drainage for crop production severely reduced wetland acreage, and most of what remains is either forested or degraded. Wetland drainage and alteration of associated uplands have led to declines in many wildlife species. The recreational and economic impacts of wetland loss in this area are also major concerns.

The Northern Plains, although one of the most altered ecosystems in the country, is still one of the most ecologically rich regions in the world. When the most recent glacier retreated, it created the prairie potholes — areas containing a high density of isolated wetlands interspersed among the short-and tall grass and mixed-grass prairies. This unique combination of habitats supported the evolution of a great diversity of ground-nesting wildlife, particularly migratory birds. Prairie potholes are the most important breeding grounds for waterfowl in North America. Over the years, however, nearly half of the original wetlands in the prairie pothole region have been drained. Of those remaining, most are cropped when the soils are dry enough for planting. Agricultural practices around the potholes often result in sedimentation and addition of pesticides and fertilizers, which degrade wetland vegetation, water quality, and wetland habitats. Runoff from unprotected cropland is slowly filling many of these wetlands with sediment.

The West has lost nearly 60 per cent of its original wetlands. Losses of wetlands in arid areas are particularly detrimental to wildlife. Wetlands in California's Central Valley have been reduced from more than 4 million acres to about 300 000 acres. The natural annual flood cycle of the remaining Central Valley wetlands was eliminated by flood control and water-development projects. Consequently, the wetlands must be managed by artificial and intentional flooding with scarce, expensive water.

Reversal in public policy

Now, however after more than a century of public policy that promoted drainage, wetlands "...are the only ecosystem type to be comprehensively regulated across all public and private lands..." in the United States (National Research Council, 1995). Change in public attitude toward wetlands had its roots first in waterfowl habitat protection efforts that began in the late 1800s and then in the broad-based environmental movement of the 1960s and 1970s. Society was learning that wetlands: i) trap sediments, nutrients, and other pollutants, thereby greatly improving water quality; ii) reduce the likelihood of flood

damage, especially important to agricultural producers who "suffer almost half of all financial losses arising from flood damage...." (National Audubon Society, 1996); iii) help control the rate and volume of runoff in urban areas; iv) buffer shorelines against erosion; v) help maintain and stabilize streamflows over longer periods of time; vi) provide spawning grounds and habitat for commercially important fish and shellfish; vii) help preserve biological diversity across the landscape

In the United States, wetlands support about 5 000 plant species, 190 amphibian species, and one-third of all bird species. They provide habitat for about one-half the fish, one-third the birds, one-fourth of the plants, and one-sixth of the mammals on the U.S. threatened and endangered species lists. Most of the remaining wetlands are palustrine wetlands: inland "marshes," "swamps," "bogs," "fens," "prairie wetlands," and "ponds," according to the U.S. Fish and Wildlife Service's ecological classification for wetlands (Cowardin, *et al.*, 1979).

Decline in wetland losses

From the mid-1950s to the mid-1970s — when public policy encouraged drainage — wetland losses due to agriculture averaged about 398 000 acres annually. In the 1970s, the rate of loss dropped to an average of 157 000 acres a year. This coincided with the passage of the National Environmental Policy Act in 1969 and the Federal Water Pollution Control Act (later retitled as the Clean Water Act) as amended in 1972.

Between 1982 and 1992, the rate of wetland conversion for agricultural production fell dramatically to about 31 000 acres per year, accounting for only 20 per cent of gross wetland loss (most of the rest was attributable to development). And even these losses were somewhat mitigated by the conversion or transition of some land from other uses to wetlands.

The reduction in wetland losses in the 1980s reflected primarily the wetlands conservation provision of the 1985 Food Security Act; the combined effect of federal, state, and local programs that protect and restore wetlands (including the Tax Reform Act of 1986, which affected capital gains from land conversion); and a marginal agricultural economy. The Food Security Act and successor legislation in the 1990s reflect growing public support for wetlands protection and restoration. Both President Clinton and his predecessor, President Bush, although of different political parties, have supported a policy of no-net-loss and long-term gain in wetlands.

Legislation protecting wetlands evolved piecemeal

NRCS first became extensively involved in wetlands protection with the passage of the National Environmental Policy Act (NEPA) in 1969. NEPA is a federal law that requires an assessment of the environmental consequences of federal policies and programs. At issue concerning NRCS were watershed activities such as channelization, which straightened and deepened stream channels and destroyed or induced the destruction of wetlands. As a result of NEPA, environmental impact statements and mitigation of wetland alterations became part of watershed project planning.

Throughout the 1970s and 1980s, NRCS activities increasingly became sensitized to wetlands protection. In our small-watershed projects, drainage activities were reduced significantly, and in some projects we started using wetlands for water quality improvement. We began helping the sponsors of these projects negotiate for the permits required by Section 404 of the Clean Water Act. Section 404 requires farmers who want to drain wetlands to get a permit from the U.S. Army Corps of Engineers. The Corps of Engineers was charged with evaluating the permit applications according to guidelines developed by the

U.S. Environmental Protection Agency (EPA), with the Fish and Wildlife Service (an agency of the U.S. Department of the Interior) serving as a consultant on ecological impacts.

In 1977, President Carter's Executive Order 11990 restricted government involvement in activities that could lead to the destruction of wetlands. And by the mid-1980s, society accelerated the pace at which agriculture protected soil, water, and wetlands. This was done through the Food Security Act of 1985, a landmark piece of legislation that took away the incentive for converting wetlands for agricultural production.

Enactment of the Food Security Act of 1985 dramatically changed the U.S. Department of Agriculture's approach to wetland conservation. For the first time, receipt of most federal farm program benefits — including commodity price supports, agricultural credit, and crop insurance — became contingent on the application of land stewardship practices, including the protection of wetlands. This law was expected to have significant impact, given that about 60 per cent of all producers participated in commodity support programs and that 74 per cent of non–tidal wetlands are on privately owned lands.

Responsibility for implementing this law fell mainly to two U.S. Department of Agriculture agencies: The Natural Resources Conservation Service provides technical wetlands determinations, and the Farm Services Agency (formerly the Agricultural Stabilization and Conservation Service) controls commodity program payments. The Fish and Wildlife Service became involved also - as a consultant on ecological impacts.

The wetlands protection provision of the 1985 Food Security Act — commonly called "swampbuster" — denied federal farm program benefits to producers who planted an agricultural commodity (an annually tilled crop or sugarcane) on wetlands that were converted after the date the act was signed. Producers could drain a wetland, but as long as they did not plant a commodity crop on it, no swampbuster violation was triggered.

Swampbuster applies to all wetlands. It also applies to wetlands that were drained or filled for agricultural production before passage of the 1985 law but that continue to pond or flood for 15 or more days during the growing season and have potholes and playas that pond or stay saturated for 7 or more days during the growing season. For purposes of swampbuster, these are called "farmed wetlands." Wetlands that had been converted before the Food Security Act of 1985 was signed were classified as "prior converted" wetlands and were exempted from swampbuster.

The Food, Agriculture, Conservation, and Trade Act (FACTA) of 1990 — which succeeded the Food Security Act — changed the violation "trigger" for swampbuster from the production of an agricultural commodity to the conversion activity which made production possible. But the 1990 law also took away some of he rigidity of the 1985 law by introducing two new concepts: a) exemption for activities that had minimal environmental impact; and b) a "good faith" clause, which dealt more fairly with unintentional violators, creating a system of graduated sanctions under which producers could regain lost USDA benefits if they restored the converted wetland. And it established a Wetlands Reserve Program, which gave landowners an economic alternative to draining wetlands. Under the Wetlands Reserve, farmers could voluntarily sell land easements to the government for wetlands restoration purposes.

Succeeding FACTA is the Federal Agriculture Improvement and Reform (FAIR) Act of 1996, which added even more flexibility to the wetlands conservation provisions. The FAIR Act:

- Provides more options for mitigation, including restoration, enhancement, or creation, as long as wetland functions and values are maintained.

- Authorizes USDA to establish a pilot wetland mitigation bank to allow USDA to assess how well mitigation banking works for agriculture. (A mitigation bank is a wetland area that has been restored, created, or enhanced and that has been set aside to compensate for future conversions of wetlands.)

- Allows NRCS, working with state technical advisory committees, to identify practices that have a minimal effect on the environment to give high priority to their implementation.

- Stipulates that wetland conversion activities, authorized by a permit issued under Section 404 of the Clean Water Act, which make agriculture production possible, will not disqualify landowners from receiving USDA farm program benefits, as long as they were adequately mitigated.

- Permits landowners to allow an area to revert to wetland status, and convert it back to a farmed wetland or farmed wetland pasture for agricultural purposes without violating the Swampbuster provision.

- Provides the Secretary with the discretion to waive penalties for ineligibility and to grant time to restore converted wetlands.

- Provides the Secretary with authority to identify for individual producers which programs are affected by Swampbuster violations and how much the penalty is.

Contentious issues

Increasing flexibility built into wetland conservation provisions of farm legislation since 1985 responded to landowner frustration over several contentious issues. One of those issues was the rigidity of the 1985 Food Security Act, including the threat of complete loss of farm program benefits with a single violation. A second issue is the overlapping federal responsibilities and conflicting standards. Given the piecemeal evolution of federal wetlands jurisdiction, agricultural producers initially had to seek out three or four different agencies (all with different missions and definitions of wetlands) and fill out many forms, then wait sometimes months to get a decision. This was a frustrating situation for the private landowners and for our field employees as well. In addition, NRCS, the Army Corps of Engineers, the Fish and Wildlife Service, and the Environmental Protection Agency define (in terms of hydrology, substrate, and biota) and delineate wetlands in different ways, according to their missions. In 1989 the four agencies drafted a common delineation manual, but critics turned it down as too regulatory.

When the President suggested a revision in 1991, this, also, was turned down as too lenient on agriculture. At stake is public trust in the integrity of the science behind public policy; so, at the request of Congress, the National Academy of Sciences, through a committee of the National Research Council, assessed the situation (National Research Council, 1995). And, to their credit, NRCS, the Environmental Protection Agency, the Fish and Wildlife Service, and the Army Corps of Engineers devised, in 1994, an agreement to help simplify wetlands decision–making. Under this agreement, NRCS was designated the lead federal agency responsible for identifying wetlands on agricultural lands under both the Clean Water Act and the farm legislation. The agencies also agreed to use the 1987 Corps of Engineers delineation manual for making wetland determinations on non-agricultural lands and to use procedures in the National

Food Security Act manual for making wetland determinations on agricultural lands. For the first time, there was uniformity among the various agencies.

A third issue is private property rights. Many landowners see restriction on wetlands use as an infringement of their rights and a threat to property values and farm or ranch productivity. Over the last few years, landowners and members of Congress have challenged what they consider the "taking" of private land through wetland (and other environmental) protection policies without just compensation. They believe that they are losing the right to use and develop their land, and they do not want to be burdened by having to pay taxes on land from which they derive no income. A fourth issue is the landowner frustration with basic culture changes. First was the reversal of public policy — from wetlands drainage to wetlands protection. Secondly, the 1985 Food Security Act took NRCS from a purely voluntary-program relationship with agricultural producers and landowners to a regulatory one. The effect of these culture changes is clear when you compare the agricultural community's frustration with the wetlands provisions to their overall approval of the 1985 Food Security Act's requirements for protecting highly erodible land — requirements similar to those for wetlands protection. That general approval for erosion-control provisions was the result of more than 60 years of public-private partnerships (led by NRCS and local conservation districts) in technical and financial assistance as well as research and education to combat soil erosion by wind and water.

Incentives and partnerships

The economic disincentives to wetland conversion — including swampbuster and tax reforms affecting capital gains from land conversion — have been effective deterrents to wetlands degradation. But their effectivness waned, and the attractiveness of incentive programs heightened, as we faced property rights challenges, reductions in federal spending, and, in the FAIR Act of 1996, a phase-out of commodity program payments over the next several years (Wiebe, *et al.*, 1995).

One of USDA's first experiments with wetlands incentive programs was the Water Bank Program, which was offered in 10 states that have major migratory waterfowl flyways and are identified as high-priority areas in the U.S. Department of the Interior's North American Waterfowl Management Plan. This program was authorized in 1972. Participants agreed to protect and maintain wetlands and establish permanent nesting cover on adjacent uplands for a 10-year period in exchange for annual rental payments and cost-share assistance to establish the cover. Budget constraints, however, are forcing us to retire the program.

USDA's Wetlands Reserve Program (WRP), first authorized in the 1990 FACTA, is for restoration as well as preservation and improvement of wetlands. The program was based on the idea of having participants agree to sell easements on the enrolled wetland and carry out a wetlands restoration plan. In return, they receive payment for the easement and NRCS funding of the wetland restoration cost. When the WRP was authorized, few thought that the federal government would be able to sell the idea of easements to private landowners, but large acreages were enrolled. Congress has authorized a maximum enrolment of 975 000 acres over the life of the program. So far, 325 000 acres have been enrolled, and we have had a growing list of applicants. Our progress, however, has been limited by yearly dollar appropriations or acreage caps — partly because of federal budget constraints and partly because of fear that land going into perpetual easement arrangements with the federal government might hinder market flexibility and harm the rural tax base (Soil and Water Conservation Society, 1995). This fear led the Congress to insert in the FAIR Act of 1996 a limit on the acreage enrolled in permanent easements. The WRP proves the importance of more than just financial incentives and technical assistance. It also proves the importance of partnerships, bringing agencies and landowners together for a common goal.

A good example is the effort in Duffy's Marsh, in south-central Wisconsin — 2 000 acres of former wet meadow that has a network of drainage ditches, pipes, check dams, and water control structures that were deteriorating as the 12 landowners in the area neared retirement. NRCS and the U.S. Fish and Wildlife Service have formed a partnership to return Duffy's Marsh to its natural state. NRCS has set aside $1.5 million dollars to fund the WRP easement program. The Fish and Wildlife Service negotiated with each landowner to purchase residual fee interest in the property. The plan is to have the restored marsh open to the public. The incentive program and partnership have worked quickly and we expect restoration to begin this year — only 12 months after the agencies first approached landowners with the idea.

The Wetlands Reserve also adapted to emergency use in 1993, following the worst flooding in recorded history in the American Midwest. The Emergency Wetlands Reserve covered some 100 000 acres in 7 states, enhancing the environment, increasing the water-holding capacity of floodplains, and giving midwestern landowners an opportunity to recoup some of their losses from the disastrous floods.

In Louisa County, Iowa, just upstream of the confluence of the Iowa and Mississippi Rivers, the Emergency Wetlands Reserve Program helped bring together a partnership to restore a 3 000 acre flood plain after the levee system was heavily damaged by the Midwest flood of 1993. Having suffered the fourteenth levee break in 60 years, farmers in the area overwhelmingly opted for the Emergency Wetlands Reserve. Out of this interest grew a partnership of many agencies and interest groups: NRCS, the Fish and Wildlife Service, the Federal Emergency Management Agency, the Iowa Department of Natural Resources, the Iowa Natural Heritage Foundation (a non-governmental organization), the Fish and Wildlife Foundation, Pheasants Forever, conservation districts, and levee districts. This partnership provided the to buy the land and turn it into part of the Mark Twain National Wildlife Refuge. Baseline studies show that the area is now heavily used by common migratory waterfowl and tropical migratory birds.

Measuring success

We have in the United States at the moment, a reasonably accurate picture of broad national trends in wetlands condition. NRCS's National Resources Inventory and the Fish and Wildlife Service's National Wetlands Inventory agree in overall conclusions, if not actual numbers, that the rate of agricultural wetlands loss is declining. But we have much work to do to establish a consistent monitoring program and database showing where wetlands are located; their type, function, and value; changes occurring over time; and the success of enhancement, restoration, and creation efforts.

Success monitoring is a new area for science. Accurate assessment of wetlands requires a thorough understanding of how wetlands work and just what it is that we are trying to assess. This means expanding our knowledge of wetland functions, wetland values, and wetland health. NRCS's Wetlands Institute is working with other federal agencies and the private sector to develop regionally based techniques for wetland functional assessment using the hydrogeomorphic (HGM) approach (Brinson, 1995). This technique is based on recognition of hydrologic and geomorphic characteristics of different types of wetland ecosystems and the use of reference systems as the basis for scaling functional attributes of wetlands. HGM gives us the tools to make objective and relatively quick assessments and can be used to determine minimal effect, mitigation ratios, and project planning targets. It is a process that requires good professional judgement and interdisciplinary effort in selecting reference wetlands. Employees in NRCS, the Army Corps of Engineers, the Fish and Wildlife Service, and the Environmental

Protection Agency are being trained in HGM and are excited about having a technique that is regionally sensitive.

Given that policy decisions are often value driven and may or may not take science into account, we also are working on techniques to estimate the economic values of wetlands. In this effort, as with making policy, a strong common denominator must be an accurate portrayal of wetland functions. Understanding wetland health— the overall condition of the resource — has involved us in the development of monitoring protocols using biological indicators. Our initial effort involves protocols for restored wetlands in the mid-Atlantic region of the United States. We expect to adapt these protocols to other regions of the country.

Computer modelling and geographic information systems are important tools as we move to decision support systems and to monitoring real-time events and measuring outcomes of our programs, policies, and conservation practices at the local as well as the national level. This requires that we invest in data digitizing and other technologies. Investment in training is essential also. We have found that the consistency and accuracy of our wetlands decisions — and thus our credibility with the public — hinge on consistent training across agency lines.

3. Vision for the future

We have made great strides in the conservation and enhancement of agricultural wetlands, especially over the last decade; and, with the help of the Wetlands Reserve Program, we expect that the United States soon will be seeing a net increase in wetlands on the agricultural landscape. This vision for the future comes from working with farmers and ranchers who have become excited about seeing their wetlands as natural filters, as natural flood control, as sources of soil moisture in times of drought, as harbors of biological diversity, and as beautiful landscapes as well as alternate sources of income. This vision also comes from seeing the American public willing to share the cost of setting aside wetlands for the health of the land and for future generations.

4. Important lessons

In working toward our vision, we have learned several lessons.

- **Base value decisions and policies on good science** — an accurate baseline of resource functions, value, and health. Science needs to help the agricultural sector establish clear environmental objectives and priorities at the local and regional levels. Science also needs to help farmers and ranchers use their natural resources in a sustainable way. To that end, biologists and ecologists, engineers, agronomists, hydrologists, soil scientists, and others, need to be talking across disciplinary lines. This includes the social sciences, which explain human behavior and why producers make the kinds of land-use decisions they do. NRCS is bringing various disciplines together to look at wetlands health and water quality and how they relate to such phenomena as soil quality. We are focusing on conservation planning for all resources on a farm or ranch — and, beyond that, to how a farm or ranch fits into the natural systems of the watershed and provides us with more than food and fiber. Our objective in NRCS is not that the landowner makes a “yes” decision, say about wetlands, but that he or she makes an informed decision. One of the challenges the scientific community faces is to help farmers, and others, understand the value of different kinds of wetlands, some of which are currently looked on as small “nuisance” wetlands, but which in reality are essential to the habitat diversity and water quality role of wetlands. Other challenges

include the development of a common federal manual for wetland definition and delineation and the development of tools to help us measure outcomes of our program activities.

- **Coordinate resource-protection programs and resource data gathering** across agency lines and target resources to where they are most needed.

- **Use regulatory programs sparingly and carefully.** Ensure that they are efficient, fair, flexible, and predictable and administered in a manner that avoids unnecessary impacts on private property and the regulated public. Avoid duplication among regulator agencies and ensure that the public has a clear understanding of regulatory requirements and various agency roles

- **Promote conservation policies and programs that are voluntary and incentive-based** and that stress partnerships and local involvement. Design conservation programs locally, because what applies to one state or region does not necessarily apply to another. Realize that partnering is essential because no one organization has all of the resources to do the entire job alone. Partnering and using flexible, more efficient programs are principles that underlie the FAIR Act of 1996. The FAIR Act establishes conservation priority areas where significant water, soil, and related natural resource problems exist, in cooperation with state and federal agencies and with state technical advisory committees that represent a broad range of interests. It gives higher priority to areas where state or local governments offer financial or technical assistance, or where agricultural improvements will help meet water quality objectives. And it consolidates several conservation programs that evolved piecemeal over time, thus increasing efficiency and ensuring that public dollars go to serving landowners, not to running a separate bureaucracy for each program.

- **Involve all stakeholders** at the community and watershed levels. People do not want government doing things to them; they want government doing things *with* them.

- Last, and most important of all, understand that no nation will have lasting conservation on private lands until landowners are excited about the land and understand that environmentally sound land use is not a limit on personal freedom but rather a positive exercise of skill and insight born out of a warm and personal understanding of our relationship to the land.

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AUSTRALIA: POLICY APPROACH FOR MANAGING ENVIRONMENTAL BENEFITS AND COSTS OF A SUSTAINABLE AGRICULTURE

by
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1. Policy perspectives

Environmental benefits and costs from sustainable agriculture: guiding principles

In Australia, as in many countries around the world, public policy approaches towards environmental benefits and costs from sustainable agriculture are constantly evolving. Nonetheless, the general approach of Australian governments towards these environmental benefits and costs is guided by the following general principles:

- The terms "environment" and "environmental" are defined to include the biophysical and ecological environments, but to exclude social and economic aspects. The biophysical and ecological environments may or may not have been subject to varying levels of anthropogenic change.

- Agricultural activities have both beneficial and harmful effects on the environment; these beneficial and harmful environmental effects should be considered in the same policy context.

- Property ownership bestows both rights and obligations upon the property owner.

- Both incentives and disincentives, as well as the provision and dissemination of information, may be utilised in policy measures to ensure agri-environmental attributes are maintained or improved to meet adequacy standards established by the community.

- The decision as to whether policy measures should be based on incentives or disincentives depends in part on the prevailing perception and/or legal definition of the rights and obligations that land ownership bestows.

- Policies should treat "property rights" in a consistent manner, e.g. if financial incentives are to be provided to landowners to undertake actions beneficial to the environment, then landowners should be required to pay compensation for any harmful off-farm impacts resulting from their activities.

- If any existing agricultural policy measures are having detrimental effects on the supply of agri-environmental attributes, these measures should be reformed, where possible, to enhance the desired supply of agri-environmental attributes, before any new measures are introduced.

- Policy measures should directly address the causes of any perceived inadequacy of supply of an agri-environmental attribute, i.e. measures should address the underlying market failure (or policy failure) that is causing the inadequacy of supply.

- Policy measures should not be linked to the volume or type of agricultural production, nor to any of the production inputs that could affect the type or volume of production, i.e. measures should be as minimally production (and hence trade) distorting as possible.

- Any policy measures that are implemented should be available to any landowner able to contribute to an improvement in the level or quality of an environmental attribute, i.e. incentives and disincentives should not be restricted to farmers.

- Policy measures should be transparent.

- Policy measures should have clear objectives, i.e. the desired quantity and quality of the attribute being promoted should be defined precisely.

- Policy measures should contain measurable performance indicators which are regularly evaluated for effectiveness.

- The policy measure selected should be the most cost effective means of achieving the desired level of attribute provision.

Environmental benefits and costs from agriculture

Definitions

In the Australian context, the term "agri-environmental attributes" is used to describe the environmental attributes, both on-farm and off-farm, associated with agricultural activities. Agricultural activities can have both beneficial and harmful effects on the levels and quality of agri-environmental attributes. The terms "environment" and "environmental" are defined to include the biophysical and ecological environments, but to exclude social and economic aspects. The biophysical and ecological environments may or may not have been subject to varying levels of anthropogenic change. "Social" attributes, such as provision of landscape amenities, which are culturally based, rather than biophysically or ecologically based, are therefore not considered to be agri-environmental attributes.

Agri-environmental attributes — at the individual level

Perceptions of benefits and costs resulting from agricultural activities are very subjective. Indeed, what may appear to be a benefit to one party can appear as a cost to another. For example, an area of remnant native vegetation or a wetland on a landowner's property, that provides valuable habitat, may be perceived as a benefit to someone who places a high value on biodiversity, whereas to the landowner it may be viewed as land that would be more profitably used directly for production, e.g. cropping. It all depends on the viewpoints of the parties concerned. Such opposing perspectives can apply to a wide range of agri-environmental attributes. There is thus scope for significantly different views between individuals over such matters, notwithstanding the existence of, or the potential for, widespread commonality of views, particularly if landowners, and the wider community, are well informed about agri-environmental matters.

It follows that the outcome of any conflict between opposing perceptions of benefits and costs will depend significantly on the rights associated with land ownership. If society bestows on landowners the absolute right to do with their land as they choose, the outcome of any conflict will presumably tend

towards the landowner's perspective, i.e. in the above example, the area of remnant native vegetation or wetland would presumably be cleared or drained to make way for production.

In practice however, property "rights" are rarely so absolutely defined. In Australia, many local governments have introduced land zoning and State governments enforce restrictions over toxic chemical use. Some State governments have placed regulatory controls on the clearing of native vegetation (without compensation to landowners) in response to a perceived community demand for a lower level of agri-environmental costs associated with certain agricultural activities. Land ownership therefore bestows both "rights" and "duties" on landowners; these collective rights and duties associated with land ownership are termed the "property rights regime".

Agri-environmental attributes - at the country level

It follows that just as individuals may have differing perceptions as to what constitutes an environmental benefit and what constitutes an environmental harm, so too may countries. Different countries can therefore be expected to have differing preferred levels of provision of various agri-environmental attributes. Factors such as the existing level of such attributes, per capita incomes, and community awareness, tastes and values, will all be sources of differences in perceptions between countries. Such perceptions can and inevitably will change over time, i.e. perceptions of benefits and costs are also dynamic.

Countries will also have differing property right regimes. Views on property right regimes may range from a Hobbsian type stance (which places greater emphasis on society's rights) to a Lockian type stance (which places greater emphasis on the rights of the individual). It follows therefore that there will be differences between countries in the appropriate (most efficient) policy approaches to seeking preferred levels of agri-environmental attributes. Given the varying perceptions, and the complex and subjective social and political judgements involved, it would seem appropriate that policy responses be largely a matter for individual countries to select, subject to the constraints of any international obligations that they have undertaken, e.g. WTO rules, the Convention on Biological Diversity, Agenda 21. Nonetheless, there is potential for countries to learn and benefit from the experience of other countries and there would appear to be ample scope for constructing some universal guidelines for policy approaches to the provision of agri-environmental attributes.

Policy measures to address an inadequate supply of certain agri-environmental attributes

Some general considerations

In Australia, decisions about the use of agricultural resources are made largely by private individuals acting on the basis of information and incentives provided through markets within an established institutional framework. This institutional framework includes a strong, but not absolute, recognition of (and entitlement to) landowner "rights".

Underlying the general policy approach towards agri-environmental attributes is a commitment to market based outcomes except in circumstances where market failure[26] is seen to exist. Consistent with this approach, Australian governments will only intervene to provide policy measures if it is determined that there is an agri-environmental attribute that currently is not being provided at the community's desired level of provision. Such a situation will presumably arise because landowners do not have sufficient

[26] Market failure in this context describes the presence of externalities and/or underprovision of public goods.

incentives/disincentives and/or knowledge and/or practical means to adequately supply such attributes) i.e. a case of market failure concerning the provision of agri-environmental attributes can be identified clearly.

The introduction of new policy measures is generally regarded as unjustified if the inadequate provision of an agri-environmental attribute is the result of any existing agricultural policy measures which may be distorting landowner incentives to maintaining or providing agri-environmental attributes (e.g. policies such as production-linked support). In these instances, the underlying cause of the inadequate supply, i.e. the "policy failure", should be rectified as a first step before any new measures are introduced.

In cases where market failure is identified, efficiency and equity considerations suggest that if incentive measures are to be provided to landowners, the measures introduced should: have clear objectives, (i.e. the desired quantity and quality of the attribute being promoted should be precisely defined); be transparent; have measurable performance indicators which are regularly evaluated for effectiveness; and be as minimally production distorting as possible. Cost effectiveness should dictate that measures are only introduced if the benefits of intervention will outweigh the costs.

When incentive measures are being designed, it should be taken into account that landowners themselves will often directly receive benefits from maintaining agri-environmental attributes and therefore may have significant existing incentives (in many instances there will be sufficient existing incentives) to provide or maintain these agri-environmental attributes. It is reasonable to assume that many landowners will have some sense of stewardship towards the sustainability of the natural resources necessary to maintain the viability of their farm operations. In regard to habitat provision for example, maintaining pockets of non-agricultural vegetation such as hedgerows or wooded areas may provide windbreaks for farm animals and crops, help to protect soils, and control salinity on land or in waterways.

Policy measures may take the form of incentives (such as payments for agri-environmental services), disincentives (such as taxes or regulatory controls on landowner activities) or measures to raise landowner awareness. The appropriate approach will depend on the circumstances prevailing in the country/region/farm. The answer to the question of who should "pay" for the provision of agri-environmental attributes depends in part on the characteristics of the prevailing property right regime.

As a general premise, no matter how property regimes are defined, consistency and equity should demand that there be no double standards employed in their application. If landowners are to be provided with payments (incentives or compensation) for providing agri-environmental attributes, (i.e. because it is judged that land ownership bestows a relatively high degree of property "rights") then landowners should also be required to compensate the community for the adverse off-farm effects of their production activities. In other words, off-farm property "rights" should be equally strictly enforced and landowners should have no special rights to inflict damage on the broader community's property.

Policy measures which distort landowners' production decisions

There are compelling reasons why any incentives to landowners should be provided in such a way as to be as minimally production distorting as possible, (i.e. provided in a way that is, as far as possible, unrelated to the type or volume of production and unrelated to the use of inputs to production that may affect the type or volume of production). In fact, agricultural production should not be a prerequisite for receipt of incentive measures. In the interests of equity and efficiency, any incentive

measures should be made available (or, in the case of disincentives, applied) to any landowner able to maintain or improve the levels and/or quality of an agri-environmental attribute.

Reasons why incentive measures should be as minimally production distorting as possible include:

- **Cost Effectiveness.** Agri-environmental policy measures which are linked to the type or volume of production are extremely unlikely to be the most cost effective means of delivering desired levels of environmental attributes because: agricultural production activities are, more often than not, the direct cause of environmental harm as well as benefits, i.e. if policy measures are production linked, any resulting increase in provision of environmental benefits will come not only at a financial cost but also a likely additional cost in terms of increased environmental harm, i.e. any environmental benefits attained will, potentially, be offset at least partially by increased environmental harm. However, policy is generally most efficient when it directly addresses the reasons for the intervention.

- **International Trade Obligations.** Production distorting measures will, by necessity, also distort trade (by crowding out imports and potentially spilling any induced excess production onto export markets) and thus act against the spirit of the Uruguay Round outcomes, if not directly contravene them.

- **Effects on Developing Countries.** Production linked measures, through their effects on world markets, will have impacts in other countries. In particular, production linked measures will frustrate the development efforts of those developing countries with economies dominated by agriculture. One of the biggest (if not the biggest) source of support that developed countries can provide to developing countries is to guarantee open markets for their exports[27] and, since many developing country economies are dominated by agriculture, agricultural commodities will often constitute their main export items. Production linked measures in OECD countries, by increasing or maintaining their agricultural output above "free market" levels, will reduce market opportunities for developing country agricultural producers. Such measures will thus slow the integration of these countries into the world economy and undermine their legitimate growth aspirations.

These adverse effects on developing countries' economic performance will, all other things being equal, lower the availability of resources in developing countries for addressing their own environmental problems. In other words, if agri-environmental benefits in OECD countries are pursued via production linked measures, any agri-environmental benefits derived in OECD countries may be offset by poorer agri-environmental outcomes in developing countries. The net effect on global agri-environmental outcomes will not necessarily be positive. It is worth noting that over the period 1970 to 1992 the share of world exports of food commodities held by developing countries fell from 34 per cent to 28 per cent. Over the same period, the share held by developed market economies rose from 58 per cent to 70 per cent[28].

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[27] Sachs and Warner (1996).

[28] UNCTAD (1995).

Types of policy measures

If it is determined that there is a valid case for introducing policy measures to address an inadequate provision of agri-environmental attributes, the question arises as to how such measures should be provided. The following section addresses this question and examines several policy measures.

Research and development activities, voluntary co-operative approaches

If it is judged that a certain attribute is inadequately supplied from the viewpoints of both landowners and the wider community (e.g. unpolluted waterways) then policy measures are best directed at the underlying reason why landowners are undersupplying (or, in the case of off-farm attributes, causing the undersupply of), an attribute they themselves desire more of. The answer will very often lie in either insufficient knowledge or a lack of practical means on the part of the landowner. For example, the landowner may unwittingly, because of inadequate knowledge of sustainable agricultural practices, be causing harmful effects on habitat or ecological function attributes. Alternatively, if the inadequate supply is being caused by the combined actions of several landowners (e.g. soil erosion or pesticide use leading to detrimental effects on a valuable aquatic habitat), the individual landowner, acting in isolation, may not have the capacity to address the problem.

In such cases it is worth exploring the potential for measures such as research and development activities and voluntary co-operative approaches (including education and awareness raising activities) to address the underlying cause of the inadequacy of supply of an agri-environmental attribute. Such measures have the advantage of being minimally production distorting. Some details on such measures can be found in Section 2 of this paper, which examines the Australian approach to the provision of agri-environmental attributes.

Direct income payments

If there is a conflict of views between landowners and the wider community as to whether an attribute is undersupplied or oversupplied, a second approach is the provision of direct income payments to landowners who provide (or agree to maintain) certain desired levels of particular agri-environmental attributes. However it is virtually impossible to provide incentives via direct income payments without distorting production decisions and thus distorting international trade. Direct income payments lead to higher farm incomes which can affect landowners' production decisions and productive capacity, for example by making the recipient landowner more credit-worthy and therefore better able to access finance. Therefore considerable care should go into the design of such measures; for example they should be tightly targeted.

Price linked support, production subsidies, input subsidies.

Measures such as price linked support, production subsidies and input subsidies all distort farmers' production decisions. It is difficult to find any justification for such measures in agri-environmental policies. Indeed, the reform of any existing measures of these types is likely, in most cases, to improve the supply of agri-environmental attributes.

Disincentive measures

It is possible to specify reference levels (adequacy standards) of environmental quality associated with certain agri-environmental attributes. These reference levels will be positioned by the social/political judgement of what responsibilities and duties are associated with land ownership. In instances where landowners fail to achieve or maintain such reference levels, disincentive measures such as regulations and taxes may represent the appropriate policy response. In these circumstances, the Polluter-Pays-Principle, with its focus on internalising negative externalities, provides a particularly useful approach for policy makers, assuming that the "polluter" can be identified (in accordance with the prevailing property regime). The user pays principle provides another particularly useful policy approach in instances where publicly owned resources are used by landowners.

2. The Australian approach

Introduction

In Australia, decisions about the use of agricultural resources are made largely by private individuals acting on the basis of information and incentives provided through markets within an established institutional framework. This institutional framework includes a strong, but not absolute, recognition of (and entitlement to) landowner "rights". These "rights" can and have at various times been restricted by Australian governments at Commonwealth (federal), state/territory and local levels through application of their direct and delegated powers. The Australian Constitution provides for the division of responsibilities and powers between the Commonwealth and State governments, while local governments can be granted delegated powers. Public policy towards resource management is primarily the responsibility of state/territory governments, although the Commonwealth government maintains influence by way of its considerable resources, linked for example to its ability to collect taxes on income.

Australian policies recognise that private (landowner) and community interests do not always coincide and that there is a role for policy makers to address the market failures that underlie such divergence. These market failures largely take the form of underprovision of public goods and the presence of negative externalities arising from agricultural production activities.

Agri-environmental policies are directed towards remedying the inadequate provision of attributes such as ecological functions and habitat provision. In the main, the Australian approach seeks to capitalise on the widespread coincidence of private (landowner) valuation of agri-environmental attributes and social (community) valuation of agri-environmental attributes. Policies seek to address the reasons why landowners are inadequately supplying (or in the case of off-farm attributes, contributing to the inadequacy of supply) of attributes that they themselves desire more of. Voluntary co-operative approaches, research and development activities, and provision of education and training (awareness raising) can often provide the most appropriate policy measures in these circumstances, as they have the potential to address the root causes of problems.

The following measures are used in Australia:

- establishing effective pricing and property rights systems that encourage resource users to take into account all economic and environmental costs and benefits and which, therefore, encourage the best long term use of natural resources;

- in instances where markets do not operate effectively, establishing regulatory systems necessary for the enhancement of environmental quality;

- providing information and promoting the skills that resource owners and managers need to make appropriate decisions;

- supporting research and development to improve information, technology and management practices relevant to natural resource management;

- supporting activities such as the preparation of catchment and regional plans that are required to address large scale resource management concerns.

A key aspect of the general policy approach is that government activity is directed towards providing public benefits, with private landowners being encouraged to accept responsibility for funding natural resource management activities on their own land which primarily provide private benefits. Concessional taxation deductions are available to primary producers and rural landowners in recognition of the fact that investments in preventing and treating land degradation and in managing water resources are a legitimate cost involved in operating a business on rural land.

Rationale for government involvement

Underprovision of public goods

The Australian approach recognises that information on sustainable agricultural practices may not always be adequately provided by the free operation of markets and, even if such information is available, landowners may not have access to it or may not adopt it into their practices. Australian governments have introduced policies directed at enhancing the supply of such information (research and development activities) and disseminating such information (for example through education, such as property management planning courses and voluntary co-operative approaches such as the National Landcare Program[29]), in order to raise landowner awareness. These measures, which address market failure in the form of the underprovision of public goods, do not distort market signals to producers. They are persuasive instruments rather than economic instruments and they address the causes of inadequate provision of certain agri-environmental attributes rather than the symptoms.

Presence of negative externalities

Another source of market failure in Australian agriculture is the presence of negative externalities, i.e. adverse off-farm impacts of agricultural activities which are not fully borne and taken into account by the landowner generating them (e.g. polluted surface water or groundwater resulting from inappropriate land use or the use of agricultural chemicals). The National Landcare Program supports the implementation of broader policy initiatives and provides assistance for broad scale activities such as catchment management, to address the causes of large scale negative externalities such as salinisation and polluted waterways. Landcare activities can involve co-operation between farmers, local communities, industry and governments. In general, such activities are funded by the parties involved, in proportion to the expected benefits each party will attain.

[29] Refer to OECD "Co-operative approaches to sustainable agriculture" [COM/AGR/CA/ENV/EPOC(96)131].

Australia also adopts a disincentive approach to address negative externalities in some circumstances. For example, many State Governments have introduced regulatory restrictions on the clearing of native vegetation, with no compensation paid to landowners. The Commonwealth Government has also introduced restrictions on the availability of certain agricultural chemicals, in recognition of the harmful ecological and health implications (i.e. negative externalities) associated with their use.

Australia's policies and programs in detail

The overall policy framework for the approach of Australian Governments has a number of elements:

- The Decade of Landcare Plan, agreed to by the Commonwealth and all State and Territory governments, provides a long term national policy approach to bring about environmentally sustainable and economically viable land management.

- A policy framework agreed to by the Commonwealth and all State and Territory Governments through the Council of Australian Governments (COAG) provides for a national approach to institutional and microeconomic reforms to encourage ecologically sustainable and economically viable management of water resources.

- Consistent with the Decade of Landcare Plan and the COAG water management policy, the National Landcare Program, administered by the Commonwealth Government, provides financial support to the States and Territories and to community groups for natural resource management and environmental conservation activities that primarily provide public benefits.

- The Murray-Darling Basin Initiative provides for a joint approach by Commonwealth and State governments for natural resource management in the Murray-Darling Basin. This basin, which covers one-seventh of Australia's land mass and encompasses a number of States, produces a significant proportion of Australia's agricultural production and includes much of Australia's irrigation agriculture.

Decade of Landcare Plan

The Decade of Landcare Plan has been in place since 1991. The Plan identifies the roles and responsibilities for private landowners/landusers and for governments. It identifies objectives to be achieved, specifies priorities and outlines the actions to be implemented. The ten-year lifespan of the program is in keeping with the longer term nature of natural resource management problems. The States and Territories have the main operational role for implementing the Plan. Local governments also have an important role in terms of utilising their ability to facilitate community action and influence land use activities.

The primary objective of the Decade of Landcare Plan is to prevent resource degradation from occurring in the future, rather than attempting to repair degradation that has already occurred. The Plan therefore places an emphasis on addressing the underlying causes of degradation rather than the symptoms, and emphasizes that individual landowners are responsible for implementing the changes required for the ecologically sustainable management of their own resources.

Under the Decade of Landcare Plan, the priority action for governments is to assist landowners to acquire the information and skills they require to manage their resources in a sustainable manner. This includes encouraging research and development. The goals for the Plan are to:

- Have all public and private land users understanding and adopting the principles and practices of sustainable natural resource management.

- Have effective and appropriate economic, legislative and policy mechanisms in place to facilitate the achievement of sustainable natural resource management.

- Promote research, development and information exchange relating to the principles and practices of sustainable natural resource management.

- Have the whole community aware of the problem of the degradation of soil, water and biological resources and the economic, social and other costs and benefits of sustainable natural resource management.

- Have all Australians working together in partnership for sustainable natural resource management.

The Commonwealth's Government's role under the Decade of Landcare Plan is to provide national leadership and co-ordination in combating land degradation. It pursues this by taking the following responsibilities:

- Setting the overall economic and social framework within which sustainable land management can be realised.

- Ensuring clear and complementary roles for the various spheres of government (Commonwealth, State, Territory and Local), individuals and the community.

- Involving the community and industry in planning and implementing landcare activities.

- Establishing, in partnership with the State governments, national priorities for sustainable land management and contributing resources as appropriate.

Water reform policy

The COAG water reform policy agreed to by the Commonwealth and all the State and Territory governments has been in place since 1994. It addresses issues and problems involving water management and the related natural resource base. These include widespread natural resource degradation which has had an impact on the quality and quantity of Australia's water resources. The policy identifies a number of features of water resource management as being underlying causes of inefficient resource use and environmental degradation. These features include inappropriate pricing policies, impediments to the transfer of irrigation water from relatively low value uses (such as broadacre production) to higher value uses (such as horticulture and dairying), inefficient service delivery and poorly defined roles and responsibilities for a number of institutions involved in water resource management.

To respond to these inadequacies, the policy reforms require that, as far as practicable, the beneficiaries and impactors pay the full costs of their use of water and water services, and that future investment in the water industry be governed by the twin tests of economic viability and ecological

sustainability. The reforms also provide for greater recourse to trading in water entitlements to secure increased economic value from water use while recognising the environment as a legitimate user of water, and more clearly focused and better defined roles for relevant institutions or agencies. They also envisage that community consultation will continue to be undertaken on a wide scale, as jurisdictions seek to effect reform involving the water industry. Because the changes flowing from the reforms are extensive and have far reaching consequences, a five to eight year implementation period has been set. The overall target for implementation is 2001. Implementation at the 'on ground' level is encouraged and supported by the National Landcare Program.

The National Landcare Program

The National Landcare Program (NLP) is administered by the Commonwealth Government. It has been in place since 1992, when it replaced separate programs that provided support to the State and Territory Governments for land conservation and water resource management. The NLP promotes an approach which brings together sustainable natural resource management and nature conservation to encourage integrated arrangements for land, water and vegetation resources. NLP funding to State and Territory Governments is provided through Commonwealth/State partnership agreements. These agreements identify joint priorities and objectives and set out the strategies and activities to be funded, the outcomes to be achieved and the timetables and milestones for implementation. The agreements provide the framework for the overall administration of the NLP by each State.

The principle natural resource management policy framework for the NLP is provided by the Decade of Landcare Plan and the COAG water reform policies. The Decade of Landcare Plan was reviewed in 1995, with the result that the focus of the plan has widened from sustainable land management to sustainable natural resource management. The Plan will now also emphasize implementation of landcare action, in addition to its existing focus on awareness raising, information transfer and skill development.

A key focus of the NLP is implementing co-ordinated projects and activities that address natural resource management concerns on a catchment and regional basis. Australia's experience has been that land, water and vegetation are most effectively managed in an integrated manner that co-ordinates the efforts of public and private resource owners and users. Consistent with the national Ecologically Sustainable Development principles, the objective of the NLP is to enhance the efficient, sustainable and equitable management of the nation's natural resources for the benefit of the overall community by: i) enhancing the long term productivity of Australia's natural resources; ii) promoting community, industry and government partnerships in the management of natural resources; iii) establishing institutional arrangements which encourage sustainable resource use; and iv) developing approaches to help resolve conflict over access to resources.

The natural resource management element of the NLP has three components: the community component, the community support component, and the national component. The community component aims to encourage community groups and through them, individual landowners to identify and solve the soil, water, vegetation management and nature conservation problems that they share. Grants assist groups with planning, education and training, resource inventory activities such as surveying and mapping, on-ground actions, trials and demonstrations, monitoring resource condition and project support.

The community support component provides funding for State/Territory government agencies, local governments, non-government organisations and industry and community organisations to achieve sustainable management of natural resources. Support is provided in accordance with the priorities and

objectives set out in the Commonwealth/State partnership agreements. Support is provided for landcare groups, education and training, property management planning, natural resource information, catchment management, country towns' water management, floodplain management and for regional projects. Well targeted, integrated actions at the regional level are being increasingly used as the NLP evolves. These actions are seen as the next significant step towards more sustainable management of Australia's environment and natural resources. It seems possible that eventually the majority of NLP funds, will be delivered through the regional mechanisms.

The national component focuses on issues which the Commonwealth Government can address in its own right to advance sustainable management of natural resources. This component provides funds for projects where additional effort is required to achieve national priorities such as encouraging better wastewater management or involving local government in landcare activities. This component also provides funding to employ the national landcare facilitator. The facilitator works at the national level with the aim of assisting community, government and industry partners in landcare to communicate effectively with one another in order to progress community landcare and sustainable resource management across Australia.

The Murray-Darling Basin Initiative

The Murray-Darling Basin Initiative (MDBI) was established in 1985 as a partnership between the Commonwealth and the four States that occupy the Murray-Darling Basin (New South Wales, Victoria, South Australia and Queensland). It is administered by the Murray-Darling Basin Commission and is directed towards equitable, efficient and sustainable use of the land, water and other natural resources of the Murray-Darling Basin. Under the MDBI, governments and communities work together to implement natural resource management policies, strategies and programs, which seek to.achieve: i) improvement in, and maintenance of, water quality for all beneficial uses - agricultural, environmental, urban, industrial and recreational; ii) control of existing land degradation, prevention of further land degradation and, where possible, the rehabilitation of land resources to ensure the sustainable utilisation of these resources; and iii) conservation of the natural environment of the Basin and the preservation of sensitive ecosystems. conservation of the natural environment of the Basin and the preservation of sensitive ecosystems.

The MDBI consists of two main programs, the Basin Sustainability Program and the Water Business Program. The Basin Sustainability Program includes:

- The Natural Resources Management Strategy Investigations and Education subprogram, which provides strategic direction and funding to projects aimed at overcoming the knowledge gaps that impede sustainable natural resource management by landowners.

- The Natural Resources Management Strategy Integrated Catchment Management subprogram, which supports community and government partnerships in the development and implementation of regional and issue-based natural resource management plans.

- The Drainage Program — this supports communities and governments in undertaking works aimed at minimising the environmental and production losses associated with land degradation arising from salinity and waterlogging problems associated with agricultural activities.

- The Irrigation Management Strategy — this aims to achieve an economically and environmentally sustainable and self-sufficient irrigation industry in the southern Murray-Darling Basin by 2010.

The Water Business Program consists of:

- the River Management subprogram, which aims to improve management of River Murray waters and protect the physical and biological environment within the Murray-Darling Basin;

- the Flow Regulation subprogram, which aims to ensure that each State's share of River Murray water is supplied in a timely and efficient manner; and

- the River Murray Works subprogram, which aims to protect the investment of the governments in the works administered by the Murray-Darling Basin Commission.

In addition to these measures, the Commonwealth and State governments in the Murray-Darling Basin have agreed that, following a 1995 water resource audit for the Basin that showed that water diversions have significantly affected the environment and water quality, an interim cap on diversions would be introduced immediately. The precise details of longer term arrangements are still being determined.

Evaluating policy performance

A mid-term evaluation of the Decade of Landcare Plan found that there has been progress against all objectives. A key result area in relation to sustainable agriculture is progress towards the goal of improving land owners' awareness and understanding of the principles and practices of sustainable natural resource management and the adoption of such principles and practices into their farm operations.

A comprehensive survey undertaken by the Australian Bureau of Agricultural and Resource Economics (ABARE 1992-93), undertaken as part of the evaluation, indicated that 30 per cent of all broadacre farmers are members of landcare groups. Of those who had not joined a landcare group, 27 per cent indicated that they would join if a group were formed in their area, a further 37 per cent indicated that they had only minor resource management problems, while only three per cent indicated that they were not interested in joining a landcare group.

The ABARE survey indicated that landcare group members were more likely to have incorporated sustainable resource management practices into their farm management program. These practices include conservation tillage (59 per cent of landcare group members compared to 40 per cent of non-landcare group members), tree planting (64 per cent to 38 per cent), regular water quality monitoring (36 per cent to 14 per cent) and excluding stock from areas affected by land degradation (47 per cent to 25 per cent). There is evidence to suggest that sustainable practices are also being adopted more widely in the farming sector generally. While no causality can be drawn from these data, there appears to be an association between landcare group membership and the use of sustainable farming methods and sustainable resource management practices.

A commissioned landcare awareness market research survey undertaken by AGB McNair in 1995 showed that 80 per cent of farmers indicated a greater awareness of natural resource management issues than in a similar survey undertaken in 1989 and further that 43 per cent of farmers are of the view that land owners should be mainly responsible for control of damage to natural resources in the rural environment. The focus of research and development activities in Australia has shifted significantly towards the sustainable management of natural resources. Progress is being made towards communicating the results of research and development to landholders and involving them in research activities.

Considerable new information is already available on sustainable land management practices; a challenge now is to remove impediments to implementation. There are numerous examples of projects which, guided by government policies and strategies and supported by programs referred to in this paper, have resulted in improved environmental outcomes from the adoption of sustainable agricultural practices. Specific examples include: the adoption of sustainable practices in the cotton industry which has resulted in a reduction in water use and a lowering of the amount of nutrients and pesticides entering waterways; improved property management planning in South Australian irrigation areas which has resulted in greater efficiency of water use (up to 20 per cent) and reduction of saline return flows to waterways; and changed land management techniques and farming systems resulting in improved environmental outcomes through salinity control and reduced groundwater accessions. While much has been achieved in the first half of the Decade of Landcare, particularly in the areas of raising awareness, improving the planning skills of farmers and upgrading the information base, the task ahead is still substantial. There remains a need to further improve the sustainable management of land, water, vegetation and other natural resources to ensure the long term viability of the agricultural sector and to maintain biological diversity and essential biophysical processes.

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NEW ZEALAND: THE ENVIRONMENTAL EFFECTS OF REMOVING AGRICULTURAL SUBSIDIES

by
MAF Policy, Wellington

Introduction

Agriculture and its effect on the environment are of considerable importance to New Zealand, given the major role of agriculture in the economy. Of New Zealand's 27 million hectares, 13.6 million hectares (50 per cent) are in agricultural use. For the year ended March 1995, primary agriculture accounted for an estimated 5.2 per cent of Gross Domestic Product, and together with related industries accounted for an estimated 15.4 per cent of GDP. Agricultural products accounted for 51 per cent of New Zealand's merchandise exports[30]. This represents a slight diversification of the economy since 1984, when primary agriculture accounted for 7 per cent of Gross Domestic Product (GDP), and 63 per cent of all merchandise exports.

In the mid-1980s, New Zealand removed a wide range of support measures for agriculture, including minimum prices for wool, beef, sheepmeat, and dairy products; land development loans; fertilizer and irrigation subsidies; and subsidised credit. Central government subsidies for soil conservation, flood control and drainage schemes were also substantially eliminated. The subsidies were removed largely for economic reasons, in conjunction with macroeconomic reforms, as the country could no longer support the burden of subsidies on the public purse. This paper describes the New Zealand reforms and examines their environmental consequences. The macroeconomic context of the reforms is described in detail in an Annex.

1. The reform of New Zealand's agricultural policies

The history of agricultural support measures

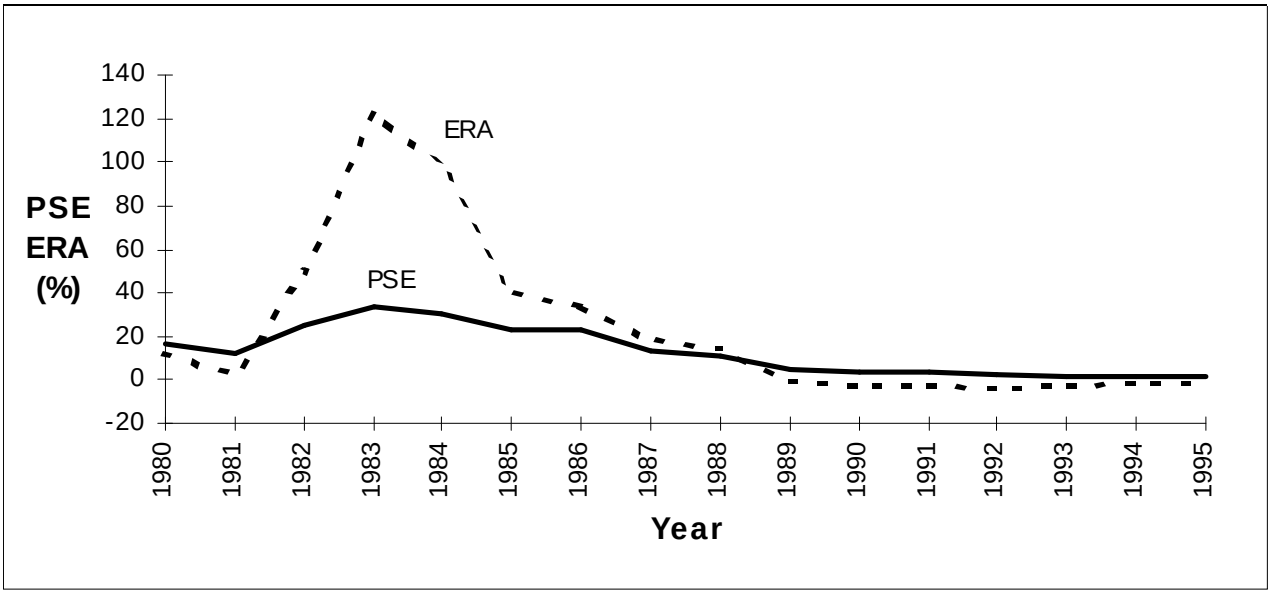
Until the late 1960s there was no significant government support for New Zealand agriculture, but thereafter assistance for farmers grew to parallel that in the rest of the economy. While the Government maintained a fixed and overvalued exchange rate and very high levels of protection for the domestic manufacturing sector, this raised the costs for many of the inputs used by farmers. Largely to compensate farmers for the resulting high input prices and low (in New Zealand dollar terms) output prices, a system of farm subsidies had developed by 1984.

[30] Ministry of Agriculture, 1996. As used in this report, the term "agriculture" includes horticulture, but excludes forestry.

The two decades to 1984 also saw a gradual acceleration in production grants and subsidies. Taxation schemes included incentives for land development and concessionary livestock valuation schemes; fertilizer subsidies continued to increase; and loans at below-market interest rates became increasingly valuable as market rates increased.

Absolute levels of assistance remained low until the 1980s, when a major slump in world commodity prices led to an escalation in the level of support to farmers, much of it in the form of deficiency payments. Over the period from 1980-84 assistance increased substantially. Pastoral assistance peaked in 1983 with a Producer Subsidy Equivalent (PSE) of 34 per cent and an Effective Rate of Assistance of 123 per cent (see Figure 1)[31]. While still moderate by world standards, the support levels were high for New Zealand. There were considerable costs to the taxpayer as well as economic costs arising from revenue and productivity forgone because of the distortionary impact of assistance. The late addition of output assistance seriously aggravated the distortions.

Figure 1. Percentage assistance to New Zealand Pastoral Agriculture[1]



1. Assistance figures are calculated with stabilisation payments spread over the years in which losses actually occurred, and not when settled.

Prior to New Zealand's economic reforms in the mid-1980s, agricultural policy focused on development and largely ignored the need for consistency between economic and environmental policy objectives. Policies on economic development, resource use, and disaster relief gave preference to encouraging short-term economic considerations. These policies encouraged certain farmers to take greater risks with climatic factors by adopting more intensive and less diversified management systems. Although New Zealand had had in place long standing flood protection and water and soil conservation

[31] The percentage PSE is the value of all agricultural assistance measures divided by the sum of the value of agricultural production at local (supported) prices and direct payments from government. The Effective Rate of Assistance (ERA) is the net value of assistance (ie less costs imposed by protection of sectors providing inputs) divided by value of production at world market prices at the border. Because the percentage PSE uses local rather than world market prices in the denominator, it masks the true extent of support, which is more accurately reflected in the ERA.

policies under the 1941 Soil Conservation and Rivers Control Act, and 1967 Water and Soil Conservation Act, the environmental consequences and costs of agricultural development and production received less attention. While soil erosion in particular was seen as a problem, few saw the connection with agricultural support policies. Environmental policies were subordinated to development objectives, and were largely oriented to alleviating the most obvious adverse effects of agricultural development.

Agricultural reforms

In early 1984 the Government announced the ending of output price assistance for agricultural products. Subsequently, fertilizer and other input subsidies were abolished as were investment and land development concessions. In addition, tax concessions for farmers were withdrawn. Free government services for farmers were eliminated. Producer Boards had their access to concessionary Reserve Bank funding withdrawn: they now have no access to taxpayer funds. Starting in 1987, central government subsidies for soil conservation, flood control and drainage schemes were substantially eliminated, although some transfer payments generated at a local authority level continue to contribute to funding.

Changes in the general economy also impacted on agriculture. Farmers expected the floating of the New Zealand dollar in 1985 would lead to devaluation given New Zealand's high inflation. But with a tight monetary policy in place to control inflation, high interest rates attracted money into the country. The New Zealand exchange rate appreciated between 1985 and 1988, lowering returns to farmers in New Zealand dollars and raising the costs of adjustment to the agriculture sector.

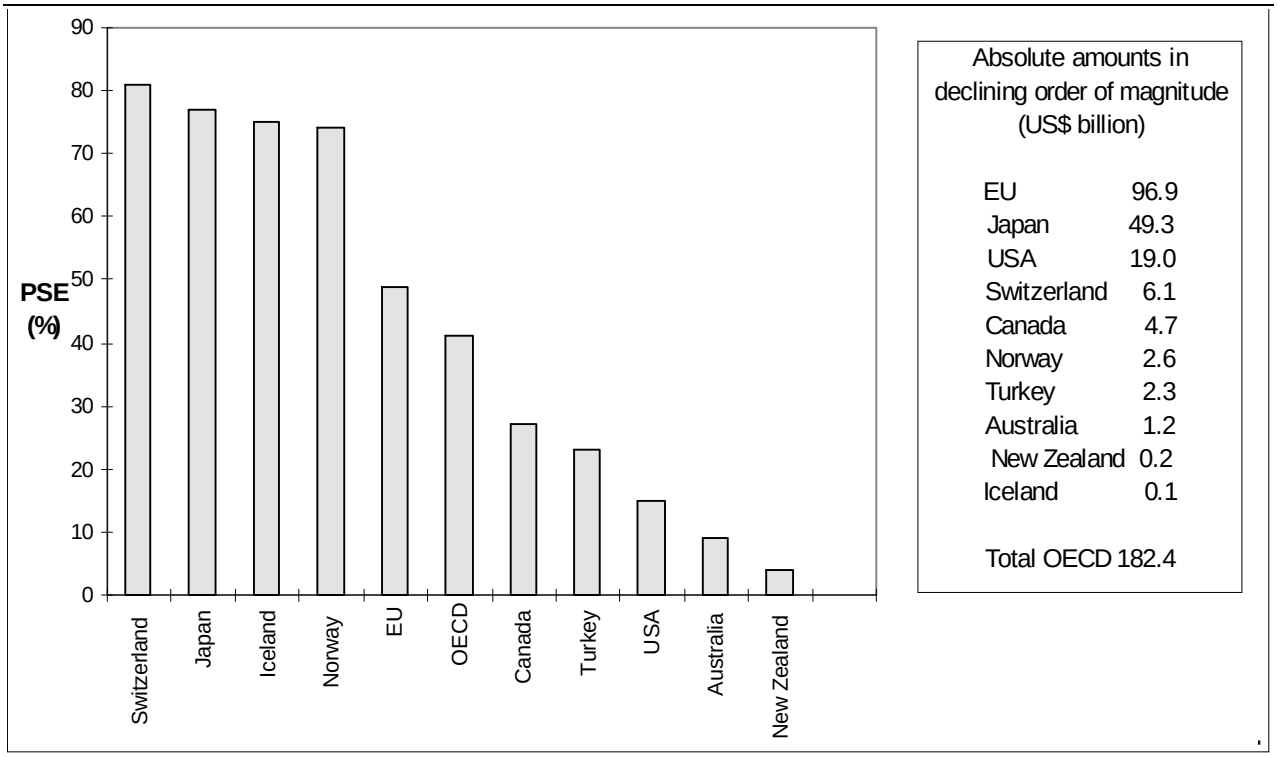
Figure 1 shows assistance to New Zealand pastoral agriculture over the past fifteen years, in terms of Producer Subsidy Equivalents (PSEs). The Figure shows the continuing decline from an average PSE of 24 per cent in 1979-86 to 4 per cent in 1995. The Effective Rate of Assistance (ERA) shows even more clearly the decline in real assistance. The result is that New Zealand farmers are again fully exposed to world market forces. This is in marked contrast to most other developed countries. Figure 2 shows the low level of assistance to New Zealand agriculture compared to other OECD Member countries.

Impact of the reforms on New Zealand agriculture

The withdrawal of farm subsidies was not, initially, popular with all farmers. Nevertheless the main farmers' organisation, Federated Farmers, promoted the broad reform agenda, provided it was implemented throughout the economy and would lower farmers' costs of production. That said, many farmers felt threatened by the changes. This opposition culminated in a peaceful march on Parliament by farmers opposed to the reforms, in early 1986.

The farmers' fears were not groundless. Farm incomes generally declined during the 1980s. But these falls did not result solely from the removal of government support. A brief surge in incomes in 1985 was a result of favourable exchange rate and good climatic conditions. Then, from late 1985 to 1988, farm incomes fell due to a combination of the New Zealand dollar's appreciation, high inflation, high interest rates and low prices for meat and dairy products in world markets. These low prices were a direct result of the overproduction and subsidised exports of, in particular, the United States and the European Community. Finally, in late 1988, farm prices improved. Farmers' terms of exchange strengthened both as a result of the long-awaited benefits from the reforms and improving world market prices for pastoral commodities. Eventually, farmers also benefited from falling input prices, and from lower processing costs.

Figure 2. Producer subsidy equivalents 1995[1]



Source: OECD (provisional).

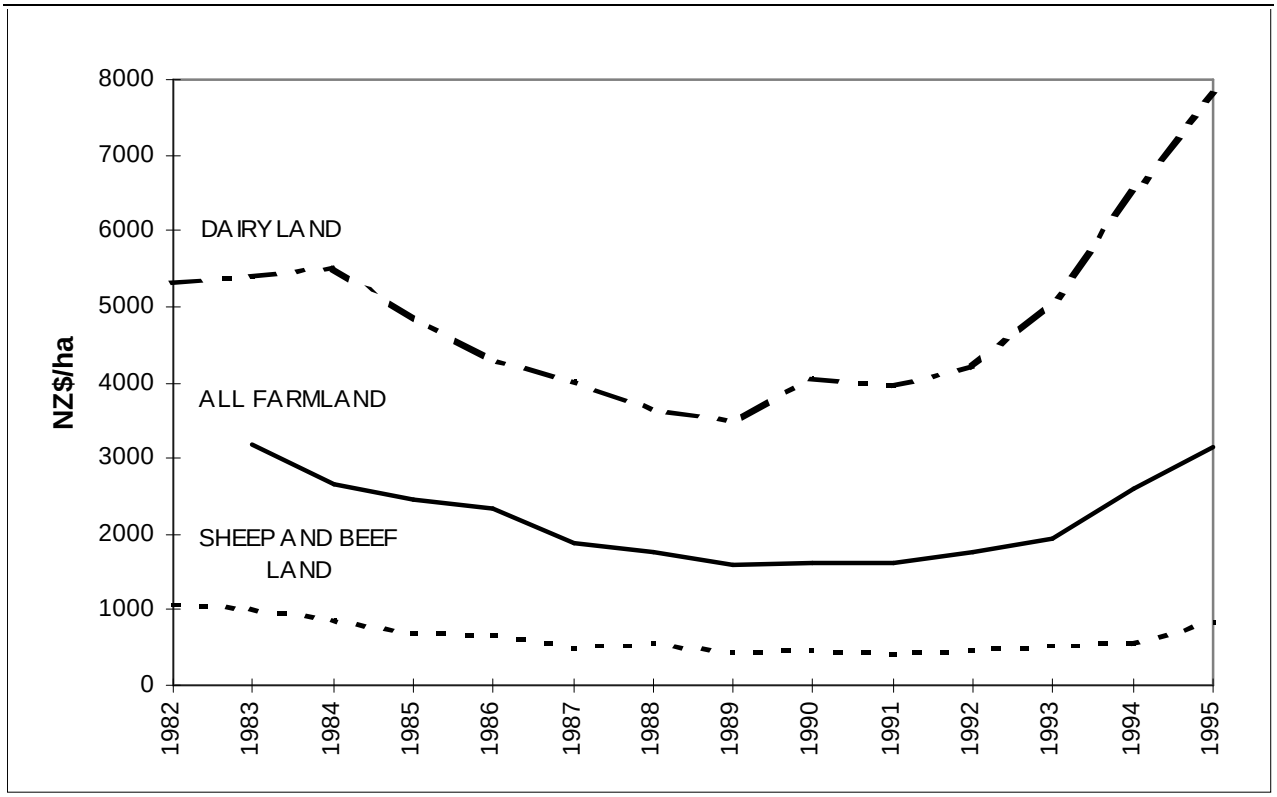
1. Total assistance from government as per cent of value of farm production, including price support and direct payments.

Following big increases in farmland prices in the early 1980s, by 1988 nominal values had fallen to around 78 per cent of their peak levels: a fall of around 50 per cent in real terms. This demonstrates the extent to which government support for agriculture was capitalised into the value of farmland. By 1995, farmland values had recovered to around 86 per cent of their 1982 value, in real terms. See Figure 3.

The reforms have had no significant effect on farm size, but the removal of land development grants has meant the withdrawal of a small area of marginal land (i.e. land not suited for pastoral agriculture) from production. Much of this land has also been planted to forestry with consequent benefits of slope stability and catchment protection [see Section 2: "Changes in land use", below].

New Zealand farmers have proved remarkably resilient in adapting to the changes that have swept the sector. After the removal of subsidies in 1984, farmers cut back discretionary expenditure including all non-essential repairs and maintenance; new land development; fertilizer applications; and capital expenditure on new plant and equipment, and they laid off labour and did more work themselves. This had a direct effect on small rural businesses, some of which went out of business. The next few years were a difficult and stressful time in rural communities (Walker and Bell, 1994, pp. 29-31). It is also interesting to note that operating expenses, as a percentage of gross farm income, fell from a peak of 80 per cent in 1984 to about 50 per cent currently (Ministry of Agriculture, 1996a). Thus, increased operating efficiency, and the removal of protection from input industries, have helped farmers cope with the decline in income.

Figure 3. Farmland prices in Real NZ Dollars[1]



1. Farmland prices deflated by the Producer Price Index for dairy farms, sheep and beef farms, and all farming respectively (1982=100).

The Government did help with some farm debt restructuring. The government-owned Rural Bank wrote off some farm debt and the Government encouraged private lenders to do the same. Many farmers went through credit mediation, involving experts in finance, law, farm management and banking to develop an action plan for the farm. In the end, about 20 per cent of the total farm sector debt was written off and about 5 per cent of farms were sold, considerably fewer than had been predicted (Walker and Bell, 1994; Chamberlin, 1996).

The market-orientation of the agricultural sector now means that the price of farmland better reflects the market value of its output, not the capitalised value of assistance. The reduction in land prices in New Zealand means that young aspiring farmers, who have not had the good fortune to inherit land, face a lesser barrier to entering their chosen profession.

Despite the pain experienced in the agricultural sector, very few farmers were forced by the reforms to leave the land. The rural collapse predicted by some never happened. New Zealand's rural population rose slightly between the 1981 census and the 1991 census despite the removal of subsidies. The rural economy has become more diversified, with tourism and other services accounting for a larger share of rural economic activity. This diversification has made rural communities less vulnerable to cyclical downturns in the agricultural sector.

2. Environmental consequences of removing agricultural subsidies

The agri-environmental context

Along with the economic reforms of the mid-1980s, the government in 1984 also initiated a Resource Management Law Reform, culminating in the enactment of the Resource Management Act 1991 (RMA). This Act replaced all or parts of 75 previous statutes and brought all activities relating to the management of land, water, air, and the coastal environment under one Act. The RMA has one clear and overriding purpose: to promote the sustainable management of New Zealand's natural and physical resources for the benefit of present and future generations.

The RMA continued previous practice of assigning most environmental responsibilities to local government. These include soil conservation activities, water quality monitoring and control, etc. Under the RMA, councils are developing policies, in consultation with their communities, to address these issues. There is now a much greater recognition that economic development often brings with it environmental risks, and the RMA requires that these be addressed when projects are under consideration for planning approval. However, proposals are considered on the basis of environmental effects rather than regulation of the activity *per se*.

Government agencies are still in the process of developing environmental indicators, and hence no comprehensive baseline exists against which to compare environmental quality since the removal of subsidies. But although "state"of the environment indicators are not available, there are data on a number of environmental "pressures", including land use, input use, stocking rates, etc. Changes in these variables, and their environmental implications, are assessed below.

Changes in land use

Since the removal of agricultural subsidies in the mid-1980s, there has been a gradual but steady change of land use from pastoral agriculture to forestry. Total area in various forms of pasture has declined from 14.1 million hectares in 1983 to 13.5 million hectares in 1995. In fact, the actual land area reverting to woody vegetation may be considerably higher than official statistics indicate, as much of it is still being farmed but less and less intensively as time passes and woody vegetation takes over. Farmers will eventually reclassify such areas when they cease grazing them entirely.

Meanwhile, the area of planted forest has increased from 1.0 million to over 1.5 million hectares, a 50 per cent increase, over the same period. This occurred despite the removal of forestry establishment grants in 1984. The new forestry plantings are typically on hill country land being taken out of sheep and beef production, in locations with ready access to an export port and with soil and climate factors favouring tree growth. This is often undertaken by city based investors, although some planting is by farmers who are seeking to diversify their operations or to stabilize erodible land. In addition to reducing erosion, forestry has positive flow-on effects on water quality, as well as storing carbon dioxide and thereby reducing New Zealand's net greenhouse gas emissions. It is increasingly being seen by farmers as a sustainable complement to traditional pastoral farming.

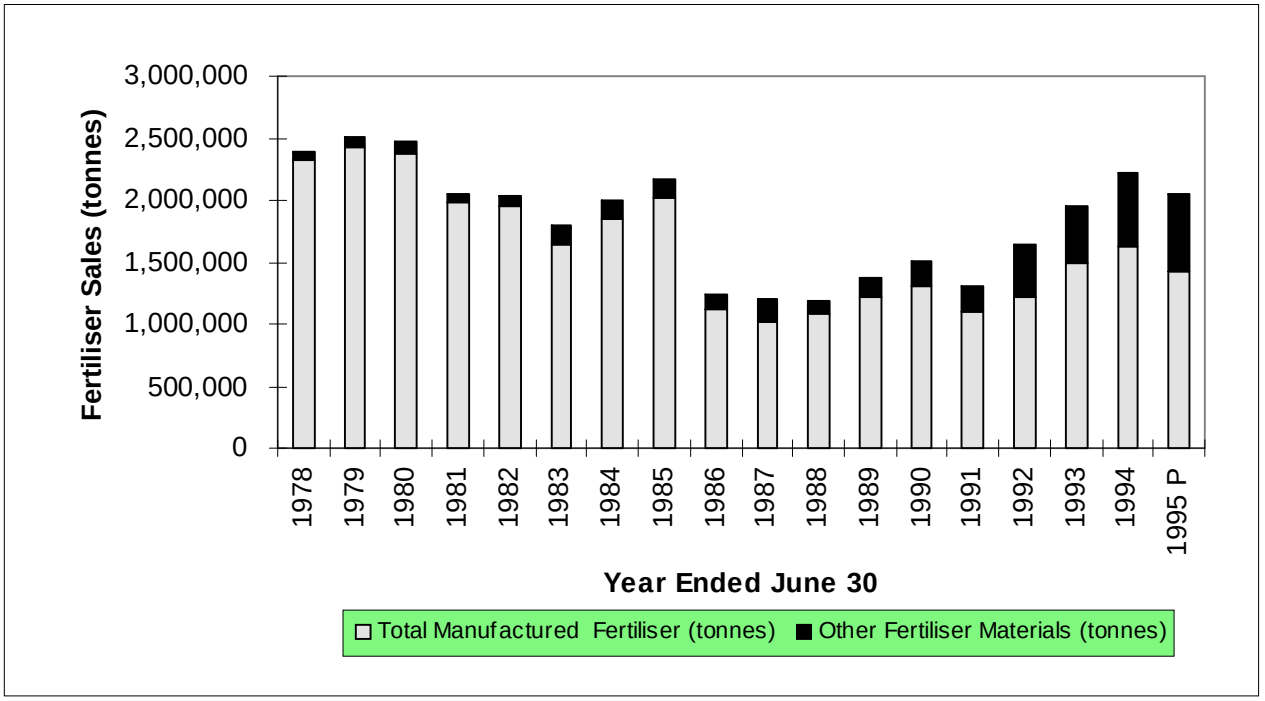
The increase in forest planting has been driven by a number of factors including the increased returns to forestry, especially relative to the declining returns to pastoral farming. The removal of agricultural subsidies allowed this divergence in returns to be fully reflected in farm profitability and land prices. Tax provisions which allow forestry expenses to be deducted against current income have also

been a factor for some individual investors, though much less so for farm foresters and forestry corporations.

Changes in pesticide and fertilizer use

Subsidies for superphosphate fertilizer took a variety of forms between 1966 and 1986, including subsidisation of cost of transport from manufacturing plants, for a brief period the cost of application, and the cost of the fertilizer itself from 1971 until 1986. However, there was a sharp decrease in the fertilizer subsidy in 1980 when the government shifted from input assistance to an emphasis on output subsidies. The government in 1984 gave two years advance notice of the removal of remaining fertilizer subsidies. This explains the very high usage in 1984 and 1985, and the very low usage in the immediately following years, as superphosphate is typically not applied every year to sheep and beef pastures. See Figure 4A.

Figure 4A. Fertilizer sales volumes 1978–1995



Source: Ministry of Agriculture.
1. P - Provisional.

Nonetheless, fertilizer sales, in gross tonnage, remained well below pre-1984 levels for several years, and only in 1993 and 1994 returned to 1983 levels. Sales fell again in 1995 due to the downturn in the sheep and beef sector. Total gross tonnage is still below the levels of 1978-1980, although the nutrient value of the much of the fertilizer applied has increased. In the late 1970s and early 1980s, around 95 per cent of all fertilizer sold was superphosphate or mixes (9 per cent P content). This fell to 70 per cent in 1995, as increasing amounts of nitrogen-based fertilizers were used, particularly in dairy areas. This may have implications for water quality in some areas, and is being monitored by regional councils. Pesticide sales also decreased after 1984, though less than the fall in fertilizer sales because pesticides had not been subsidised. The real value of pesticide sales has varied since then, but the trend has been a gradual increase to near 1984 levels. See Figure 4B.

The increased use of fertilizer and pesticides in recent years is linked to the general improvement in market conditions. Hence, the fact that input use has returned to pre-reform levels confirms rather than brings into question the conclusion that removal of subsidies caused a reduction in input use. The data show that input use is related to input and output prices, which are in turn related to subsidies. A study by Jones (1990) found that fertilizer purchases by farmers were positively related to farm incomes and output prices, and that subsidies increased fertilizer usage by between 10 per cent and 25 per cent during the 1970s. A reduction in subsidies will therefore lead to a reduction in input use compared to a scenario of continued subsidies, even if occasional improvement in market conditions and gradual changes in farming practices cause input use to increase overall. If New Zealand had not removed its agricultural subsidies, input use during the 1985-1993 period would have been higher than it was, and would today probably be higher than it is.

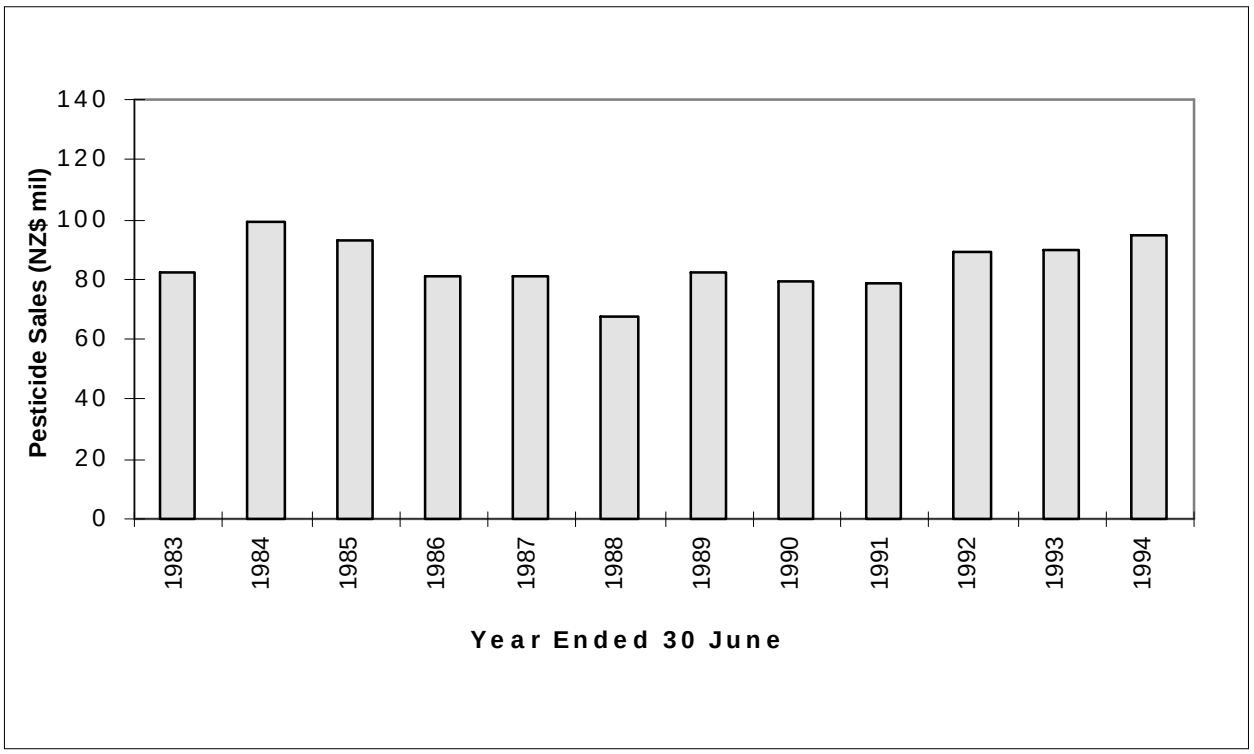
Fertilizer use is of environmental concern primarily because of possible impacts on water quality. There is insufficient evidence to prove that removal of subsidies, and the resulting reduction in fertilizer use, has improved water quality in New Zealand. Nevertheless, studies have shown reductions in leaching of phosphates from hill country pasture catchments, where phosphate is the dominant nutrient applied (Cooper *et al.*, 1987, and Smith, 1989). In the New Zealand environment, there may also be cases where insufficient application of fertilizer to hill country pasture leads to poor growth and over-grazing, which can actually exacerbate water quality problems due to sediment loss and nutrient transport. Farmers can only maintain this for a few years, however, before fertilizer is applied or stock numbers are reduced. On balance, it is considered that reduced input use in New Zealand agriculture has had a net positive effect on water quality in particular.

Livestock numbers and composition

Both sheep and cattle numbers grew throughout the 1960s. During the early 1970s, beef numbers continued to rise, to over 6 million, while sheep numbers declined. These trends were reversed over the period 1975 to 1983, influenced by subsidies, with sheep numbers peaking at 70 million in 1983. In 1984 and subsequent years, with the removal of support mechanisms for sheep production, there has been a steady liquidation of the sheep flock, to only 49 million in 1995. Meanwhile, beef numbers have increased slightly since 1983, from around 4.5 million to 5.2 million head, and dairy cattle have increased from 3.13 million in 1983 to 4.1 million in 1995. Farming of deer and goats has also increased considerably over the period, from 0.4 to 2.1 million stock units. In total, stock units have declined from 105.1 million in 1983 to 97.8 million in 1995, a 7 per cent reduction. See Figure 5.

The decrease in stock numbers has almost certainly yielded environmental benefits: less erosion and transport to waterways of sediment, nutrients and faecal matter, as grazing pressure declined. The benefits of reduced sheep numbers are particularly significant on some of the steeper and less productive "hard hill" country in areas of the North Island, some of which is being left to return to trees and other woody vegetation. However, it should be noted that the vigour and productivity of hill country pastures, based on a mixture of white clover and grass species, demands a certain minimum intensity of grazing pressure by livestock in order to be sustained. In addition, emissions of methane from ruminant livestock, which now account for an estimated 52 per cent of New Zealand's greenhouse gas emissions, have fallen in line with stock numbers.

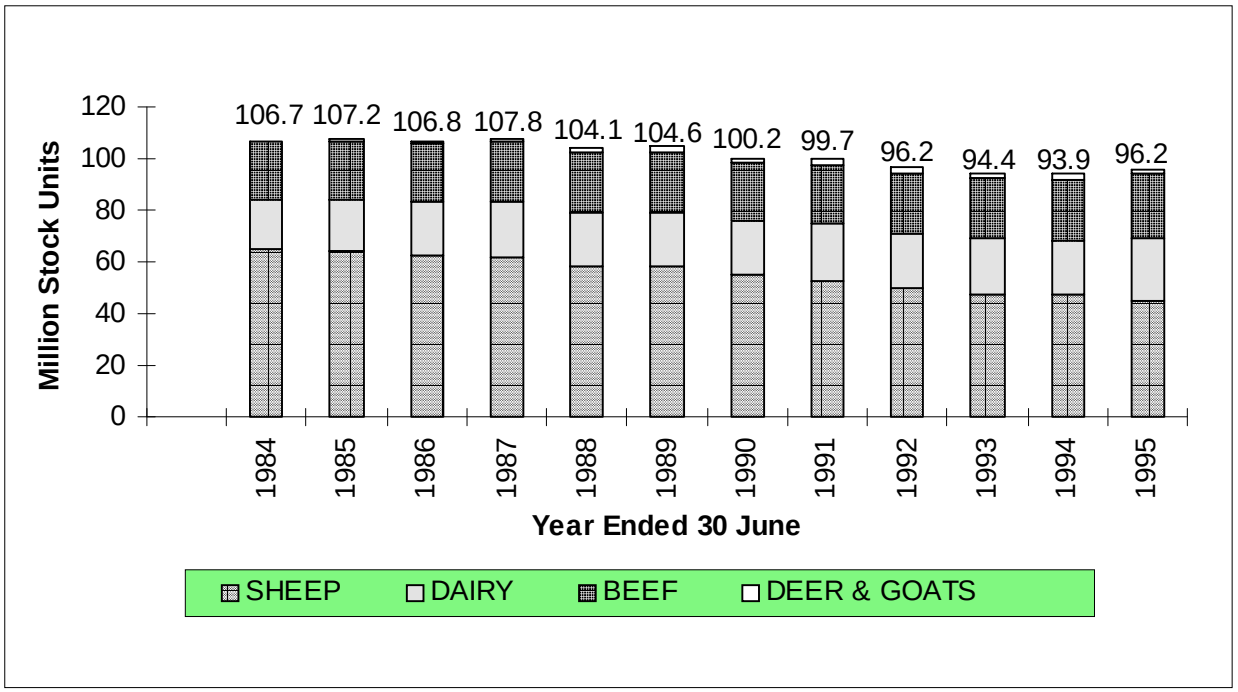
Figure 4B. Pesticide sales[1] (Real NZ$ mil.) 1983–1994



Source: Ministry of Agriculture.

1. Value of sales of fungicides, insecticides and herbicides, deflated by Producer Price Index (1982=1000).

Figure 5. Livestock numbers



1. Stock unit is equivalent to one breeding ewe.

At the same time, numbers of dairy cattle and deer have increased. While these enterprises are still extensive in nature compared to, for instance, dairy systems in most other OECD countries, they are relatively intensive compared to sheep and beef farms in New Zealand. They make higher use of nitrogenous fertilizer, and in some cases this leads to run-off into surface or ground water supplies. This is being monitored by local authorities.

As total stocking rates have declined since the removal of subsidies, it is expected that the net environmental effect of changes in livestock enterprises is positive. These changes are due not just to removal of subsidies, but also to market forces which affected the relative profitability of different enterprises. Output assistance, for sheep in particular, masked the impact of market signals. Its removal has now allowed farmers to respond to market forces, with a consequence that adjustment has proceeded more quickly.

Development of marginal lands

Subsidies for land development and for increasing livestock numbers encouraged farmers to clear forest and other woody vegetation to increase pasture area and stock units carried. These schemes were terminated in 1984, effectively ending the historical "settler ethic" in New Zealand which encouraged the clearance of "bush". With the decline in subsidies and in prices for pastoral products, it has become less economic to bring new land into production. In addition, amendments to the Forests Act require that any native trees that are to be milled into timber must come from sustainably managed forests. The felling of regenerating and established native forest for agricultural development has declined substantially, and is now probably negligible. This has the obvious benefit of preserving more of New Zealand's natural flora and fauna.

As noted in Section 2, "Changes in land use", the total area in pasture has declined slightly since 1984. The decline in expenditure for new land development has been much more marked, from NZ$ 184 million in the year ended 30 June 1983, to a low of NZ$ 55 million in 1988/89. See Figure 6. Development expenditure recovered somewhat to NZ$ 84 million in 1992/93 (the latest figures available), but anecdotal evidence indicates this is largely conversion of the better sheep and beef pasture into dairy farms rather than conversion of natural forest to agriculture.

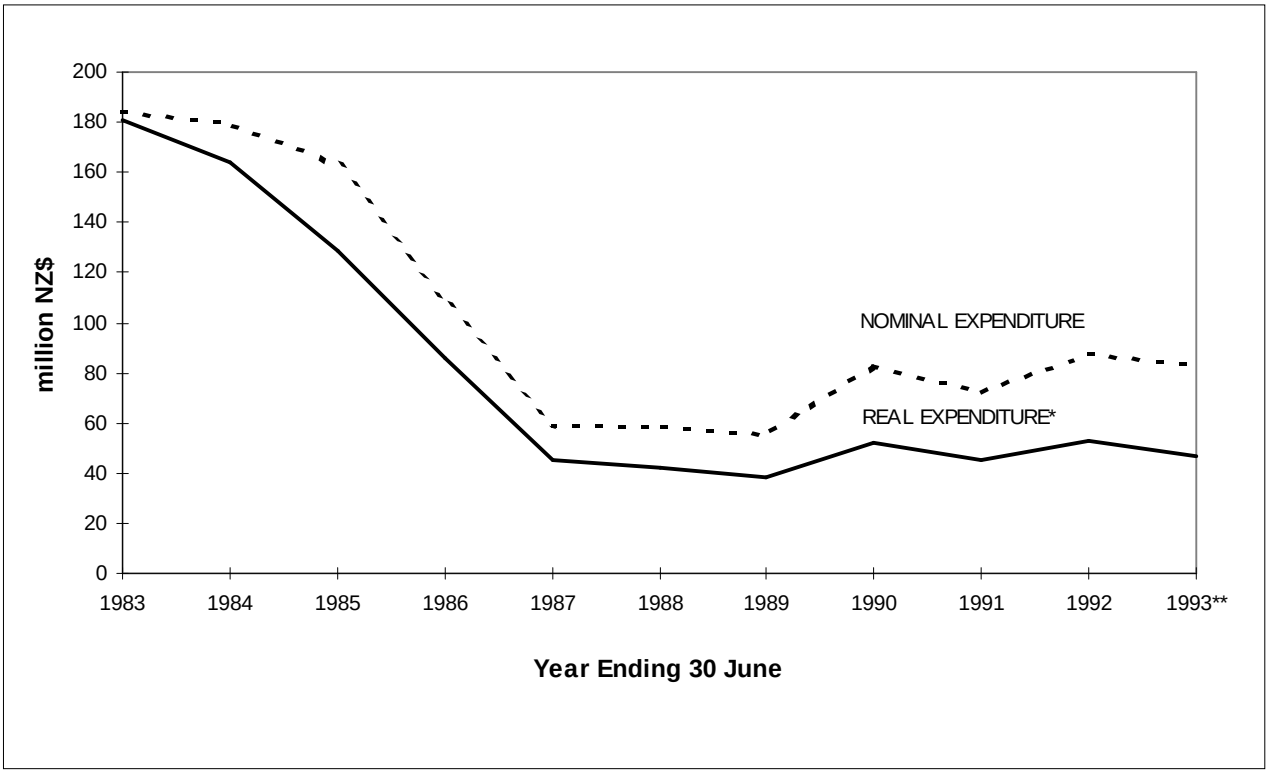
Water use for irrigation

Irrigation is a major consumptive use of water in New Zealand, taking an estimated 55 per cent of all withdrawals in 1993. Withdrawals for livestock accounted for a further 17 per cent. As a part of a long standing policy to mitigate the impact of climate risks on livestock and crop farming, successive Governments had actively encouraged this use of water resources by providing subsidies for irrigation schemes, and for livestock water supply schemes. The assistance rates for irrigation, removed in 1988, were considerably higher than for other types of agricultural development.

Prior to the removal of subsidies, the government funded the majority of the costs to develop irrigation projects, including costs of investigation, head works, distribution and half of the costs of on-farm delivery systems as well. Additionally, on-farm costs were eligible for concessional development loans, with deferred capital and interest terms available during the early 1980s, further increasing the concessional element for that period. Government also effectively subsidised delivery costs and water charges to irrigators, as most irrigation schemes operated at a loss. Authorising legislation provided for some of this assistance to be repaid over 40 years. However, high interest rates in the 1970s resulted in

debts that could not be recovered. This was one of the factors leading to the privatisation of the schemes in the late 1980s and early 1990s.

Figure 6. Land development expenditure



* Nominal expenditure deflated by Producer Price Index (1982=100).
** Series ended in 1993.

All irrigation schemes now have been sold, except for one small scheme of about 150 hectares. Although time series data are not available, water abstractions for agriculture are expected to have stabilized, compared with the increases while subsidies were available for irrigation development. More recently, demand for irrigation water has been building, and various schemes are under investigation. However, in contrast to earlier policies, none of these projects are receiving government assistance, with the exception of one which got a single grant of NZ$ 1 million. All of the current proposed projects will need to be privately financed, and get the necessary environmental permits, if they are to proceed.

Disaster relief policy

The New Zealand Government has in the past played a significant role in providing relief to farmers affected by climatic disasters. It is now recognised that disaster relief can itself encourage environmental degradation if it removes the incentive for land managers to plan for such disasters. For example, livestock farmers need to de-stock when drought becomes a real possibility, and also need to keep grazing pressure down to a level that will better enable hill country pasture to sustain heavy rainfall.

More recently, the New Zealand Government has implemented a policy of encouraging individual landholders to manage climatic risks. Central government support is still available, within tight

criteria, when an adverse event is beyond the ability of the local community to deal with. In such cases, support is provided in a manner that does not reduce individual responsibility for managing risk. There is no assistance to producers for lost production or infrastructure. In addition, the government implemented a major extension programme on risk management in 1989/90. Government expenditure on disaster relief has declined from an average of NZ$ 26.4 million per year during the period 1986/87-1990/91, to NZ$ 5.6 million in 1992/93. For the most recent two years, there has been no disaster relief expenditure by the Ministry of Agriculture, despite the occurrence of a number of extreme climatic events, including hail and snow storms, that would have attracted government assistance under previous policies.

As a result, many sheep and beef farmers in particular have adopted stocking policies that are better adapted to climatic risks and are quicker to respond to early signs of drought. This reduces the likelihood that pasture will be overgrazed and made more vulnerable to erosion. A recent survey asked farmers what assistance government should provide to farmers seriously affected by drought. Fifty per cent said "none," and among those who favoured assistance, the type most often suggested was some tax relief for capital livestock sold during a drought (Walker and Parker, 1996). As for floods and other forms of adverse climatic advents, it is not yet clear whether farmers have altered their management practices to adjust for these risks.

3. The post-reform challenge: initiatives to address agri-environmental issues

The removal of subsidies is a necessary, but not sufficient, approach to addressing the environmental impacts of agriculture. To achieve sustained environmental benefits, agricultural policies also need to be co-ordinated with policies affecting macroeconomic conditions, environmental management, and disaster relief, among others. Since 1990, New Zealand has made considerable progress in developing a co-ordinated and balanced set of policies with the core objective of sustainable use and development of the nation's natural resources.

As noted above, the principle of sustainable management is embodied in the Resource Management Act 1991 (RMA). Under the RMA, regional and district councils are developing policies, in consultation with their communities, to address soil conservation issues, water quality monitoring and control, among other agri-environmental issues.

The OECD Polluter-Pays-Principle is generally applied in New Zealand. Regional councils are increasingly requiring payment for all administrative costs associated with environmental permits (Sinner *et al.*, 1995). The reduction of Government assistance in the funding of pest management, flood control and land drainage programmes has now required an increase in user-pay funding, through special property tax assessments on the landowners who benefit. In some cases, regional councils charge for technical advice, including assistance with soil conservation planning. This is all part of a wider movement in New Zealand government towards "user-pays," i.e. requiring payment for services from those who benefit from them, or from those who generate the costs. This ensures that services are not demanded unless fully justified, and that the community does not pay for services required by an individual or a small group. Both objectives are consistent with the Polluter-Pays-Principle.

Pest control is also a major issue in New Zealand. Some of the plants and animals European settlers brought with them have proved difficult to control, and quickly developed populations to pest levels. The Biosecurity Act 1993 provides for pest control operations under national or regional pest management strategies, which must specify the costs and benefits of control, who benefits, and proposed funding mechanisms. Any individual or group can propose a pest management strategy, which takes

effect if it is approved by the Minister of Agriculture (for national strategies) or the relevant regional council.

The New Zealand Government released a position paper on sustainable agriculture in 1993, as part of a wider policy on sustainable land management. Sustainable agriculture is defined as the use of farming practices which maintain or improve the natural resource base, and any parts of the environment influenced by agriculture, are financially viable, and allow people and communities to provide for their economic and cultural well-being. The Ministry of Agriculture has undertaken a facilitation programme designed to encourage the adoption of sustainable agricultural practices, and regional councils are also promoting sustainable agriculture as part of their responsibilities under the Resource Management Act. Meanwhile, grassroots "landcare", or community based, groups have been established in many parts of New Zealand. These groups have the potential to make a key contribution to sustainable agriculture, although many are still identifying their relationship with central and local government agencies.

The Government announced in May 1996 assistance for the establishment of a Landcare Trust and the establishment of a national Sustainable Land Management Advisory Group. The Landcare Trust is intended to develop a network of trained landcare, or community group, facilitators, and to provide support for small community based projects. The Sustainable Land Management Advisory Group will help to co-ordinate information needs and delivery systems, encourage the adoption of better land management practices, and provide feedback to Government on policy initiatives and associated land management issues.

There are several other industry-led initiatives on sustainable agriculture in New Zealand[32]. Project F.A.R.M.E.R. has farmers helping train other farmers in the use of computer-based decision support systems, including better monitoring and analysis of environmental and farm performance data. The project also has helped identify knowledge gaps and worked with researchers to fill them. The leaders of this project helped establish the Rural Futures Trust as a vehicle for funding Project F.A.R.M.E.R. and other farmer-led sustainable land management initiatives.

The industry-owned Dairy Research Institute has funded a project in the Waikato region to address farming impacts on water quality. In co-operation with the regional council and another research institute, dairy farmers have developed an operational definition of sustainable dairy farming, compiled a list of sustainable management practices, and designed subjective indicator scales to monitor their performance. The current phase of the project aims to convert the subjective scales into objective criteria. The New Zealand Meat Research and Development Council (also industry-owned) uses 21 privately owned farms to monitor and demonstrate to sheep and beef farmers how farm business planning and monitoring can improve performance. The Council has incorporated environmental objectives into two of the monitor farms on a pilot basis, with some funding from regional councils and the Ministry of Agriculture. These monitor farms have associated "sustainable farming community groups" which discuss issues and possible management approaches, and follow the progress of the farm.

Codes of practice have been developed by the pork industry, the logging industry, and by an agrochemical education trust initiated by leaders in the horticulture industry. Guidelines for responsible fertilizer use are being developed by the fertilizer industry, and grazing guidelines are under development by leaders in the pastoral sector.

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[32] For a more complete description of these initiatives, see OECD, "Voluntary, Cooperative Approaches to Sustainable Agriculture," COM/AGR/CA/ENV/EPOC(95)118/REV1, June 1996, pp. 60-65.

In many of these cases, farmers are motivated not just by the desire to do the right thing, or the possibility of regulatory pressure if problems are not addressed, but also by market considerations. Farming leaders sense that consumers in New Zealand and in overseas markets are increasingly interested in how a product is produced, in addition to traditional quality concerns. They are therefore supporting efforts to establish systems to ensure that their production systems are sustainable and that this can be demonstrated to consumers. Thus, in a variety of ways, the environmental costs and benefits of sustainable agriculture are being internalised to the production process.

4. Conclusions

The past mix of agricultural support and resource development policies encouraged farming systems and land use patterns that in some areas were not sustainable. For example, the livestock price supports, when combined with fertilizer and land development subsidies, diverted significant amounts of financial and scientific resources into pastoral farming systems. This package of subsidies encouraged clearance of native forest, followed by sowing and heavy fertilization of pasture. The artificial profitability of livestock farming, especially sheep, encouraged farmers to run stock numbers that exceeded the long-term productive capacity of the land resource. Government's willingness to assist farmers after adverse climatic events further reduced risk exposure and the cost of farms exceeding biological and physical limitations.

In the past decade, New Zealand has implemented wide-ranging general economic and environmental reforms. Government intervention in the economy, including in agriculture, had led to severe misallocation of resources and high levels of assistance which could no longer be maintained. With general economic reforms in 1984 and succeeding years, government assistance to agriculture was virtually eliminated.

The elimination of agricultural subsidies caused a number of changes with environmental implications. The removal of subsidies occurred at the same time as high interest rates and an overvalued exchange rate, which were associated with macroeconomic reforms. These factors contributed to financial stress for many farmers, which in some cases led to short-term exploitation of the resource base. On the positive side, conversion of natural forest to agriculture and development of marginal lands virtually ceased, livestock numbers declined, forestry plantings continued to increase, and the use of fertilizers and other agricultural chemicals decreased. All of these changes lessen the likelihood of farming systems causing the degradation of marginal lands and off-site contamination of water resources.

Despite these changes, environmental challenges remain. The New Zealand experience has confirmed that, while the removal of agricultural subsidies is beneficial, specific environmental policies are necessary to address the environmental effects of agriculture. The development of these policies is well underway. The New Zealand government no longer provides significant disaster relief payments to farmers, but instead requires farmers to manage their land in consideration of these risks. More importantly, in 1991 the New Zealand Government enacted the Resource Management Act, that refused antecedent policies, with the overriding purpose of promoting the sustainable management of natural and physical resources.

User-pays and polluter-pays principles are well established in New Zealand. Agricultural inspection services and extension services formerly funded by central government are now on a user-pays basis, although some environmental extension is still provided free by local authorities. Pest management programmes are funded largely by levies or special property taxes on landholders who benefit from them.

Farmers are required to install effluent treatment and disposal systems at their own cost. They run the risk of fines if these systems do not comply with local government regulations.

Furthermore, for a range of activities, farmers must obtain environmental permits and, in an increasing number of circumstances, must pay the administrative costs and on-going monitoring costs associated with the permit. To address non-point source pollution problems, local authorities are encouraging landowners to take collective responsibility for devising solutions to meet community expectations. Farmers are increasingly recognising that forestry plantings are a sustainable complement to their farming systems which, in addition to being profitable, can help to address priority environmental issues. The farming sector has taken several initiatives to address environmental issues, including codes of practice, formation of landcare groups and development of on-farm indicators by farmers themselves. These initiatives should help them to respond positively to consumers who are becoming more interested in production processes. Although there is still some way to go, New Zealand is moving towards internalisation of environmental costs in order to encourage the efficient and sustainable use of natural resources.

New Zealand has taken the approach that it is necessary to remove distorting price signals and address environmental "bads" before considering whether agriculture provides environmental "goods" that require government assistance. To have done otherwise, i.e. to compensate farmers for perceived environmental "goods" without addressing the "bads", would have risked entrenching current systems that were causing environmental damage, and would have been just another way to subsidise farming. Without policy reform, payments for "environmental benefits" may merely serve to encourage the continuation of overly intensive or otherwise environmentally damaging production systems.

There is little evidence of market failure in the provision of environmental "goods" by New Zealand agriculture. In New Zealand, most biodiversity resides in natural ecosystems, both terrestrial and aquatic. While agriculture can provide landscape amenities and *in-situ* preservation of biodiversity, including biodiversity of agricultural species, these "goods" are by-products of agricultural systems and are still being provided despite the withdrawal of government assistance. If anything, government assistance to agriculture was having a negative effect on the supply of biodiversity and other environmental goods, and the first step was to remove such distortions.

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Annex: The macroeconomic context of New Zealand's eonomic reforms

In an effort to diversify the economy and control the balance of payments deficit, the New Zealand government of 1938 introduced import licensing and exchange controls. This protection of the domestic manufacturing sector was maintained and New Zealand, for many years thereafter, had what were probably the highest tariffs on imported manufactured goods of any OECD country, and was the only developed country to maintain a comprehensive system of quantitative controls on imports. During the late 1950s and 1960s, New Zealanders enjoyed one of the highest standards of living in the world. Most of the country's agricultural produce was exported to the United Kingdom, which was an assured market with generally high prices. But New Zealand's trade balance was hit hard by the oil price shocks of the 1970s, and by the accession of the UK to the European Community and its protectionist agricultural policy. New Zealand's secure, high priced market for agricultural exports became increasingly compromised by adverse market developments in the UK, driven by European Community agricultural policies. During the 1980s the New Zealand government intensified its intervention in the economy, to combat inflation, and balance of payments and current account deficits.

Initially there was little opposition to this increased government intervention. For many years, few people were aware that the economy's underlying situation had actually deteriorated significantly. Throughout the 1970s and early 1980s, the inefficiencies, though obscured, had continued to multiply and deepen. Although attempts were made to control inflation, this was only symptomatic, and through the brief application of the expedient of a wage and price freeze imposed in June 1982.

By mid-1984 a number of acute problems had to be addressed: i) the fiscal deficit, which had reached 9 per cent of GDP, was imposing ever larger debt servicing burdens on taxpayers; ii) a lax monetary policy, including the government's suppression of interest rates, had led to excessive monetary growth; iii) a persistent current external deficit complicated overseas debt management, and put pressure on the exchange rate, which remained artificially overvalued.

The economy was stagnating and unemployment was growing. There was also heavy selling of the New Zealand dollar, which threatened to exhaust the country's foreign exchange reserves. In short,

most policy instruments were subordinated to or dominated by the wage and price freeze. It became inevitable that the freeze would have to be removed and that there would then be a resulting resurgence of inflation.

In 1984 the New Zealand government acknowledged that current levels of support to agriculture were unsustainable, and announced a programme for the termination of price stabilisation and support programmes. But as the country's economic performance worsened, the impetus for more comprehensive reforms grew. A snap election in 1984 brought a different party to power.

Across the economy, the new government implemented reforms with a focus on macroeconomic policies and the aim of promoting efficiency and generating sustained economic growth. The philosophy underpinning the changes was that of "the level playing field": the government relinquished the role it had assumed under previous administrations of "picking winners" for which subsidies and tax incentives would be provided. On the level playing field, all sectors would compete equally. Market forces, rather than government, would select the winners.

All sectors of the economy were affected. One of the first acts of the new government was to announce a 20 per cent devaluation of the New Zealand dollar, together with removal of controls on all lending and deposit rates. Exchange controls were removed in December 1984 and the New Zealand dollar has floated since March 1985.

Key sectors of the economy, including finance, communications and transport, were deregulated. Export assistance was removed. Tariffs were lowered and the extensive import licensing system was phased out. Free trade with Australia expanded under the Closer Economic Relations agreement, so that it now encompasses almost all goods and most services. The tax system was overhauled, creating one of the least distorting tax systems in the OECD.

The Reserve Bank Act 1989 gave the central bank increased autonomy in the pursuit of a single goal: to achieve and maintain price stability. More recently, industrial relations policy was changed by the Employment Contracts Act 1991. As a result, centralised pay bargaining has been increasingly replaced by site agreements and individual employment contracts.

NEW ZEALAND: POLICY CONSIDERATIONS REGARDING LANDSCAPE AMENITIES AND BIODIVERSITY FROM SUSTAINABLE AGRICULTURE[33]

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In considering environmental effects of agriculture, landscape amenities and biological diversity ("biodiversity") are sometimes cited as benefits which agriculture provides as "public goods." This paper examines issues concerning the provision of these "public goods" by agriculture, in the wider context of the environmental benefits of a sustainable agriculture.

1. What are "environmental" benefits?

To consider the "environmental benefits from a sustainable agriculture" requires some definition of "environmental." For clarity, we suggest that in the context of agricultural reform, the term "environmental" be defined as relating to the biophysical environment. Thus, environmental benefits are those which maintain and enhance flora and fauna, i.e. biological diversity, and the natural resource base (soil, water, air). Policies designed to support or maintain rural communities, social or cultural traditions, or heritage values are *social* policies rather than environmental policies. While these may be an appropriate focus of public policy, they should not be confused with discussion of the *environmental* benefits from sustainable agriculture.

2. Landscape amenities and biological diversity

Landscape amenities from agriculture are typically by-products of particular production systems. For example, if society enjoys seeing sheep grazing on pasture or fields of ripening grain, then the visual amenity is a by-product of agricultural production. As long as production continues, so will certain landscape amenities. Although other amenities, such as hedgerows and riparian strips, may compete for land area with productive activities, they also perform some useful services for farmers. For example, hedgerows separate paddocks, shield crops and livestock from wind, provide habitat for species which predate on pests, etc. Furthermore, features which enhance the visual appeal of the landscape almost by definition make the farm itself more attractive. Farmers take pride in the attractiveness of their properties,

[33] This paper draws upon the conclusions of an OECD seminar held in 1995, reported in OECD, *Amenities for Rural Development: Policy Examples*, 1996. It also draws upon work done in the OECD in the 1980s, which resulted in a Ministerial Council resolution on principles calling for clear objectives and transparency, examination of policy options, targeting each objective with a single instrument, efficiency, etc.

which enhances the value of the property if a farmer chooses to sell. So farmers will continue to provide many of these amenities out of self-interest.

Agricultural effects on biodiversity have two components: biodiversity within the managed agricultural system (including wooded areas etc. within farm boundaries) and biodiversity beyond farm boundaries which is affected by farm runoff polluting waterways, spraydrift, etc. Within agricultural systems, biodiversity is threatened by both the intensification (i.e. increased use of inputs on a fixed area of land) and expansion of agriculture (increase of area farmed through removal of hedgerows, ploughing up stream banks, etc.).

Like landscape amenities, many features which provide biodiversity also provide goods or services to farmers. Small parcels of forest provide firewood and hunting opportunities, both of which may provide revenue as well as being used for the farm household. Forests and hedgerows provide shelter for livestock; riparian vegetation enhances fish habitat. However, features that enhance landscapes or biodiversity may, beyond a certain level, actually detract from the landscape's appeal, or become a nuisance because they harbour pests that attack neighbouring crops. Hence, sub-optimality can occur due to an excess of certain features, as well.

Beyond farm boundaries, agriculture has primarily a negative effect on biodiversity, due to farm runoff of sediment, fertilizer and pesticides. These impacts are mainly felt in aquatic ecosystems (including marine ecosystems where affected rivers flow into the sea), but terrestrial species are also affected by, e.g. unintended effects of pesticides.

3. Market failure for public goods and externalities

Economic theory suggests that public goods will be undersupplied by market forces. Landscape amenities and biological diversity are both public goods, as well as externalities. In certain cases, however, when a public good is also an externality there may not be market failure. This can occur if the production of the normal good creates the externality as a by-product in sufficient quantities to supply all demand for the public good. Consider a bridge that has been built in a rural area by a forestry company in order to facilitate its own access to its forests. If the company allows the public to use the bridge, and there is no congestion as a result, then there is no market failure despite the fact that the bridge is a public good. There is no need for government expenditure to build the bridge.

Is there market failure in provision of biological diversity and landscape amenities? Clearly, market forces have led to a reduction of biological diversity to an extent that an international agreement has been signed to address the problem. Agriculture has contributed significantly to the loss of biodiversity through the clearance of forest, draining of wetlands, conversion of grassland etc. This is true in New Zealand as elsewhere. But is there market failure in the provision of the elements of biological diversity that are found within agricultural systems, i.e. species that have adapted to the mix of pasture, cropping and field margins? Given the widespread distribution of agriculture, and the likelihood of its continuation, the situation seems akin to that of the bridge built by the forestry company. Many of these elements of biodiversity will continue to be provided by production driven by market forces, and there may be no need for government intervention.

A critical question, in relation to both landscape and biodiversity, is whether the current supply of these by-products is adequate or sub-optimal. Precisely what features do people value, and how much is optimal? Another relevant question is how the supply of these by-products would change with

agricultural policy reform. If output-linked subsidies were reduced, would the supply then be adequate or sub-optimal. Has rigorous analysis been brought to bear on these questions? What is the evidence?

A reduction in output-linked subsidies might lead to a slight decrease in complementary landscape amenities if it causes a decrease in land devoted to visually pleasing enterprises. However, it seems more likely that output-linked subsidies would have an adverse effect on landscape, because they provide an enhanced financial incentive to convert hedgerows, stream banks, wetlands etc. into productive area. Such subsidies can also encourage emphasis on one or only a few crops, as well as mechanisation and increased use of inputs, to the detriment of biodiversity. Hence, the removal of output-linked subsidies should lessen the pressure on these resources and enhance the diversity of crops and other farm enterprises.

However, landscape is location specific. It would seem that, in a national context, the reversion of a small percentage of land to natural vegetation will not have a significant effect on landscape amenities overall. However, communities at the margin may have a larger than proportionate share of the reverting land, and hence there could be a noticeable change to the landscape in these areas. This also raises question of who should pay. The principle of subsidiarity suggests that efficiency and transparency are increased the closer the funding for a programme is to the beneficiaries. Thus, if landscape benefits are enjoyed primarily locally, and vary locally, then the funding should be raised through local taxes, or even better, through user fees where possible.

The second complicating factor is that landscape values are subjective and dynamic over time. Some in a community may claim to prefer the status quo of a completely managed agricultural landscape (or whatever existed 10 or 20 years earlier) to one with pockets of natural vegetation interspersed. However, if such pockets were to develop over a few decades, it is quite likely that the succeeding generation would value the varied landscape over the previous landscape of only agriculture. Governments should therefore be cautious about assuming that past or present landscapes have inherently more value than future landscapes.

With respect to biodiversity, removal of subsidies should lessen the financial incentives for producers to expand into sensitive areas on-farm. At the other extreme, even if land "abandonment" were to occur, this would allow the return of natural vegetation over time and should lead to an increase in biodiversity. This will occur where an adequate supply of land remains in agricultural systems to ensure that other elements of biodiversity are preserved. Furthermore, the reduced incentives to use fertilizers and pesticides will decrease adverse effects on flora and fauna beyond farm boundaries, providing a clear benefit for biodiversity.

4. Environmental goods vs. bads

As the paper by Bromley makes clear, distinguishing between environmental goods (i.e. benefits) and environmental bads is not straightforward, and depends at least in part on property rights. Some argue that farmers must be paid for any requirements to "provide" environmental benefits, such as not draining wetlands, based on some notion of absolute property rights. But as Tawney (quoted by Bromley) points out, the state can change or re-define property rights because property rights are created by the state in order to further society's ends. This may include requiring farmers or other landowners to "provide" environmental benefits, especially as societies gradually increase their expectations about environmental performance. Of course, any such decision would be taken in the existing political and legal context of property rights in a particular country, and take account of its potential effect on landowners' willingness to invest in their property. However, the use of urban zoning,

whereby authorities set and change rules governing the use of private property, without compensation, is not controversial in most OECD countries. There is no particular reason why rural land should be treated differently.

Bromley also cautions that a decision to compensate farmers for redefining property rights will tend to reinforce the myth that rights are absolute, making it even more difficult to achieve environmental objectives in the future. He adds that "The history of law as instrumental social policy tells us that those things defined as 'progress' will inevitably win out over those things which are seen as preserving the status quo. ... over time, it is probably true that activities that emit what will come to be regarded as 'pollution' are living on borrowed time in that particular location."

5. Public policy towards agricultural biodiversity and landscapes

As noted above, many landscape and biodiversity amenities associated with agriculture will be provided without any government intervention. The desired quality and quantity should be compared with what would be provided in the absence of government intervention. Where rural amenities and other environmental goods will continue to be provided in sufficient quantities without intervention, payments for their provision could risk creating a nuisance as well as be a waste of public resources.

Furthermore, paying farmers for what they arguably should do (and in most cases are already doing) undermines the duty of stewardship for which many feel landholders should be responsible.

Regulation and direct payments are not the only policy options. Research, extension and facilitation of private initiatives can also be important policy tools, because in many cases a lack of information is a key reason for market failure. Such tools utilize farmers' own motivation to be good environmental stewards, and they avoid distorting market signals. In some other cases, providers of environmental goods may be able to charge those who benefit from them. For example, farmers in northern Italy now charge fees to tourists who come to pick wild mushrooms.

If farmers are to be paid for "environmental benefits," governments should ensure that the programmes have clear objectives, are well-targeted, and can be monitored for achievement of objectives. The concept of "reference level" presented in the consultant's paper by Hutchinson is also relevant. Hutchinson's "reference level" is similar to Bromley's "*status quo ante"* in that it refers to the level or amount of an environmental good which society expects or requires to be provided without compensation. As Hutchinson notes:

> "Services provided up to the reference level are not benefits, they are the duties and obligations that society and conventional land management practices place on land owners. Such services should continue to be provided without payment to landowners and, in many cases, may not be under threat of reduction as they form joint products with private goods or arise from landowners preferred management practices. Where landowners fail to achieve reference levels, enforcement including regulation and taxation and not payments are appropriate policy responses. ... threshold (i.e. reference) levels (should) be set for all environmental indicators as a matter of priority."

This point is related to another of fundamental importance, the need to consider a property's *net* contribution to society's environmental goals. That is, payment for environmental goods should be offset by charges for environmental bads. Otherwise, payment programmes are liable to be criticised as simply

another means to funnel taxpayer funds to farmers, with environmental concerns a secondary consideration. If it is argued that equity principles justify paying farmers for the "environmental goods" they provide, the same principles would suggest farmers be charged for their environmental bads. Without some attempt at valuation of damage as well as benefits, there is no assurance that the environmental costs of the agricultural system being protected do not outweigh the benefits. This would result in policy failure as described in the Secretariat's overview paper, leaving society worse off in environmental as well as financial terms (OECD Secretariat, 1996).

Alternatively, if farmers are not charged for damage, there is a stronger case for regulation to require the maintenance of certain features as part of landholders' contribution to society's environmental goals. This could be implemented as "cross-compliance," i.e. farmers would be required to meet minimum standards to remedy their environmental harm to qualify for payments for providing environmental goods. Because reference levels are subjective and politically determined, and will inevitably vary across countries, there is tremendous scope for programmes to secure "environmental benefits" to be used simply to provide subsidies to farmers which could distort production and trade.

Given that a substantial amount of landscape amenities and biodiversity will be provided in the absence of internvention, governments should pay no more than the marginal cost of supplying the additional goods or services. Payments should not exceed the cost to producers of implementing the measure. Some governments appear to be seeking to increase farmers' incomes using agri-environmental programmes. While nations have the right to set their own environmental objectives, they should, in choosing how to achieve those objectives, seek to avoid any adverse effects on other countries.

6. The New Zealand approach

In the mid-1980s, New Zealand eliminated a range of subsidies that were distorting resource use in agriculture. As a result, government policy was no longer actively promoting unsustainable production practices. At the same time, the goverment embarked on a broad reform of environmental law. This culminated in the Resource Management Act 1991, with its stated purpose of promoting sustainable management.

Under the Resource Management Act, local authorities have primary responsibility for most environmental issues. These authorities use a variety of instruments: i) regulation and polluter pays for activities commonly identified as "pollution", and to protect waterways and small areas of valuable habitat; ii) user-charges for services such as pest and flood control; iii) research and facilitation for problems such as erosion and non-point source water pollution where lack of information is a major part of the problem; iv) selective purchase of, or permanent easement over, large or ecologically very significant areas (usually by central rather than local government), thus ensuring their permanent protection v) a combination of regulation and selective land purchase to protect valued landscapes (this is needed only in very specific local areas).

In addition, both central and local government are encouraging voluntary, cooperative approaches by the private sector. Agricultural organisations have taken several initiatives to address environmental issues, including codes of practice, formation of landcare groups and development of on-farm indicators by farmers themselves. Farming leaders sense that consumers in New Zealand and overseas are increasingly interested in how a product is produced, in addition to traditional quality concerns. Farming groups are therefore supporting efforts to ensure that their production systems are sustainable and that this can be demonstrated to consumers.

The policies regarding habitat for biodiversity can be seen as local authorities requiring farmers to achieve the "reference level" by protecting small areas of significant vegetation. Where protection of very large or very significant (and economically valuable) areas is necessary to achieve programme objectives, this can be seen as above the reference level and can therefore justify some compensation. This approach enables the New Zealand government to promote environmental benefits from a sustainable agriculture, without distorting production decisions and without reinforcing notions of absolute property rights that would complicate environmental policy in the longer term.

7. Conclusions

The above discussion suggests the following considerations for public policy regarding the provision of landscape amenities and biodiversity associated with agriculture:

- Policy makers must first decide whether there is a need for intervention, based on the desired quality and quantity of the good and the costs and benefits of its provision.

- Where intervention is warranted, programmes should take account of the location and value of the amenity. Programmes should be regionally and locally specific, with funding derived as closely as possible from those who benefit.

- Where farmers are emitting what is commonly considered pollution, the OECD Polluter-Pays-Principle should be applied, consistent with treatment of other sectors of the economy.

- Payments should only be used where necessary to achieve the programme's environmental objective, taking account of available alternatives, and should address as directly as possible the causes of "undersupply" of the good.

- Any environmental good or service being promoted through government intervention should be precisely defined. Programmes should have specific environmental targets and measurable performance indicators, and should be monitored and evaluated regularly for efficacy and efficiency.

- Interventions should seek to alter supply or demand conditions permanently so that the amenity will continue to be enjoyed at minimum or even zero economic cost in future. (Appropriate measures might include regulation, information and facilitation, land purchases or permanent easements, or mechanisms that allow providers of amenities to charge beneficiaries.)

- Policies to secure environmental benefits from agriculture should be preceded by, or at least be implemented together with, policies to address environmental harm caused by agriculture. This promotes a sustainable agriculture, and ensures that government policy does not encourage current systems that are causing environmental damage.

- Governments should set reference levels for environmental goods subject to intervention; landowners should be required to achieve the reference level, and payments should only be available for goods supplied in excess of that level.

- To be consistent, payments for environmental goods should be offset by penalties for environmental bads, i.e. payments should be for "net" environmental services.

- To the maximum extent possible, in order to avoid production and trade distortions, payments should not be related to, or based on, the type or volume of production, or any factors of production

in a manner which would affect the type or volume of production. Rather, payments should be based on environmental outcomes, or on farming practices which are primary determinants of those outcomes.

- Payments should be available to anyone who can provide the environmental good in question, and should not be restricted to farmers. Payments should be limited to the extra costs or net loss of income involved in complying with the government programme.

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JAPAN: THE ENVIRONMENTAL BENEFITS FROM AGRICULTURE IN THE ASIAN MONSOON CLIMATE ZONE AND POLICY IMPLICATIONS FOR THEIR MAINTENANCE AND ENHANCEMENT

by
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Introduction

The nature of Asian agriculture dominated by paddy fields and its environmental benefits, which may not be familiar to other OECD Members, have been repeatedly introduced by the Japanese Delegation at the meetings of the Joint Working Party of the Committee of Agriculture and the Environmental Policy Committee of the OECD, particularly at the sessions on the development work on agri-environmental indicators.

For Asian people, one can *a priori* recognise the environmental benefits of paddy field-dominated agriculture. For instance, more than 60 per cent of people responding to the 1993 Government Poll on food, lifestyles and the role of rural areas conducted by the Prime Minister's Office agreed that agriculture contributes to the conservation of the natural environment and national land through maintaining and enhancing the quality of vegetation, air and water, and preventing disasters, including floods. However, it seems that this is not always obvious to other OECD Members having different natural environment and national land conditions.

This paper aims to review the nature of environmental benefits from paddy field-dominated agriculture in the Asian monsoon climate zone, using the Japanese case as an example, and will attempt to consider possible policies for the maintenance and enhancement of these benefits.

1. Environmental benefits from agriculture in the Asian monsoon climate zone

Characteristics of the natural environment in the Asian monsoon climate zone

There are many common characteristics found in the natural environment and in agriculture in Asia. Countries in the Asian monsoon climate zone experience various types of geographical conditions: Japan, Taiwan, the Philippines, and Indonesia are characterised as Island countries; Thailand, Vietnam, Laos, Cambodia, Myammer, and Malaysia are characterised as peninsular countries; and China is characterised as a continental country. However, there are some characteristics common all to these countries, such as a marked seasonal variation in climate with high humidity and precipitation. Furthermore, a steep topography with limited flat area is commonly observed in islands, peninsulas, and even the edges of continental China.

For example, in Japan, a long chain of mountains 2 000 to over 3 000 metres high runs down the middle of the archipelago, and flat areas are located only on the edges of the mountain regions; as a result, rivers flow from mountainous area to plains with a very high gradient compared with western countries. Over 70 per cent of the national land is mountainous and not suitable for farming, and most of it therefore remains as natural forest. Therefore, agricultural areas are located in scattered plains and basins, occupying only 14 per cent of the national land and competing with urban areas (Figure 1). High precipitation, which averages 1 750 mm annually and which is almost twice that of other regions (Figure 2), is concentrated in the very short summer period. In summer, high temperatures and humidity stimulate rapid growth and development of vegetation. These features are also commonly observed in other regions in the Asian monsoon climate zone.

It is obvious that, if the land in the Asian monsoon climate zone is left without appropriate management practices, water resources and surface soil would rapidly disappear towards the sea. Temperate and humid climates necessitate careful land management, otherwise abandoned land would result in the rapid growth of weeds and even outbreaks of potentially hazardous pests, and would deteriorate environmental conditions for a long time. Consequently, there has been a historical necessity for the people in the Asian monsoon zone to conduct environmentally sound agriculture in order to conserve their natural resources under the above-mentioned circumstances.

Characteristics of agriculture in the Asian monsoon climate zone

In the Asian monsoon climate zone, people have developed and established a unique agricultural system adapted to its natural conditions. Farmers have elaborated their agricultural system to improve and maintain productivity, and have consequently established a relatively labour-intensive system dominated by rice paddy fields. This system was evolved over a long time, together with very careful management of the surrounding environment. Moreover, since this system supports a greater population than other farming systems, it forms the basis of rural areas dominated by paddy rice farming as well as highly populated Asian communities.

Research has revealed many valuable functions and mechanisms of paddy fields. They can maintain a water-saturated condition for a long time and even throughout a whole season, during which time organic matter decomposes very slowly, soil fertility is well-maintained, there are few problems from continuous cropping, and there is little leaching of nutrients. These features are comparable and even superior to those of upland farming.

In addition, paddy fields have been built extensively on terraces carved into steep mountainsides. This type of artificial modification of terrain improved the conservation function of the national land by, for example, such as prevention of landslides and fostering of water resources. As rivers flow into their lower reaches, water resources are extensively and repeatedly utilised for irrigation and finally for city water and other urban use. Furthermore, paddy fields surrounding urban areas significantly contribute to the prevention of floods and land subsidence. On the whole, it can be easily recognised that the agricultural system dominated by paddy fields developed in the Asian monsoon climate zone is closely linked with urban areas in terms of water and land utilisation, and this environmentally balanced and highly sustainable system deserves to be maintained for the future.

Figure 1. Comparison of land use in selected countries

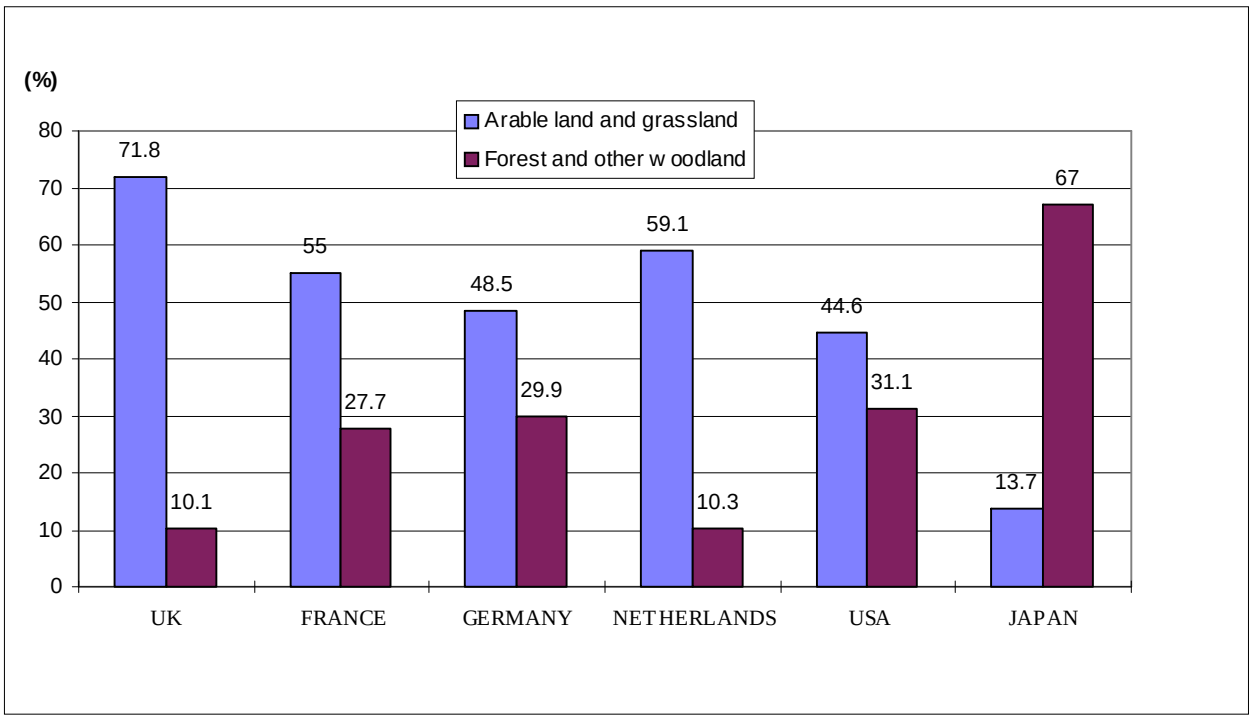
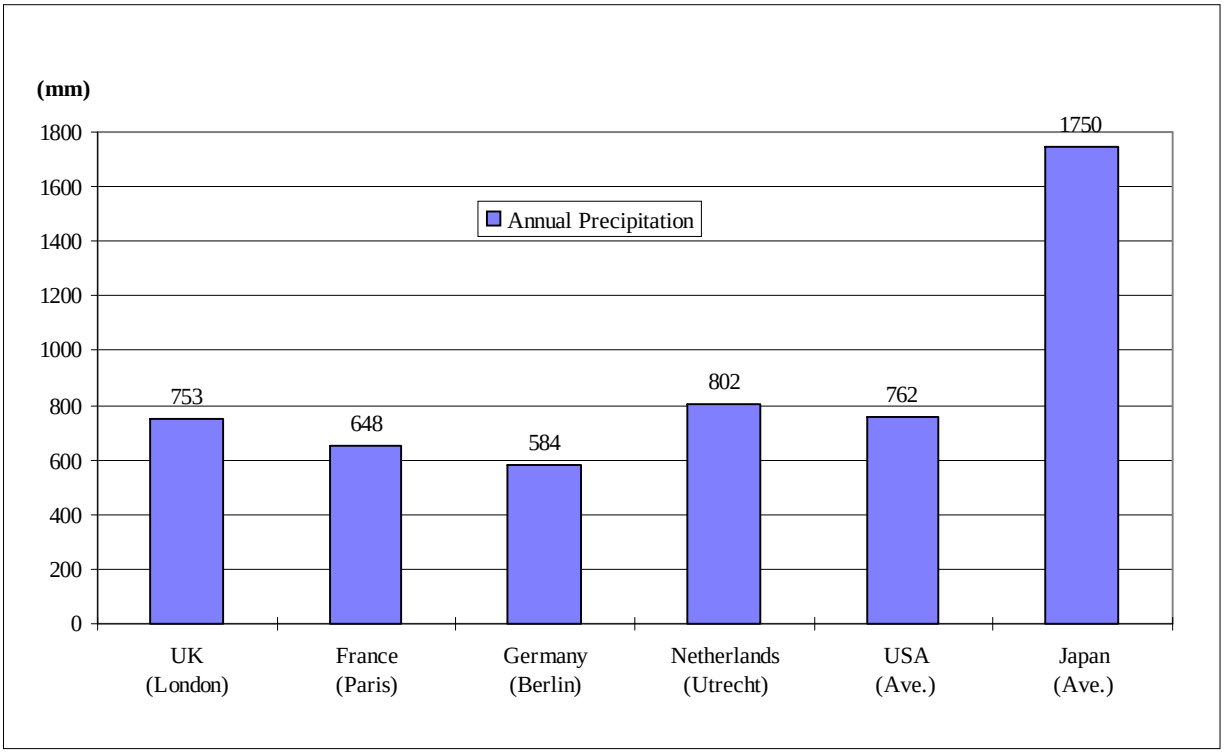


Figure 2. Annual precipitation in selected countries



An evaluation of land/environmental conservation functions of the land currently used for agriculture in Japan

Agricultural land has, in itself, beneficial effects on the environment when it is appropriately used and managed by farmers who endeavour to reduce the adverse effects of agriculture on the environment. The typical beneficial functions of agricultural land are described below.

Flood prevention

Cultivated areas and agricultural production facilities, such as dams, small reservoirs and irrigation/drainage canals, can receive and store a considerable amount of rain water in the short term and then release it gradually into rivers. As a result, flood damage in surrounding areas and downstream can be prevented or mitigated. Though both paddy and upland fields can hold water in their soil temporarily and ease acute increases in river flow, paddy fields in the Asian monsoon climate zone, which has a marked rainy season, can be considered to have the greater flood control potential, due to their "three-dimensional" structure.

Fostering of water resources

Rain or irrigation water supplied to agricultural land penetrates the soil and is stored as groundwater. Part of this water is then released slowly into rivers, thus contributing to the stabilisation of the flow of the river. Such a water flow system between agricultural land and rivers can retain water, which can then be used for multipurpose and to prevent drought in surrounding areas as well as in areas around the lower reaches of rivers. As paddy fields are submerged continuously during the irrigation period, the degree of penetration of water is much greater than in other land use. The contribution by paddy fields to underground water storage can therefore be considered to be very high.

Landslide prevention

Steep mountain areas, precipices and shelves are potentially vulnerable to natural disasters, such as landslides or debris flows caused by heavy rain. Even so, since paddy fields in sloping areas are terraced and are maintained by farmers' daily work, including cleaning and repairing the network of irrigation and drainage canals and levees, and increasing the impermeability of paddy field beds, they are much more resilient than sloping areas which are not dominated by paddy fields.

Soil erosion prevention

Surface soil can easily be eroded by water and wind, mainly from agricultural areas having low vegetation or from poorly-managed slopes. In contrast, well-managed paddy fields suffer very little from soil erosion by water because irrigated water can absorb the impact of rainfall and water flow. Even after a paddy field has been drained, as the water content of the soil is relatively high and its surface is covered by rice stubble, soil erosion by wind is only very slight.

Air purification

Crop plants produce organic matter by photosynthesis using solar energy and absorbing carbon dioxide from the air. In this cycle, plants also absorb air pollutants such as sulphur dioxide or nitrogen dioxide, thus purifying the air.

Climate moderation

On agricultural land, water evaporates through plants, from the surface irrigation water and through transpiration from crop plants, and heat is therefore absorbed. Through this heat exchange cycle on agricultural land, atmospheric temperature changes can be moderated. In particular, paddy fields are superior in cooling air temperature through the absorption of latent heat resulting from evaporation of irrigation water and transpiration by rice plants. This function is especially important in suburban areas which tend to form heat-islands.

Maintenance of biodiversity

Rural areas provide a large habitat for many wild species. Among species nominated by the Environment Agency as endangered, vulnerable or rare, 30-40 per cent of fauna and 40-50 per cent of flora have been found in rural areas. Maintaining biodiversity may help to reduce the effects of harmful weeds and pests and enhance the amenities in rural areas. There are also significant implications for education, culture, science, conservation of genetic resources, etc.

Formation of scenic landscapes and amenities

Agricultural areas provide both inhabitants and visitors with scenic landscapes formed through farmers' daily farming activities, as well as opportunities for recreation, relaxation and reflection. Furthermore, they also form and preserve habitable areas with in a calm and pleasant environment, and preserve the unique culture and traditions accumulated through their long history. Thus, as providers of not only food but also the above-mentioned functions, agricultural areas have various values significant to both rural and urban people.

Other functions

Agricultural areas can also serve as escape zones for disasters. Moreover, many flat areas in Asia are located in alluvial plains and retain a high water content; therefore, the fact should not be ignored that paddy fields considerably recharge groundwater into those areas and thereby prevent the subsidence of land.

Approach to quantifying the environmental benefits of the agricultural system

Many of the functions characterised in the above paragraphs are very typically observed in paddy fields in the Asian monsoon climate zone, although some are observed in agricultural fields in other regions, too. The Integrated Study for Maintaining and Improving the Beneficial Functions of Agriculture, Forestry and Fisheries on Natural Resources and the Environment was implemented to develop evaluation methods for the multifunctions of agriculture and forestry from 1982 to 1987. In the

study, our researchers developed a method of an evaluating land/environment conservation functions and made a series of maps showing the distribution of these functions which shows a part of the results which has been incorporated into the third edition of the 3-dimensional 1 kilometre-lattice Numerical Data Information on National Land with some modifications by new data and findings.

The maps indicate that the water fostering function is higher in the coastal plains facing the Sea of Japan where paddy fields are extensively exploited and the soils have a relatively high permeability. In the same manner, the function of preventing soil erosion is higher in the areas with low precipitation, and that of preventing landslides is higher in paddy fields in flat areas and upland fields.

A consideration of the environmental functions of paddy fields in the Asian monsoon climate zone

Recently, in most advanced countries, growing concern has been focused on the increase in the adverse effects on the environment of agricultural inputs such as fertilizers and pesticides. To some extent, this is the case in the paddy fields in the Asian monsoon climate zone. However, it should be emphasized that such effects in paddy fields in this zone are markedly less than those in agricultural fields in other climate zones.

Since soil in paddy fields under water-saturated conditions becomes reductive, the oxidation process in soil layers and the nitrification of ammonium nitrogen by bacteria are very limited. As a result, ammonium nitrogen is absorbed into soil particles and hardly leached into the ground. Nevertheless some amount of ammonium nitrogen will be converted to nitric nitrogen especially near the soil surface and rhizosphere. However, such nitric nitrogen is easily converted to gaseous nitrogen which is the most predominant component of atmosphere through the denitrification process. However, levees surrounding paddy fields effectively restrict the runoff of soil particles from the soil surface which would otherwise be potential pollutants in irrigation channels and rivers. In addition, phosphorus is usually absorbed by soil particles, especially when volcanic ash is a predominant constituent of a paddy soil and, as the soil under water-saturated conditions becomes reductive, phosphorus gradually becomes available to rice plants.

As an overall consequence of the chemical, biological, pedological and hydrological processes, it is well-recognised that adverse effects of paddy fields on the neighbouring environment are very limited compared with those of upland fields (Table 1). Our survey revealed that the nitric nitrogen content of underground water near paddy fields was remarkably low, regardless of considerable nitrogen fertilizer application. It is obvious that paddy fields have a filtration capacity for irrigation water especially with regard to nutrients.

People in most agricultural areas in the Asian monsoon climate zone have wisely developed an ecologically and environmentally sound farming system regardless of the comparatively intensive resource input. A very typical land utilisation pattern in these regions is that animal husbandry, fruit, vegetables and other upland crops occupy the relatively high altitudes and rice is planted at lower altitudes. This arrangement minimises the adverse effects of agricultural chemical application on upland fields, as the runoff and discharge from upland fields can be re-utilised by rice plants usually located at lower levels. There is some indication that inappropriate treatment of livestock waste and excess use of chemical materials in intensively developed farming systems causes environmental problems in particular areas. However, the extent of the problem can be markedly alleviated through a material circulating rational land utilisation (Hasegawa *et al., 19*85) (Yokohari and Kato) (Figure 3). This unique linkage between upland fields and paddy fields could lessen many environmental problems such as nitrate contamination in groundwater which is now the major problem concerning agriculture in most developed countries.

Figure 3. Successive changes in nitrogen (nitrate) efflux according to land use changes

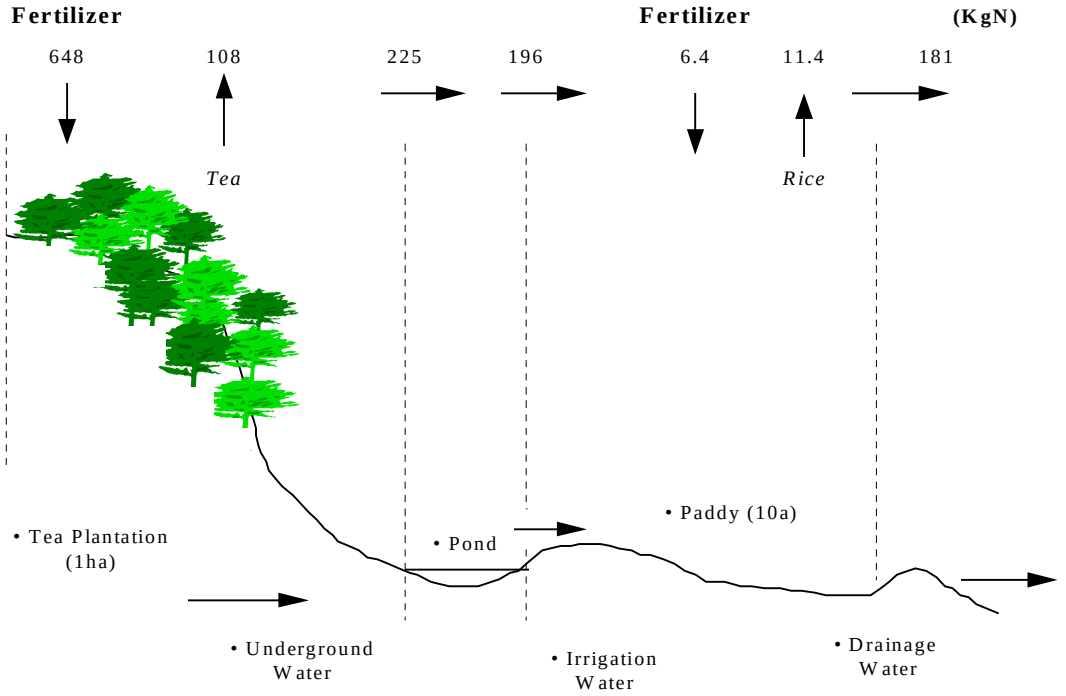


Table 1. Nitrate concentration in underground water according to the pattern of agricultural land use (mgNO–N/l)

Site	Number of Samples	Minimum	Maximum	Mean	Land Use Pattern
A	5	7.3	17.0	10.9	Field crops
B-1	4	16.9	32.2	23.8	Tea field
B-2	1			29.2	Tea field
B-3	1			13.2	Tea field
C	4	8.7	17.2	12.2	Intensive cropping field
C’	18	10.9	25.1	17.2	Intensive cropping field
D	120	2.3	48.5	21.3	Field crops with livestock
E	20	21.7	110.7	46.0	The vicinity of livestock lots
F	5	1.0	3.1	2.1	Ume (Japanese apricot) orchards, mountainous area
G	1			75.6	Upland field
G’	1			0.9	Field crops in a paddy field (adjacent to G)
H	5	1.5	1.8	1.7	Rice paddy field
I	5	0.1	0.8	0.5	Rice paddy field
J	5	0.2	1.9	0.5	Rice paddy field
K	5	0.9	1.4	1.0	Rice paddy field
L	5	0.3	1.2	0.6	Rice paddy field
M	5	0.2	0.5	0.3	Rice paddy field

Paddy fields contribute to the protection of the lowland environment as well as the surrounding environment through other functions such as preventing soil erosion, landslides, and floods, and fostering water resources. They have been developed in the Asian monsoon climate zone since the prehistoric age and are still a very predominant part of land utilisation. There exists a scientific rationale for the establishment of paddy fields in the Asian monsoon climate zone as a very environmentally sound and sustainable agricultural system with relatively high productivity through the intentional or unintentional efforts of many generations.

2. Possible changes in environmental benefits resulting from a decline in agriculture

Changes in land/environment conservation functions resulting from an abandonment of agricultural land

As explained in the previous Chapter, agricultural land performs various functions relating to the conservation of land resources and the environment, and it is important to bear in mind that these functions can be maintained solely through appropriate farming practices. According to the results of the program mentioned above (under the heading "Approach to quantifying the environmental benefits of the agricultural system"), we estimated the possible changes of the land/environment conservation function by assuming an 80 per cent decline in plant cover in abandoned land and presented the distribution of these changes in the maps.

The maps show that, in terms of water fostering, flat land and land on gentle slopes have a high value, and, in terms of preventing soil loss and landslides, mountain ranges with steep slopes and a high rate of rainfall in the central part of Honshu island and in the southern regions, have a high value. These results indicate that the abandonment of agricultural land has a very negative influence on land/environment conservation functions.

Changes in environmental benefits resulting from agricultural recession and consideration of forestation as an alternative land use

In Japan, the population is concentrated for the most part in relatively small flat areas, and urban areas have been enlarged by encroaching upon agricultural land especially in low and flat areas. On the other hand, hilly and mountainous areas have been extensively cultivated, and have provided food to rural areas. However, conditions such as small partitions and difficulties of mechanisation, have gradually resulted in an abandonment of agricultural land use in these areas.

Possible changes in urban areas

In recent years, in accordance with the progress of urbanisation, suburban agricultural areas, especially those in low and flat land, have been decreasing their acreage. Therefore, the flood prevention function of this agricultural land has been declining and torrential rain can cause a rapid increase in water effluence. Responding to these phenomena, some municipal governments have attempted to improve flood control capacity in urban areas through the concrete lining of rivers, construction of underground ponds and water ways, etc. However, these measures are not sufficient and many medium- and small-sized rivers still frequently flood in urban areas. It is argued that artificial regulatory reservoirs are necessary to compensate for the decline in flood prevention function in the areas.

At the same time, urban and suburban local administrations have begun paying attention to the careful use of the flood prevention function of remaining agricultural land, and it has become one of the important issues of the day. In fact, some municipal governments are implementing projects to maintain or conserve paddy fields mostly for the purpose of maintaining their flood prevention function. The function of air purification and climate moderation is another important environmental conservation function of urban agricultural land. This is because the concentration of NOx and SOx and the temperature become higher than in surrounding areas owing to the "heat island" phenomenon of urban areas. The decrease in agricultural land in urban areas means an immediate decline in this function.

When we consider the conversion of urban agricultural land (especially paddy fields) into other forms of land use, woodland is one option which may be effective from the viewpoint of environmental conservation. However, in the case of Japan, it requires very careful consideration, as most abandoned agricultural land is diverted into building lots under the current supply-demand situation of land use (Table 2). In addition, woodland has a lower water purification function than paddy fields. Moreover, the disordered conversion of paddy fields will hinder the functions of the irrigation and drainage canal network, and its water purification function.

Table 2. Changes in conversion of agricultural land to other use in Japan

(Unit:ha)

Year	Total Area	Housing	Mining and Industries	Schools	Parks and Play-grounds	Roads, Water-ways and Railways	Other Buildings	Affore-station	Others
1988	21 670	7 176	4 423	110	133	172	6 372	1 801	1 483
1989	25 018	7 878	5 335	96	173	178	7 111	2 427	1 821
1990	27 022	8 015	5 859	160	145	176	7 941	2 670	2 057
1991	27 774	8 235	6 010	100	161	188	8 742	1 880	2 459
1992	26 542	8 047	5 278	106	134	181	8 805	1 576	2 414
1993	23 296	7 909	4 577	99	126	164	6 627	1 276	2 517

Possible changes in hilly and mountainous areas

With regard to the effect of abandoning the conservation and control of terraced paddy fields in hilly and mountainous areas, and in particular with regard to the flood prevention function, an analytical study based on scientific data suggests that the frequency of peak water outflow caused by torrential rain, which appears once in 50 years if the land is kept as terraced paddy fields, will be doubled (Hayase, 1982). Regarding soil loss, it is proven that, by not cultivating farm land for six years the amount of soil loss increases by 80-90t/ha/yr compared with the case where the land is maintained as agricultural land (Table 3). Soil loss increases by 19t/ha/yr (in the sixth year) in the case of a terraced paddy field being diverted into a white oak groves (Ida *et al.*, 1988). In addition, water storage in terraced paddy fields, three-dimensional water conservation controlled by underground water percolation, and the accompanying water circulation function of terraced paddy fields can be disrupted to a great extent by abandonment.

Table 3. Effect of land use changes on soil erosion

Changes in Land Use			Annual Erosion t ha^{-1}
1989	→	1995	
Paddy		Pastureland	11.9
Upland		Pastureland	11.4
Paddy upland		Wasteland	92.7
Pastureland		Wasteland	43.2
Wasteland		Wasteland	10.1
Pastureland		Pastureland	7.2
Paddy		Paddy	2.8*
Upland		Upland	8.3**

* including 2 t yr-1 of soil which was supplied for slope maintenance.
** including 8 t yr-1 of soil restored.

As described above, while terraced paddy fields in hilly and mountainous areas have a high land/environment conservation function, forestry also rates highly for this function. Therefore, there is an opinion that even if we abandon rice production in terraced paddy fields, there should be no problems in terms of environmental conservation if the land is converted to forest. However, unlike the agricultural land in Europe and North America which was developed by reclaiming woodland, many paddy fields in Japan were established in inundated areas which are not ecologically adaptable to the cultivation of wood species. Moreover, forestry in Japan is managed by farmers (i.e. agriculture and forestry are managed together), and profit from forestry itself has declined significantly. Therefore, we can no longer expect good management of forestry under the current situation of declining agriculture. Furthermore, in humid and warm climates, a considerable labour input is necessary, involving, for example, undergrowth cutting, for forests to reach an ecologically stable state.

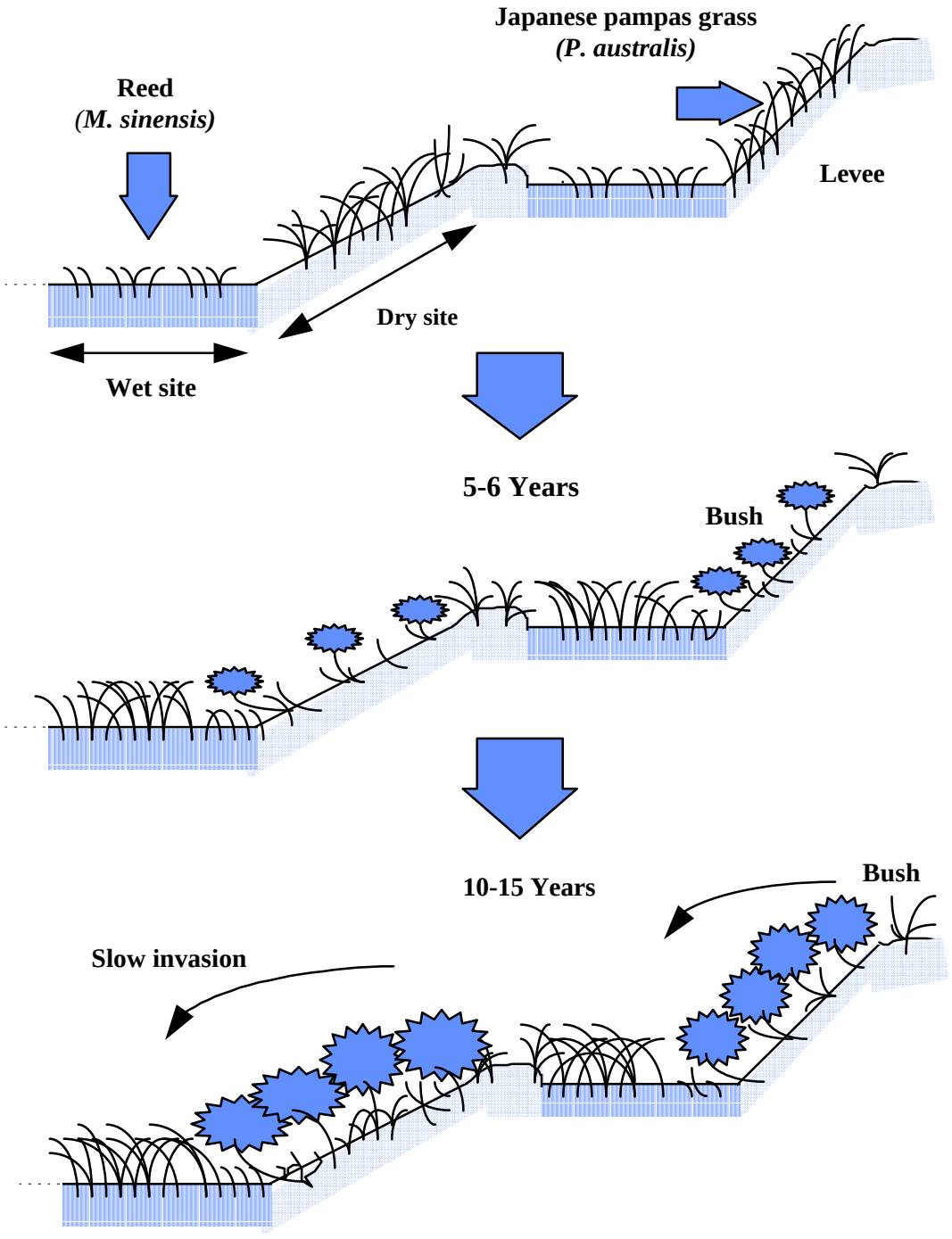
Moreover, many ecological studies show that natural vegetation takes several decades to reach to a maximum stage of succession, and it can be easily assumed that, judging from the succession process of vegetation in abandoned agricultural land, paddy fields would require more decades to establish an ecologically stable stage and to recover a land/environment conservation function at the same level as that of the original paddy field (Figure 4). Taking also into consideration that landslides and floods are sure to occur during the succession period, abandoning terraced paddy fields and conversion to forests may give rise to many such problems.

3. Discussion on policies for enhancing and maintaining the environmental benefits from agriculture in Japan

The necessity of policies for the enhancement and maintenance of environmental benefits of agriculture

As seen in Section 1, management of national land, including regional societies and cities, as well as the food supply, is based upon paddy field farming in monsoon climates. This role of agriculture has basically remained un-changed through the various stages of economic development, and should not be ignored in discussions on significant roles of agriculture in monsoon climates. In this context, the environmental benefits in Asian monsoon agriculture are attributable to the management of water and soils, whereas those in Europe and North America are exclusively attributable to landscape and biodiversity which, in turn, are related to socio-cultural factors.

Figure 4. Phasal changes of vegetation in terraced paddy fields after abandoning cultivation



Asian monsoon agriculture has a "public goods" nature since its environmental benefits spread over broad areas, including downstream areas where urban people live. In Japan, agricultural policies have been formulated to conserve these environmental benefits which have been generated as a result of sound agricultural production. In other words, rural promotion policies, including production promotion policies, have resulted in sound agricultural production practices and this, in turn, has encouraged the maintenance of agricultural land in an environmentally beneficial way. The set-aside programme for rice proves this assumption. Since the loss of land conservation functions of paddy field farming (in particular flood prevention, preservation of water resources and prevention of landslides and erosion), was anticipated as a result of the programme, environmental provisions were made in order to prevent environmental degradation.

Recently, while interest in the environment has been growing among the Japanese, adverse effects on the environment due to agricultural policy reform, including the implementation of the Uruguay Round Agreement on Agriculture, have been observed. These changes have raised broad and lively discussion on how best to promote the environmental benefits of agriculture. The time has come to consider policy measures focusing on the enhancement and maintenance of the environmental benefits of agriculture in Japan.

It is recognised that a reduction in agricultural protection through agricultural trade liberalisation has caused a depression in agriculture, leading to the abandonment of farm land. This also causes the loss of environmental benefits — especially in disfavoured areas — and difficulties in the maintenance of rural society. As a result of these changes, the argument that policy intervention for conserving environmental benefits is necessary is gaining in popularity.

Issues to consider in introducing policies focusing on the enhancement and maintenance of environmental benefits of agriculture in Japan

It is necessary to give consideration to the following points in introducing such policies:

- First of all, most of the environmental benefits of agriculture in Japan are lost when sound agricultural practices become extensive or are abandoned. As seen in Section 1, functions such as flood prevention, fostering of water resources and prevention of landslides and soil erosion are realised through appropriate farming practices, including production, which manage agricultural land in an environmentally sound manner (e.g. through management of paddy field ridges). Abandonment, extension management, or even a disordered diversion of crops causes loss of environmental benefits. In particular, abandonment of farming in the Asian monsoon climate zone causes rapid growth of weeds, an increase in pests, and in order to control weeds and pests, it may invite non-sustainable practices which increase the burden on the environment. Bearing in mind the fact that agricultural activities and their environmental benefits are inseparable, policies to maintain appropriate agricultural production and land management activities are required.

- Secondly, it would be very difficult, or would require huge public expenditure, to maintain the environmental benefits of agriculture in Japan by alternative land use, such as forest. In flat suburban areas, it is highly likely that, due to high demand, abandoned farm land will be used for housing and industry which have low environmental benefits. On the other hand, in hilly areas, it takes several decades until afforested land realises sufficient environmental benefits. In both cases, therefore, additional administrative costs to preserve the environmental benefits which farm land has provided will increase significantly despite the government's current difficult financial situation.

- Thirdly, the so called "voluntary, co-operative approach" is not an appropriate policy measure to preserve the environmental benefits of agriculture, given the fact that current beneficiaries exist in broad regions, including downstream urban areas. Certainly, there are several successful examples of the voluntary approach, such as direct marketing contracts between rural farmers and urban consumers to conserve terraced rice paddy fields. It is obvious, however, that this approach will not cover all rice fields, which play a significant role in terms of environmental conservation.

- Finally, several problems have to be solved in examining the suitability of direct payments for environmental purposes in the context of agricultural policy reform.

One of the main concerns is the long time scale necessary to develop methods for quantifying the environmental benefits from agriculture in terms of monetary value. Furthermore, even if this measurement were possible, the implementation of direct payments would entail huge costs in countries like Japan, where many small farms exist, to estimate the exact payment to each farm, equivalent to the environmental benefits from each farm's activities. Another concern is the possible adverse effects of direct payments on farm size. Therefore, the degree of progress in structural adjustment, such as the distribution of farm size in each country, should be taken into account in introducing direct payments for environmental purposes.

4. Concluding remarks

This paper discusses the environmental benefits of agriculture, including rice farming, in Asian monsoon climates. In particular, it focuses on the characteristic benefits of rice production, such as flood prevention, fostering of water resources, prevention of landslides, and prevention of soil erosion. The paper also shows that the continuation of rice production with appropriate management is necessary to preserve environmental benefits, since those benefits cannot be gained by abandoning cultivation and set-aside, and that other land uses, such as forestry, cannot be substituted for rice production in order to preserve the same environmental benefits.

Considering the fact that the role of agriculture in national land management, including the interaction between rural and urban areas, varies according to the nature and climate of regions, flexibility should be retained in the choice of policy measure to preserve the environmental benefits of agriculture. As far as Japan is concerned, we consider it important to maintain the environmental benefits from agriculture by focusing on the following: i) maintenance of appropriate agricultural activity through regional development policies, including agricultural production promotion policies; ii) development of methods to quantify various environmental benefits from agriculture, such as water and soil management and amenities; iii) development and extension of labour-saving technologies of land management for land and environmental conservation, e.g. the method of acreage reduction; and iv) promotion of settlement in rural areas by improving rural life through investment in infrastructure.

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KOREA: SUSTAINABLE SOIL MANAGEMENT BY FARM PARCEL

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Introduction

With social interest in increased production for our staple food, during a period of chronic deficit of food in the 1950s, the government began to survey Korean soils for fertility improvement with the goal of food self-sufficiency. Results showed that Korean soils are mostly sandy, low in organic matter content and fertility, and susceptible to erosion due to violent summer typhoons; many areas having a slope greater than 60 per cent. The government executed several long term soil survey and fertility projects. Much care was given to the improvement of low productive soils occupying more than half of Korea's arable lands. Soil improvement, development of new high yield varieties, and a sufficient application of chemical fertilizer made it possible for Korea to achieve self-supply rice. In this way, the government recommended the application of complex fertilizers for balanced fertilization, inducing farmers to use a lot of concentrated fertilizers for their major field crops and cash crop vegetables in the greenhouses. Through recent monitoring of arable land fertility, however, it was found that excessive fertilization has resulted in salt accumulation from fertilizers in some soils and agricultural practices of conservative low input are required again to avoid environmental problems and to sustain their productivity, especially for greenhouse soils and erosion susceptible upland soils on sloping areas. A new five year soil survey and testing project for farm parcels is being executed to manage soil sustainably for simultaneous achievement of productivity maintenance and environment conservation. The project also focuses on the global movements following the 1992 Rio Conference (UNCED). This report introduces the present soil management related to sustainable agriculture practices for conserving environment and productivity.

1. Soil survey and soil improvement

Korean soils have been dominantly formed from acidic rocks of coarse texture, such as granite and granitic gneiss under a humid temperate climate. Most soils are developed on mountainous and hilly areas. More than 70 per cent of the annual rainfall of 1 400 mm is concentrated in showers in July and August. Such unfavourable soil conditions have made the soils acidic and infertile. Soil surveys have scientifically confirmed the above mentioned facts. This modernised soil survey began in 1964 to increase staple food production with the collaboration assistance of FAO and was completed in 1967. The results were published in nine provincial soil maps covering the entire country of 9 848 million hectares on a scale of 1:50 000, and have been utilised for higher level national development programmes.

The reconnaissance survey, however, was not satisfactory for agricultural purposes, because the large number of soil classifications and the least mapping unit was too large at 6.25 hectares. These short comings made it necessary to obtain more detailed soil information. Therefore, a detailed soil survey was

conducted from 1966 to 1990. The results were published with the detailed soil maps on a scale of 1:25 000 for 137 counties. The maps included various fundamental data of soil resources, establishing 378 soil series which were categorised into six soil types of paddy and upland. Most soils types belong to low productive soils occupying 68 per cent of paddy and 58 per cent of upland (Table 1).

Table 1. Distribution of low productive soil types on paddy and upland

Paddy	Extent (per cent)	Upland	Extent (per cent)
Normal	31.9	*Normal*	42.3
Low Productive:	68.1	*Low Productive:*	57.7
Sandy	31.9	Sandy	23.0
Unmatured	23.0	Unmatured	17.5
Wet	9.1	Clayey	13.9
Salty	3.9	Volcanic Ash	2.2
Acid Sulphate	0.2	Highland	1.1

These low productive soils need to be improved. Therefore, the highly detailed soil survey and improvement project for every farm parcel of paddy was performed from 1980 to 1989. This 10 year plan of integrated soil improvement has significantly contributed to increase in crop production capacity. A soil survey was carried out on every farm parcel of paddy covering 1 391 million hectares and soil testing was done on 617 000 samples from 6 701 million farm parcels, and recommendations for fertilization were issued to every farmer based on soil survey and chemical analysis. Through the project, sandy soils were improved by adding fine clayey earth, totalling 661 000 hectares, unmatured soils of 6 684 million hectares were deeply ploughed, and poorly drained soils were amended by drainage installation. The low productive soils of paddy were ameliorated to some extent by these integrated improvements.

Table 2. Changes in soil chemical properties in the last three decades

	Decade	pH (1:5)	OM (g/kg)	K	Ca	Mg	Available phosphate	Available silicate
				--(cmol)/kg--			---mg/kg---	
Paddy	1960	5.5	26	0.21	4.5	1.8	60	78
	1970	5.9	24	0.3	4.4	1.7	88	
	1980	5.7	23	0.3	3.8	1.4	107	88
Upland	1960	5.7	20	0.3	4.2	1.2	114	-
	1970	5.9	20	0.5	5.0	1.9	201	-
	1980	5.8	19	0.6	4.6	1.4	231	-

During the integrated soil improvement project, potash, phosphate and silicate contents were gradually increased in both paddy and upland soils (Table 2). This is mainly due to application of a large amount of chemical fertilizers and soil amendments. We understand that a major factor in increasing crop production has been due to the increased use of chemical fertilizers which were sufficiently supplied at low prices. Fertilizer price occupied only 6.2 per cent among rice production cost in 1985, however, it gradually decreased to 4.1 per cent in 1994. The ratio of rice market price to fertilizer was 9.5 in 1985, but

jumped up to 35.9 in 1996. The low fertilizer price policy accelerated the use of chemical fertilizers resulting in an increase in salt accumulation in some soils.

2. Recent problems in soil management

Although high levels of chemical and mineral fertilizers used have increased agricultural production, they also led to surface or ground water contamination and accumulation of nutrient components in soils. Therefore, soil quality monitoring is required to monitor changes. On the bench marked (samples) soils of paddy, upland, orchard, and greenhouses, the changes of soil fertility were tested every four years. In addition, the remnant components of agro-chemicals, polluting heavy metals, nitrate nitrogen (NO_3-N) are determined in agricultural products and waters. Unbalanced nutritional feature in soils has become serious due to the overuse of chemical fertilizers especially, concentrated compound fertilizers of 21-17-17 and 17-21-17.

Table 3. Present soil chemical components and their optimal ranges

Chemical Components	Paddy Soils		Upland Soils	
	Average	Optimal	Average	Optimal
pH (1:5)	5.6	6.5	5.5	6.5
Organic matter (g/kg)	25.0	30.0	24.0	30.0
Phosphate (mg/kg)	128.0	100.0	538.0	300.0
Potash (cmol/kg)	0.32	0.30	0.64	0.50
Calcium (cmol/kg)	4.0	5.0	4.2	5.0
Silicate (mg/kg)	72.0	130.0	-	-

Table 4. Yearly changes in soil fertility after greenhouse cultivation

Chemical Components	Year				
	0	1	2	3	4
pH (1:5)	4.4	6.6	6.9	2.2	7.2
Organic matter (g/kg)	9.0	16.0	23.0	24.0	31.0
Phosphate (mg/kg)	368.0	786.0	850.0	1020.0	1230.0
Potash (cmol/kg)	0.24	0.6	1.35	1.6	3.3

The excess application of mineral and organic fertilizers induced the pronounced increase of available phosphate and exchangeable potassium in soils. Salt accumulation is remarkable in greenhouse soils mostly due to overdoses of chemical and organic fertilizers. Optimal soil concentration is 300 mg/kg for phosphate and 0.5 cmol/kg for potash. For green-house cultivation soils, the phosphate content is 77 per cent higher than optimal, and potash in 56 per cent higher than optimal (Tables 3 and 4).

Another constraint in soil management is an increased inflow of wastes into arable land. Recent rapid development of industry and urbanisation produced tremendous amounts of wet waste each year. Korea has imported over 10 million tonnes of feeding raw material and released 44 million tonnes of wet manure to the environment. NPK components in the wet wastes totalled 921 000 tonnes which is

equivalent to the total amount of annual chemical fertilizer consumption on a component basis in 1994 (Table 5).

Table 5. Yearly manure production and NPK component (1 000 tonnes/year)

Livestock	Production	Nitrogen	Phosphate	Potash	TOTAL[1]
Cow	29 936	156	78	172	
Pig	14 214	114	124	104	
Chicken	3 259	73	61	39	
TOTAL	44 409	343	263	315	921

1. NPK component

Recently, organic farming is prevailing as a type of sustainable agriculture in which farmers intend to produce high quality agricultural products. They believe the more organic fertilizer, the better the quality of their products. On some organic farms, organic fertilizers materials are applied at a rate of over 100 tonnes/ha/year resulting in phosphate, potash and organic matter accumulation in some soils which induce various deterioration of surface and ground waters, as well as the yield, the quality, and the storability of their products.

In Korea a large part of the land is occupied by sloping lands where traditional farming systems have evolved. Sloping land agriculture is managed on small plot sizes and poorly consolidated farms which are susceptible to soil erosion. Annual soil loss from 15 per cent sloping upland fields are about 30 tonnes per hectare. Soil loss is more sensitive on steep areas with poor soil properties. A typical example is the alpine vegetable area located at 850 meters above sea level. The soils in this area are poor, with shallow soil depth and a high content of gravel or stones and are barren except for the short plant growing period. Most topsoil was lost due to improper soil management during the heavy rainfall season, hence, parent materials are often exposed to the surface. Land consolidation preserving soils is prerequisite to reduce soil loss, however, its progress is slow, especially on upland.

3. Strategy for sustainable soil management

Aiming to help every farmer to manage their soils sustainably, the highly detailed soil survey was introduced for paddy during the 10 years of the integrated soil improvement project from 1980 to 1989. Following the soil survey, the problematic paddy soils were corrected farm by farm and optimal fertilization for farm parcels was recommended to every farmer based on the survey and chemical analysis of soil samples. In addition, land consolidation has greatly progressed through land size enlargement, plot shape rearrangement, new soil addition, and installation of irrigation and drainage ways in paddy fields. These projects greatly contributed to the improvement of agricultural environment on terms of land use, optimal fertilization, and rearrangement of paddy fields. But such a project for uplands was not initiated until 1994, even though the situation had changed so that soil survey and land consolidation for uplands became urgent due to the rapid growth of the economic value and the environmental effects of uplands. Now, cash crop production, livestock development, and greenhouse agriculture are spreading rapidly on uplands, where over-fertilization, water movement on and in soil, and erosion with the various polluting components make another environmental problem.

Sustainable soil management by every farm is essential not only for environment conservation but also for productivity maintenance. Soil improvement and fertilization should be based on the soil survey and testing results. Through this alertness, the accumulation of fertilizer salts in soil would be decreased without productivity loss. For the efficient planning of agriculture and guidance of farmers, a highly detailed soil survey and soil testing, on-site investigation of crop management, and the construction of geographical information system including soil and climatic data are essential.

From 1995, a highly detailed soil survey project was started for upland of 583 000 hectares on sloping topography of less than 15 per cent. This project is being conducted to maintain productivity in harmony with environment and ecological systems. The project includes evaluation of morpho, physicochemical properties of parcel soils for optimal land use, consolidation, and fertilization. Now, soil maps are being computerised with all the soil data, including cadastral maps. Rural county extension offices keep the packaged information diskettes, choose appropriate technologies, and disseminate them to farmers for soil management. 144 rural county extension offices are operating soil testing laboratories for soil samples from farm fields. Farmers are given information on fertilizer recommendations with the reports on soil quality, salt accumulation, amelioration techniques, and the required quantity of amendments. Fertilization based on the soil analysis improved various agricultural problems, including low productivity, salt accumulation, and even heavy metal pollution. Conservational land consolidation is being planned for erosion control of steep, sloping lands based on highly detailed soil survey results. The soil surveyors classify every farm by soil properties and topography, and describe proper conservation facilities, such as hillside ditch, grass and rock or stony barrier, farm road, open and subsurface drainage system. The government is planning to bring in new practices based upon this database.

After the Rio Convention, the strategies for soil management have gradually changed in Korea: from yield increasing, to optimisation for environment conservation; from crop basis fertilization, to the farm fertility basis; from chemical fertilizers, to a balance with organic fertilizers; from a national environment basis, to an international standard basis.

4. Environmental benefits of sustainable soil management

The environmental deterioration under high input agriculture is caused by nitrate movement into ground water, salt accumulation in greenhouse soils, phosphate rich soil erosion into reservoir, and inevitable doubled over-application of manure due to imported feed and food. To minimise environmental impacts of the recent high input agriculture, optimal fertilization is essential for the sustainable soil management.

In 1994, about 961 000 tonnes of chemical fertilizer was used through farmer's decision. It was calculated by NIAST that about 260 000 tonnes of chemical fertilizer could have been saved in 1995, if farmers had only applied as much fertilizer per crop, as had been recommended officially; and 419 000 tonnes could have been saved, if applied as determined by soil testing for every farm parcel (Table 6).

Ground water contamination in upland areas can be reduced by optimal fertilization, because over fertilization of nitrogen and potash deteriorate the quality of ground water and result in salt accumulation as well as acidification of soil. Moreover, heavy fertilization changes the properties of microbe flora in soil (Table 7).

Table 6. Comparison of actual fertilizer consumption to the estimation based on official recommendation by crop and by soil testing (1 000 tonnes)

Application Method	Nitrogen	Phosphate	Potash	TOTAL
Farmer's decision	475	222	264	961
Recommendation by crop	273	197	231	701
Soil testing by parcel	260	114	168	542

Table 7. Chemical and microbial characteristics as influenced by fertilizer application

Applicatio Method	pH	OM g/kg	P_2O_5 mg/kg	---Ex cation (cmol/kg)--- Ca	Mg	K	Na	NO_3-N mg/kg	EC dS/m	Pseu. 10^3	Bac. 10^4	Fus. 10^2
Farmer	6.3	30	1 294	7.9	3.2	1.94	0.66	564	7.5	19.2	64.5	6.4
Soil testing	5.9	20	699	4.7	1.3	0.64	0.30	112	1.3	65.8	86.1	0.2

The quality of ground water is liable to be influenced by fertilization in coarse textured paddy soil containing less than 15 per cent clay, which plays a significant role for percolation in paddy. In these soils, rapid percolation of water induces fertilizer loss into ground water and lowers water efficiency. On 661 000 hectares of coarse textured paddy, red clay has been added during the last 10 years to reduce the percolation and the leaching of nutrients. This method of soil improvement raise rice yields and contribute to sustainable agriculture.

Rice paddy is beneficial with respect to flood control, ground water storage and soil erosion removal. Rainfall of 2.4 billion tonnes can be kept on rice paddy of 1.2 million hectares in Korea, if flooded to 20 cm. Annual percolation of the flooded water on paddy soil is much greater than that of running water on upland, resulting in ground water storage of 15.7 billion tonnes/year, which is equivalent to percolation of 8.7 mm/day from all paddy for 150 days. The reservoir effects of paddy originated from surface storage and percolation reduces the peak discharge of rainfall, resulting in flood control effect.

The most beneficial point of paddy for environment conservation is that an erosion problem is negligible by paddy, because water run-off is possible only in water ways (Table 8). If erosion is negligible, phosphate eutrophication in reservoirs and rivers becomes negligible because of a negligible movement of phosphate rich surface soil on running water. But farmers recently want to grow cash crops on paddy or to reclaim paddy into orchard or upland, as influenced by the change of the agricultural economic situation after the Uruguay Round Agreement. Some farmers want even to abandon their paddy due to a shortage of workers in rural areas. The rapid changes without corrosion control measures may induce another problem for environment conservation.

5. Summary and conclusions

On the basis of soil survey and soil fertility testing initiated in the 1950s, various agricultural policies were executed for the fulfilment of staple food self-supply, including land use planning, recommendation of fertilizers, and improvement and consolidation of paddy fields. Recently, through the self-awakening of the importance of environment for welfare or as influenced by global movement for

environment conservation, the government has executed various projects for optimisation of fertilization, soil improvement, and paddy fields consolidation and continues to invest for highly detailed soil surveys and testing for fertilization without environmental deterioration. But some measures for environment conservation require the sacrifice of productivity, moreover, farmers want to decide all agricultural management by themselves following the change of the economic situation after Uruguay Round Agreement. The government must persuade them through accurate guidance based on scientific information and planning for the advance of sustainable agriculture in harmony with environment without the loss of productivity.

Table 8. Estimation of environmental benefits from paddy cultivation

Major Effects	**Estimated Benefits**
Flood control	2.4 billion tonnes of water Dam const. cost; Cost: $19 billion
Ground water storage	15.7 billion tonnes of water
Atmosphere cooling	46 billion litres of gas
Soil erosion control	26 million tonnes of soil, $250 million red earth
CO_2 recycling	
CO_2 removal	Chemical treat cost of $210 million
O_2 emission	Manufacture cost of $7.3 billion
Water clarification	
Other	
Natural nutrient supply	$77 million