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Preface

The report 'Ground for Choices: four perspectives for the rural areas in the European Community' is based on numerous preparatory studies, some of which were drawn up by independent experts, and some by staff of the Council. A large number of institutions both in the Netherlands and abroad were asked for their comments on the figures collected for this report. The studies involved mostly come from the Netherlands Scientific Council for Government Policy's (WRR) *Working Documents* series, and include the following titles:

D.D. van der Stelt-Scheele, *Regionaal beleid voor de landelijke gebieden in de Europese Gemeenschap; inventarisatie en evaluatie* (Regional policy for the rural areas of the European Community: inventory and evaluation - in Dutch); Working Documents no. W46, 1990.

H. Hengsdijk, *Karakterisering van de landelijke gebieden in de Europese Gemeenschap* (Characterisation of the rural areas in the European Community – in Dutch) ; no. W51, 1990.

M. Wijermans and J. Meeus, *Karakteristieke cultuurlandschappen van Europa* (Characteristic Cultivated Landscapes of Europe – in Dutch); no. W58, 1991.

Netherlands Research Institute for Recreation and Tourism, *Trends in Tourism and Recreation in the European Community. Outline Report*; no. W60, 1991.

G.H.J. de Koning, H. Janssen, H. van Keulen, *Input and Output Coefficients of Various Cropping and Livestock Systems in the European Communities*; no. W62, 1992.

D. Scheele, *Formulation and characteristics of GOAL*; no. W64, 1992.

J.D. Bulens, A.K. Bregt, *Crop production potential of rural areas within the European Communities, I: GIS and data model*; no. W65, 1992.

G.J. Reinds, H.A.J. van Lanen, *Crop production potential of rural areas within the European Communities, II: A physical land evaluation procedure for annual crops and grass*; no. W66, 1992.

G.J. Reinds, G.H.J. de Koning, J.D. Bulens, *Crop production potential of rural areas within the European Communities, III: Soils, Climate and Administrative Regions*; no. W67, 1992.

G.H. de Koning, C.A. van Diepen, *Crop production potential of rural areas within the European Communities, IV: Potential, water-limited and actual crop production*; no. W68, 1992.

H.A.J. van Lanen, C.M.A. Hendriks, J.D. Bulens, *Crop production potential of rural areas within the European Communities, V: Qualitative suitability assessment for forestry and fruit crops*; no. W69, 1992.

Other studies:
M. Creemer, *Natuurbeheer in Europa. Een inventarisatie van doelstellingen, methoden en kosten van inrichting en beheer in beschermde gebieden in de landen van de EG* (Nature conservation in Europe. An inventory of aims, methods and costs of arrangement and management of protected areas in the member states of the European Community – in Dutch); report on a period of practical training, 1990.

N.T. Bischoff and R.H.G. Jongman, *Development of rural areas in Europe: the claim for nature*; WRR, forthcoming.

The report was drawn up by an internal WRR project group made up of Council members Prof. R. Rabbinge (project chairman) and Mrs. Dr. M.A. van Damme-van Weele, and staff members J.C.F. Bletz, H.C. van Latesteijn (project secretary), D. Scheele and Mrs. Y.M.M. Starrenburg. H. Hengsdijk and Mrs. E.C.A. Bolsius (who works at the National Physical Planning Agency) were also involved in much of the group's work.

The Council is very grateful for the cooperation showed by so many institutions during the drawing up of this report. In the Netherlands these included the Bureau voor Buiten Architectuur (BBA – Landscape Architecture and Research), the Centre for Agrobiological Research (CABO-DLO), the Netherlands Research Institute for Recreation and Tourism (NRIT), the National Physical Planning Agency, the Economic Research Institute (SEO), the central government Agricultural Research Department's Staring Centre (SC-DLO) and the Department of Rural and Urban Planning at Wageningen Agricultural University (LUW).

Special thanks go to Prof. J. de Veer, former director of the Agricultural Economics Research Institute in The Hague, for his advice on and criticism of earlier versions of the text.

Executive summary

In its programme for the period 1988-1992 the Netherlands Scientific Council for Government Policy (WRR) announced that it would be conducting a study on the future of rural areas in the European Community. The reasons behind this decision were:

- the structural increase in agricultural productivity, which means that growing surpluses are being produced on the land already under cultivation;
- the prospect that the possibilities for further technical improvements to increase productivity have by no means been exhausted, which means that future production levels could far exceed those of today;
- the forecast growth in the budgetary burden on the Community if policy is not amended;
- the growing social pressure for attention to be devoted to matters other than productivity, such as the sustainable protection of the environment, nature and landscape.

As a result of these developments the member states of the European Community, and therefore also the Dutch government, have been confronted with the need to make strategic choices concerning the future of agricultural areas.

Structure of the report

This report contains four model scenarios for land-based agriculture and forestry in the European Community up to approximately 2015. These are not forecasts, but technical surveys which define the limitations of *every* future development. The scenarios indicate how land can best be used in rural areas, depending on the choices which ensue from a number of different philosophies for the future. Four strategic philosophies based on the main positions in the current debate on European agricultural policy are used to construct four scenarios:

- scenario A: free market and free trade;
- scenario B: regional development;
- scenario C: nature and landscape;
- scenario D: environmental protection.

Outcomes

The outcomes of the four scenarios differ by a factor of 2 to 7 in terms of the amount of land required, costs, employment, and use of fertilisers and pesticides. They also differ greatly from the current situation.

The Council regards these differences as significant for policy in two ways. Firstly, the differences between the scenarios are important for policy (particularly that on European agriculture). Widely varying policy options lead to widely varying results. This means that policymakers must constantly take account of the goals they want to achieve, including when they come to choose instruments. The changes recently agreed in Brussels – a reduction in price supports and an increase in land-related and income subsidies – will, in the view of the Council, have little effect on long-term developments. They will not solve the basic problems and offer little scope for exploiting new opportunities.

Secondly, the four scenarios unmistakably point to a number of structural developments in land-based agriculture and forestry, which will have to be catered for in future policy. According to the Council, these developments are:

- a continuing rise in productivity in the agricultural sector which will eventually reach objectively defined ceilings;

- increasing land surpluses, irrespective of policy;
- a further loss of jobs in agriculture;
- good possibilities for more environmentally friendly agricultural production;
- sufficient land is available to achieve a tentative ecological main structure at the level of EC-12 as the 'backbone' of nature.

In all cases, policy which is not geared to reducing the amount of land under cultivation would appear to be counterproductive. Opting to keep land in production artificially, partly in an attempt to 'artificially' preserve jobs, would hinder the creation of new structures in the sector, thereby also frustrating environmental and technical improvements which have been made possible thanks to technological progress.

Recommendations

This report, which is essentially a technical study, does not give rise to recommendations which can be translated into specific measures, but simply sets out a research and policy agenda.

Further study in specific areas should focus, among other things, on the consequences of the expansion of the Community to include important agricultural producers in central and eastern Europe. The Council believes that this would emphasise the signalled developments.

As far as the policy agenda is concerned, the Council would urge that the report be used as a framework for decision-making. Its findings offer starting points for a more fundamental approach, at both national and European level. The need to pursue an active land policy is at any rate clear.

Contents of the report

Chapter 1 presents an overview of the report containing its most important outcomes. It can therefore be regarded as a document in its own right. Chapters 2 to 6 examine the individual parts of the study in more detail. *Chapter 2* describes the positive and negative aspects of the boom in European agriculture. *Chapter 3* contains the methodology. It explains how options for policy aims are combined with technical information on potential production levels and techniques and how, using a model specially developed for this type of problem – GOAL (General Optimal Allocation of Land use) – contrasting scenarios for future land use in the EC have been drawn up. *Chapter 4* summarises the results of a large number of smaller studies carried out by various institutes and university departments for the Council. *Chapter 5* contains the core of the report – the four model scenarios in which, on the basis of the information gathered, the optimal allocation of agricultural land is presented in the light of the various political philosophies concerning the future of Europe's rural areas. *Chapter 6* looks at how a number of policy goals which could not be included in the scenarios (relating to nature and landscape) can be achieved. Finally, in the *Afterword*, the Council elaborates on the analyses and outcomes in the report.

Land use in the EC: Policy options

1

1.1 Introduction

Agriculture in the European Community is becoming ever more productive. The combination of better production conditions, increasing knowledge of cultivation techniques and high-yielding varieties have led to a period of growth whose end is not yet in sight. Even greater productivity may be expected in the future as a result of technological innovations (biotechnology).

There are many sides to this picture. There has undoubtedly been resounding success in this field. 'Guaranteed' agricultural production, the primary objective of the European Common Agricultural Policy (CAP), has been achieved. However, if one carries this increase in productivity to its logical conclusion, a more sombre picture emerges. There has already been a dramatic rise in the costs of the agricultural policy; there is conflict with important trading partners over the subsidised dumping of EC surpluses on the world market; the market is distorted, mainly to the detriment of developing countries; and there are increasing environmental problems resulting from current intensive production methods. If we carry on along the same lines, these problems will become intractable.

It is therefore generally recognised that the CAP must be reformed. However, it is not clear what form this reform should take. The reforms recently agreed in Brussels have been hailed as a breakthrough [1]. This is certainly true as far as pricing policy is concerned. A 29 per cent fall in grain prices over three years is not inconsiderable and would bring European prices into line with those on the world market. However, the compensation scheme for land taken out of production leaves the basic problem untouched, since there was no fundamental debate on the *aims* of the policy and the changes were almost exclusively limited to the instruments used. There was inadequate discussion of the extent to which these goals – and/or any adjustments deemed necessary – give rise to a need for a policy review.

The present report aims to contribute to a fundamental debate of the issue. It therefore presents an analysis of possible variations in land use within the EC up to the year 2015. Using the linear programming model GOAL (General Optimal Allocation of Land use) developed by the Council, the project group examined where, depending on various policy options, land should be used for agriculture and forestry and what methods should be employed to achieve certain combinations of policy goals as effectively as possible. The allocation of land use would thus be guided by the relative value attached to different policy goals. The pattern of land use was determined which emerges when priority is given to varying policy aims relating to employment, the environment and economics, assuming a certain level of demand for agricultural products and use of the best technical means currently available. This gave rise to a sometimes radical reallocation of production.

Since the differing values placed on goals determines outcome, the chosen approach made it possible to devise possible scenarios corresponding to contrasting political *philosophies* about the desired policy on land-based

[1] Commission of the European Communities, *The development and future of the Common Agricultural Policy. Proposals of the Commission*; COM(91) 258 final, Brussels, 11 July 1991.

agriculture and forestry in the EC. A philosophy can be defined in this context as a cohesive set of preferences with regard to a number of goals. The core of this report comprises four such scenarios. Besides agricultural production as such, they also encompass aims relating to socioeconomics, the environment and nature conservation and development.

This report examines only the territory of the current European Community before the unification of Germany. If countries with a large agricultural potential (which applies to most of central and eastern Europe) join the Community, it will only serve to make the need for a review of the objectives of European agricultural policy even more pressing.

1.2 The four scenarios

Four contrasting policy philosophies have been devised on the basis of the main movements in the current debate on agriculture. These are extreme philosophies, in which the ideas which have been put forward in the debate are taken to their logical conclusions. They determine the order of policy goals which form the basis of scenarios A to D.

1.2.1 Scenario A: free market and free trade

Under the free trade scenario agriculture is treated in the same way as every other economic activity. Production is as low-cost as possible. A free international market for agricultural products has been assumed, with a minimum of restrictions in the interests of social provisions and environment. The philosophy which dominates this scenario is similar to the American approach to the current negotiations on the General Agreement on Tariffs and Trade (GATT).

1.2.2 Scenario B: regional development

This scenario accords priority to regional development of employment within the EC, which creates income in the agricultural sector. The predominant philosophy can be regarded as a continuation and extension of current EC policy.

1.2.3 Scenario C: nature and landscape

Under this scenario the greatest possible effort is made to conserve natural habitats, creating zones which divide them from agricultural areas. Besides protected nature reserves, areas would also be set aside for human activity. Nature conservation groups are exponents of this philosophy.

1.2.4 Scenario D: environmental protection

The primary policy aim under this scenario is to keep alien substances from entering the environment. In contrast to scenario C, the main aim is not to preserve or improve certain species of plant and animal, but to protect the soil, water and air. There is therefore no physical division between natural and agricultural areas; on the contrary, these are integrated. Farming may take place anywhere, but subject to strict environmental requirements. The philosophy behind this is in line with the concept of *integrated agriculture* as developed partly at the instigation of the WRR [2].

[2] *Bouwstenen voor een geïntegreerde landbouw* (Building blocks for an integrated agriculture – in Dutch) by W.J. van der Weiden, H. van der Wal, H.J. de Graaf et al., WRR Preliminary and background studies no. V44, The Hague, Staatsuitgeverij, 1984.

1.2.5 Land requirement assessment

The four scenarios do not cover all the problems dealt with in this report. Goals relating to nature and landscape cannot be expressed in figures in such a way that the GOAL model can interpret them. To remedy this situation, maps have been drawn up which represent the best division of land from the point of view of landscape and nature conservation. The outcomes of the model were assessed on the basis of these maps. It could be that the results produced by the model will have to be amended as new space requirements arise.

1.3 Role of the scenarios

Chapters 3 and 4 examine in detail the workings of the GOAL model and the method of entering data into the model. In this chapter, by way of an introduction to the model, an indication is given of what it does and does not do.

The model does not produce forecasts. The scenarios are *surveys of technical possibilities* based on a series of well-founded assumptions and presuppositions from which, however, a number of factors have been excluded (such as price changes, assumptions about the behaviour of actors, institutional obstacles). What we are concerned with is not, therefore, a study of the effects of a number of possible amendments to the CAP. The model does however indicate the technical limitations within which these changes will have to be made. In many other policy areas such a definition of technical limitations would be impossible. (In the case of population, for example when should the Netherlands be considered 'full'? What level of prosperity is 'enough'?). This is possible for land-based agriculture in the EC, though, because it can be based on known data (demand for agricultural products, technologies, possible uses of land).

In other words, the technical survey provides a framework for assessing the strategic policy options on which the government and other actors will have to decide in the years to come. Policymaking can be improved, because the outcomes can be used to determine to what extent current policy can cope with the developments which occur to a significant extent in the scenarios (this is particularly the case with the continuing rise in productivity, and the decrease in employment in land-based agriculture linked to this). An estimation can therefore be made of the effort required to achieve goals, depending on the question of whether we will have to 'go against the tide' or simply go with it. In this way the outcomes produced by the models can serve as *guidelines for policy.* If they all point in the same direction, there is clearly conflict between the technical possibilities and a policy which seeks to achieve something else. Current policy, then, 'goes against the tide'. If the outcomes of the models are very varied, there is clearly greater scope for policy.

Variations in the results can also point to unsuspected potential in certain areas. Finally, they can also show extra possibilities by indicating when certain developments can be substituted for others.

One source of the kind of conflict mentioned above could lie in the fact that all four scenarios can be put into effect using at least 40 million hectares less than the 127 million hectares of agricultural land currently in use in the EC. It is safe to assume that great effort would be needed to maintain the current area of agricultural land in the long term. Would this be worth doing? Should not other goals be given preference? Simply defining technical possibilities gives rise to such questions. Examples of unsuspected potential and possible substitutions are not examined in this report.

The scenarios are designed to promote debate on policy at various levels. Firstly, they demonstrate the possibilities for achieving the goals to which the

various philosophies attach importance. These are results at *community level.* They also show which areas are most suitable for agriculture in the EC, what type of agriculture can most effectively be pursued in each area (arable, livestock or forestry) and what methods should be used (geared towards higher production, environmental protection or maximum use of land). These results have an effect at *regional level.* If the results on EC– and regional level have consequences for certain countries, they will affect policy at *national level* as well.

In the following sections the main results of the model calculations are summarised (the figures and interpretations of them are given in chapters 4 and 5). These set the basic guidelines for policy. Finally follows an examination of the extent to which the scenarios give rise to a need to amend current and recently adopted policy.

1.3.1 Community level

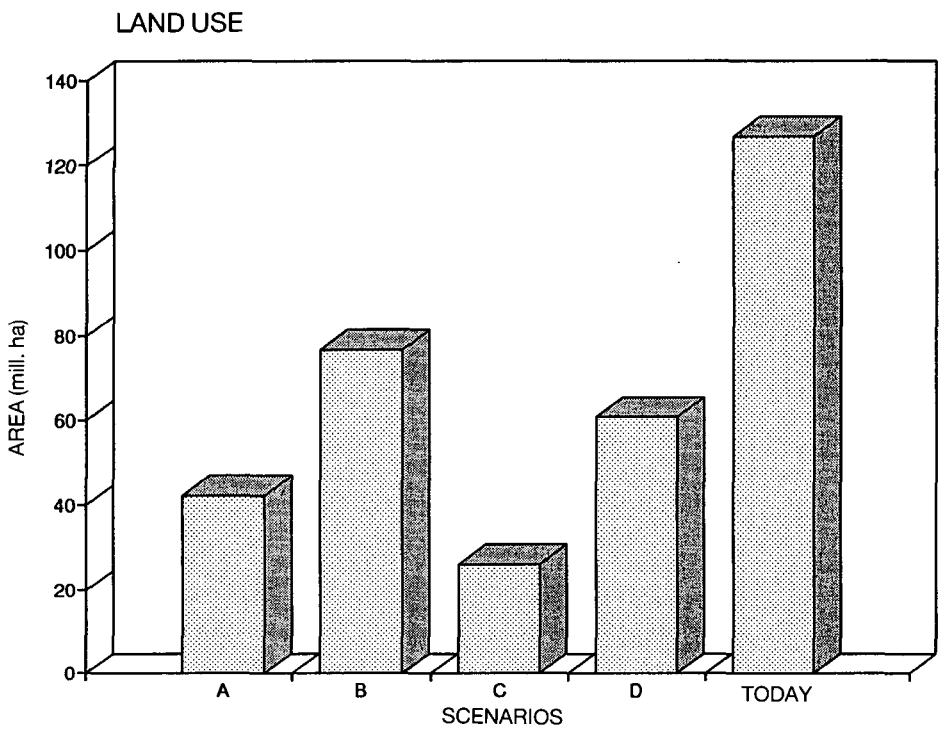
Contrasts between the scenarios

The model calculations point up dramatic differences between the four scenarios. The values of the individual goals differ from scenario to scenario and from one area of policy to another. When it comes to land use the highest value is some three times higher than the lowest. The difference is twofold as far as the costs of land-based agriculture, total employment and use of nitrogen (total and per hectare) are concerned. Highest values for use of crop protection agents per hectare are 4 times the lowest, while the totals differ by a factor of 7.
The first conclusion which can be drawn from these significant differences is that there is scope for a clear policy to be pursued.

Land use

The highest and lowest values for land use do vary widely, but all four scenarios lead to a considerable or very considerable reduction in agricultural land. This is illustrated in figure 1.1 which compares the land required under the four scenarios with the current amount of land under cultivation.
The second conclusion is that there is little scope for a policy geared to keeping all current agricultural land in use.

Figure 1.1 **Land use in the different scenarios compared with current land use (in mill. ha)**



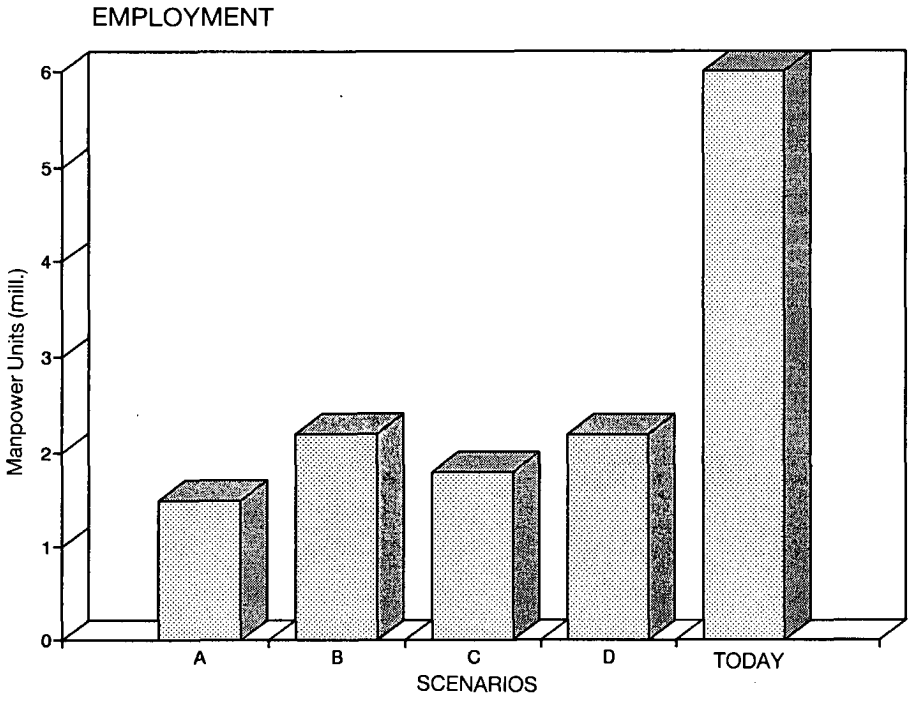
Scenario A – Free market and free trade
Scenario B – Regional development
Scenario C – Nature and landscape
Scenario D – Environmental protection

Source: WRR.

Employment

All the scenarios show a further reduction in agricultural employment, ranging from 3 to 4.5 million manpower units (MPUs) (see fig. 1.2).
The third conclusion is that in all cases considerable effort is required to accommodate the wastage of labour from agriculture.

Figure 1.2 **Employment in the different scenarios compared with current employment (in mill. MPUs)**



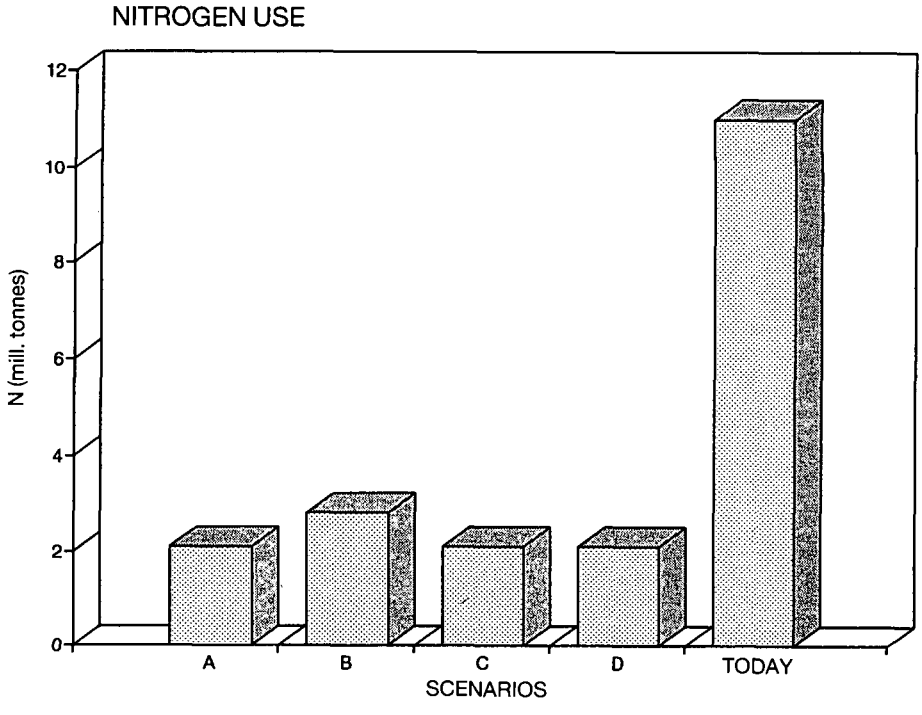
Scenario A – Free market and free trade
Scenario B – Regional development
Scenario C – Nature and landscape
Scenario D – Environmental protection

Source: WRR.

Environment

It is technically possible to significantly reduce the use of both nitrogen fertilizer and crop protection agents without adversely affecting production. This is shown in figures 1.3 and 1.4. In particular crop protection offers a great deal of scope.
The fourth conclusion is that policy measures can successfully promote more environmentally friendly production methods by limiting the use of nitrogen fertilizer and above all by reducing the large-scale use of crop protection agents.

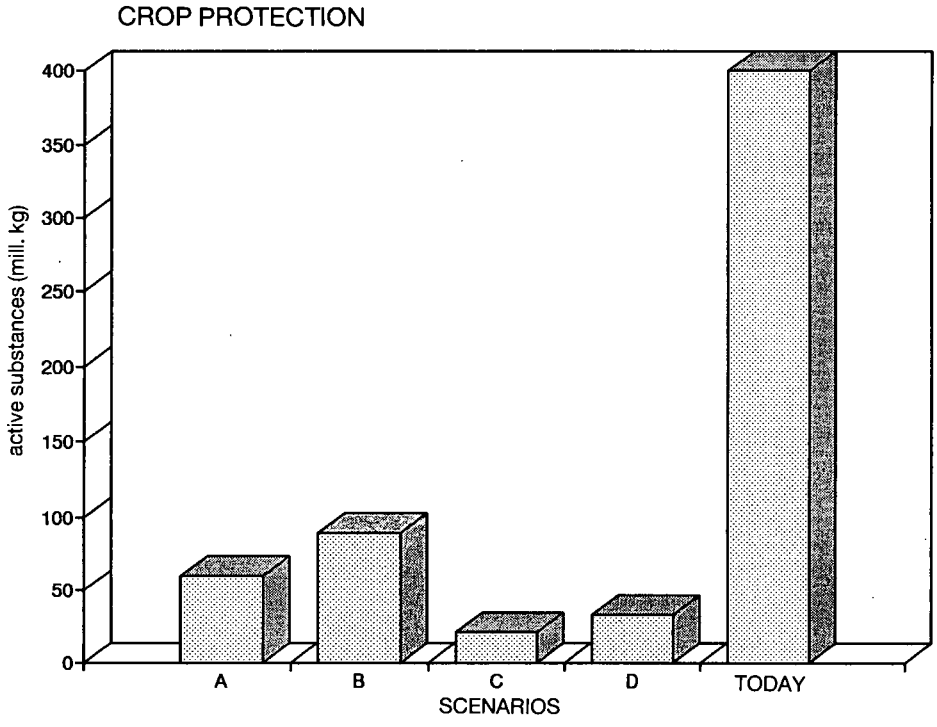
Figure 1.3 **Use of nitrogen fertilizer in the different scenarios compared with current use (in mill. tonnes)**



Scenario A – Free market and free trade
Scenario B – Regional development
Scenario C – Nature and landscape
Scenario D – Environmental protection

Source: WRR.

Figure 1.4 **Use of crop protection agents in the different scenarios compared with current use (in mill. kg)**



Scenario A – Free market and free trade
Scenario B – Regional development
Scenario C – Nature and landscape
Scenario D – Environmental protection

Source : WRR.

1.3.2 Regional level

In addition to information on objectives at Community level, the scenarios also provide information on individual regions in the EC. Each scenario shows a different regional land use pattern.

In scenario A (free trade) agriculture is confined mainly to the northwest of the EC. In scenario B (regional employment) agricultural activities are distributed fairly evenly throughout the EC. In scenario C (nature and landscape) many agricultural activities shift to the southern regions. Scenario D (environment), like B, results in a fairly even spread of agricultural activities over the whole of the EC, with the exception of the Benelux and Ireland. The difference in the location of agricultural activities in the different scenarios is naturally also connected to differences in land use objectives. For instance, in scenarios A and C the distribution of employment over the regions is extremely uneven.

It is interesting to compare these results with the existing distinction between strong and weak regions in the EC (weak regions are those with a low score in terms of production, productivity and employment rate). As far as weak regions are concerned, in scenario A only Ireland retains a substantial share of

employment in arable farming [3]. In scenario C Spain and Italy retain 40 and 34 per cent of current employment respectively and Portugal only 14 per cent [4].

The significant differences between the scenarios show that all the regions have more or less the same potential. If the parameters are altered, different regions can perform equally well. Weak regions in scenario A are strong in scenario C. In the latter scenario, which seeks to minimise the area of agricultural land in favour of large nature areas, virtually no land-based agricultural activities remain in a number of regions which enjoy a strong position at present. In this scenario production on a limited area of land is given preference over production at minimum costs. This shows not only how relative the term 'weak' is, but also how important policy objectives are for the future of rural areas in the EC. The development of highly productive, irrigated agriculture in southern Europe may cause land use and agricultural employment problems in the northern member states.

Scenarios B and D give a more uniform distribution of land use among the 12 EC member states. In scenario B this is a result of the condition that maximum employment must be retained in all the regions. Model calculations show that it is technically possible to maintain 29 per cent of the current level of employment in all the regions. Since the same percentage of employment is maintained in all the regions, those with a high level of employment at present enjoy a relative advantage. This applies especially to the Mediterranean regions. In scenario D 50 per cent of the present level of employment is retained in Spain, 14 per cent in southern Italy, 11 per cent in Greece, and 10 per cent in Portugal. The imposition of restrictions other than costs in these two scenarios results in a shift of agricultural activities to southern Europe (provided the necessary irrigation takes place).

As far as strong regions, which are mostly situated in the north and west of the EC, are concerned, the example of the Netherlands is representative. In scenario A only 5 per cent of employment in land-based agriculture is retained in the east of the Netherlands (the minimum figure allowed in all the scenarios). Eighteen per cent of employment in arable and livestock farming is retained in the south of the Netherlands, 26 per cent in the west, and 36 per cent in the north. In scenario B, 29 per cent of employment is retained in all the regions because this is one of the conditions in this scenario. In scenario C land-based agriculture disappears from the Netherlands almost completely; the remaining 5 per cent employment is provided by forestry and a certain amount of livestock farming in the south. In scenario D little land-based agriculture remains: 5 per cent employment in arable farming in the north, east and south of the Netherlands and in forestry in the west of the country. Similar effects occur in Denmark, Germany, Belgium and Luxembourg. These results show that 'strong' is also a relative term.

Regional shifts also occur when the scope is examined for using agricultural land which can no longer be exploited profitably for creating a network of protected areas in the EC (see chapter 6). In all four scenarios next to arable farming and forestry sufficient land is in principle available in most of the regions to allow a significant area to be used for this purpose (36% of the total area; at present only 3% can be regarded as protected area). Scenarios A and C are particularly attractive in this regard, which is not surprising since in these scenarios the demand for agricultural products may also be met by agricultural activities outside the EC.

[3] In this scenario the creation of labour is relatively expensive in the southern regions.

[4] In scenario C it is assumed that agriculture takes place on the smallest possible area of land and therefore gives the highest productivity. In this scenario the creation of jobs is relatively expensive in Greece and Ireland.

It is, however, surprising that the 'surplus areas' are mainly found in the central part of the EC rather than in the Mediterranean areas, where low productivity, an ageing population and emigration result in a great deal of land being taken out of cultivation. The scenarios therefore indicate the scope for a different type of development in the Mediterranean area.

As far as the costs of agriculture are concerned, there is a difference of 20 billion ECU between scenarios A and C, in both of which agricultural products may be imported from outside the EC. This difference can be seen as the price to be paid for making large areas of land into protected nature areas (minus acquisition and development costs; in this regard it should be borne in mind that the additional costs in C are moderated by the benefits arising from increased employment and less use of crop protection agents; production on a smaller area will also affect costs). The difference in costs between B and D is difficult to attribute to a single factor. It should be noted, however, that the uniform distribution of employment required in B offsets the lower use of nitrogen in D. Maximum distribution of employment or a relatively low level of environmental pollution can be achieved at comparable cost.

1.4 Policy objectives and instruments

The scenarios developed in this report can serve as a guide for policymakers. The results point to a need for a review of current policy objectives and instruments and show the degree to which the technical potential is not being realised. In cases where this applies, a more appropriate policy is indicated below.

1.4.1 Current objectives

The primary objective of European agricultural policy is to improve productivity. The instruments referred to in the EEC Treaty include promoting technical progress, rational development of agricultural production and optimum use of the factors of production. Higher productivity is achieved in practice by increasing yields per hectare or head of cattle. This will steadily reduce the area of land, number of cattle and amount of labour required to achieve a level of production which provides a secure food supply within the EC.

This leads to a paradoxical situation: one of the EC's objectives is to increase the productivity of land, livestock and labour, but these efforts cause so many problems that at the same time attempts must be made to reduce production. To this end a combination of quota schemes (for sugar and milk) are used, together with reductions in price guarantees (cereals), early retirement schemes for farmers and set-aside schemes (in which the use of land for agricultural purposes is temporarily discontinued). But a reduction in production in conjunction with rising productivity conflicts with the aid schemes for maintaining jobs in agriculture and the schemes for keeping superfluous agricultural land in use. After all, one of the conditions of set-aside is that land use must not be altered. This is certainly a case of swimming against the tide.

The highest land productivity is achieved in scenario C, where the area of agricultural land is smallest. Of the 127 million hectares of agricultural land now in use, 26.4 million hectares remain in scenario C. The other scenarios also lead to a sharp fall in the area of land required: 42 million hectares in A, 76 million hectares in B, and 60 million hectares in D. The discrepancy between the area of land currently in use and the area that is technically necessary for food production shows that the present set-aside schemes are of very little significance.

Moreover, the same measure may have conflicting effects at different levels.

There are surpluses of agricultural land at both Community and national level. However, it is often in the interests of individual farmers to acquire more land: as productivity rises they can extend their farms and increase production (and income) with the same means of production. Individual farmers are therefore interested in buying land from other farmers who are retiring. Bonuses for terminating operations without an obligation to take the land out of cultivation for good therefore lead to increased production. The set-aside schemes raise the same objections. After a period 'in mothballs', the land is brought into use again. Thus although this offers a partial solution in the short term, it prevents a genuine solution to the problem of structural surpluses. Macro- and micro-interests conflict.

Not only does the implementation of the Treaty suffer from internal contradictions; objectives are also misinterpreted. One of the policy objectives referred to in the Treaty is a reasonable standard of living for farmers, not – contrary to popular belief – the preservation of the current level of employment in agriculture.

Even in scenario B, in which an attempt is made to keep as many people as possible employed in land-based agriculture in the EC without subsidies, employment declines. Of the 6 million manpower units (MPUs) today (1988/89), no more than 2.8 million remain. It can be concluded from the scenarios that preserving the current level of employment amounts to maintaining hidden unemployment, and costs a great deal of money. Moreover the loss of jobs in the agricultural sector already amounts to 2 to 3 per cent a year. If this trend continues, in 15 years' time employment will be about 40 per cent lower than today, despite all the measures taken.

The Treaty originally contained no environmental objectives, but an environmental section has been included in the Single European Act, and the Commission's latest agricultural proposals also contain an agri-environmental action programme. It is interesting to note that the Treaty's productivity objective is ignored in the action programme; farmers are presented as managers of the agricultural cultivated landscape, entitling them to subsidies for their management activities.

The quality of the environment is affected mainly by the use of crop protection agents and artificial fertiliser. A reduction in their use is seen in current European policy as a service which farmers render to society. It is assumed that as a result they will suffer a loss of income and must therefore receive compensation. However, the scenarios show that the use of nitrogen fertiliser and crop protection agents can be sharply reduced without loss of production. Generally speaking, there is therefore no need for compensation.

This does not alter the fact that there are considerable regional differences as far as the environment is concerned. In the northwestern corner of Europe in particular, where the use of pesticides and nutrients is highest (from the standpoint of rational and efficient management, it is out of hand), a reduction in use can take place without necessarily leading to a lower level of production. In this regard, the scenarios show that taking general policy measures with regard to a highly differentiated, regional activity such as agriculture is a precarious matter.

I.4.2 Scope for other policies

The driving force behind change in land use and land productivity is technological progress. The scenarios show that this force can be strengthened or weakened by policy measures. Improvements in production conditions, price guarantees, research, information campaigns and education promote

technological development. Adjustments can be made by altering production conditions and product requirements. The scope for this exists, and several possibilities will be outlined below.

1. *Use of rural areas*
- physical planning policy at European level;
- rural development: assessment at European level of national and regional policy and activities;
- nature development policy at European level.

At EC level a policy in which the different physical planning aspects are viewed as a whole does not (yet) exist; physical planning policy in rural areas is mainly indirect, incorporated in agricultural policy, regional policy or environmental policy. The scenarios show that, in the absence of an integrated policy, regional conflicts will increase rather than decrease. Growing incompatibility among European, national and regional policy seems unavoidable. A general European planning policy, which indicates how rural areas should be used, is therefore required. Such indications could act as a frame of reference for assessment of whether to grant requests for European funds to make structural improvements in production conditions (irrigation, rural development projects or other infrastructural works).

There would also seem to be scope for nature development policy at EC level. European landscapes and nature parks are few in number at present. The scope for such initiatives exists, but has not (yet) been utilised. Concerted action by European and national authorities and nature conservation groups may get things moving.

2. *Setting aside agricultural land by putting it to different use*
- promoting the development of nature (Council directive on the protection of natural and semi-natural habitats and of wild flora and fauna);
- promoting recreation;
- promoting agrification/energy recovery on arable land.

There is not yet much scope for setting aside productive agricultural land. Under the present set-aside scheme land must be kept for agricultural purposes, and the extensification scheme assumes that productivity increases will be nullified and that even a decrease is possible. The scenarios in this report show the contrary. If productivity steadily increases, a set-aside scheme becomes extremely expensive. It seems improbable that this will receive much political support, especially since land and income supports and other measures will also make demands on European funds.

The calculations in this report indicate how production capacity can be reduced by putting agricultural land to different use. Nature development has already been mentioned. Another possibility is recreation. There is also scope for agrification, where preference must be given to activities requiring a great deal of space, such as energy farming. There is scope for this at European level, but it is not yet very attractive economically. However, a study conducted by the Netherlands Energy and Environment Company (NOVEM) clearly shows that energy recovery on arable land faces promising prospects in the long term, provided the energy is refined (electricity, gasification etc.) [5]. This confirms the results of earlier studies in this field.

[5] Netherlands Energy and Environment Company (NOVEM), *De haalbaarheid van de produktie van biomassa voor de Nederlandse energiehuishouding*. Eindrapport (The feasability of biomass production for the Dutch energy supply – in Dutch); Utrecht, March 1992.

3. *Regional development and employment*
- indirect policy involving the European Regional Fund offers limited scope;
- the Social Fund and (temporary) income supports offer reasonable scope.

As already stated, in all the scenarios employment in land-based agriculture is much lower than it is at present. European policy attempts to counteract the loss of jobs by improving the structure of agriculture. An evaluation of the structural funds intended for this purpose has shown that even now much of the money used has no impact or is even counterproductive [6]. A policy that takes account of changes resulting from technical progress could make better use of the funds and alleviate the adverse effects.

The same applies to some degree to income supports. If, for social reasons, supplementing farmers' incomes is considered, there are various ways of doing so. If support is linked to individuals, it amounts to a Community assistance scheme. If it is linked to land, it cannot be confined to agricultural land only, since this hinders land mobility. By granting a land support for land which is put to different use, a basic financing system will be created for other purposes, such as nature conservation. Such ideas require further consideration. The scenarios show that current plans, involving the use of structure funds, amount to carrying coals to Newcastle.

4. *Promoting certain production techniques*
- crop protection policy;
- environmental policy.

Policy in the field of legislation concentrates on production methods. As already mentioned, there are many methods for reducing the use of pesticides which could be employed at European level, including EC levies on pesticides and returnable deposit systems for plant nutrients.

5. *Promoting certain forms of land management*
- hill farmer scheme;
- Policy Document on Agriculture and Nature Conservation;
- scheme for preserving certain landscapes and land use patterns.

A number of schemes at national as well as European level assume that the maintenance of a number of natural features (nature, landscape) must be paid for or that compensation should be provided for 'natural handicaps'. Relevant schemes, such as the one under the Dutch Policy Document on Agriculture and Nature Conservation and the European hill farmer scheme, can offer relief for a number of areas where land management is deemed important in the interests of landscape and nature.

1.5 Conclusions and recommendations

1.5.1 Research agenda

The preparation of this report required a considerable research effort. In developing the methodology and producing the GOAL model the council encountered a number of problems. Several of these are of sufficient interest to be referred to again here. Further research on these matters may facilitate similar studies in the future.

[6] D.D. van der Stelt-Scheele, *Regionaal beleid voor de landelijke gebieden van de Europese Gemeenschap; inventarisatie en evaluatie* (Regional policy for the rural areas of the European Community: inventory and evaluation – in Dutch); Working Documents no. W46, The Hague, WRR, 1989.

The survey conducted by the Council focused on the 12 EC member states, and can be extended in two directions. The model can be used to examine the consequences of the accession to the EC of central and eastern European countries. In addition, follow-up studies at regional level can help to provide greater information on the prospects for regions within the conditions set by the scenarios. Greater attention can then be devoted to other economic sectors.

One of the key assumptions on which the model is based is that agriculture throughout the EC takes place with the best available techniques and without wastage. The different production techniques could be specified in greater detail. The best regional specification permitted by current knowledge has been given. A more detailed adaptation of production techniques to specific regional conditions may be worthwhile.

The report does not deal with the financing of policy on rural areas. Only the total costs of agriculture are given in the scenarios. Even at this level, there are major differences between them. The share of costs to be borne by the producers and the authorities was not examined, and nor were the consequences for European taxpayers. This information is essential if policy alternatives are to be developed further.

The financing structure of nature conservation policy has also been left out of account. An attempt to distinguish between different forms of nature management has not led to directly applicable results [7]. The purpose of this distinction was to safeguard the various ecological values at minimum cost. The positive response of nature conservation groups to this first attempt warrants further effort in this direction.

To make the study more specific, a tentative network of protected areas in the EC has been developed. Although this approach proved very useful in interpreting the scenarios, it is no more than a first attempt, and requires further development if it is to be used to assess a future European nature conservation policy. Such an approach would have to be taken by the EC as a whole, since the necessary criteria must be agreed. In addition, the regions need to do more to indicate which areas are eligible for inclusion in a network of protected areas.

I.5.2 Policy agenda

The scenarios in this report suggest a clear policy agenda. They indicate that the rural areas in the EC may see very radical changes in the coming decades. EC policy in this field is developing rapidly. National governments can use the scenarios as a guide in their contribution to this policy. More specifically, this has the following implications:

1. The intended objectives should be used as a starting point in all proposals, surveys and analyses concerning the reorganisation of European agricultural policy. The GOAL model developed by the Council could be used for this purpose. Policy goals must determine the choice of instruments. Discussion on these goals must be conducted openly, not through policy instruments. Once the goals have been chosen, they must serve as the background for the elaboration of policy. Although other considerations will undoubtedly play an important role in the negotiating process, they should not be accorded too much significance. A situation where the combination of goals and instruments leads to some instruments conflicting with others, as is now generally the case, must be avoided.

[7] M. Creemer, *Natuurbeheer in Europa, een inventarisatie van doelstellingen, methoden en kosten van inrichting en beheer in beschermde gebieden in de landen van de EG* (Nature conservation in Europe. An inventory of aims, methods and costs of arrangement and management of protected areas in the member states of the European Community – in Dutch); The Hague, report on a period of practical training, 1990.

2. In all the land use options in the 12 EC member states which the Council has studied, there are considerable surpluses of agricultural land. Their size and regional distribution differ from one scenario to another, but the general picture is clear. This means that a policy designed to maintain the use of land for agricultural purposes in the long term (either directly by means of extensification, for example, or indirectly by means of set-aside schemes) will meet increasing resistance. The costs of such a policy may rise sharply and the eventual results will sometimes be incompatible with other goals (e.g. nature conservation, and also environmental goals).

3. All the options studied by the Council show that far fewer jobs are required in agriculture than at present. Even today there is a high level of hidden unemployment in many regions of the EC, and this level will rise sharply if the present number of jobs is maintained. Measures can be devised to mitigate the adverse consequences of this loss of jobs, but the artificial maintenance of maximum employment in agriculture is unaffordable and impracticable. It would be better for policy to manage this drop in employment.

4. The environmental impact of agriculture in many areas of the EC is very serious, especially in the Netherlands. As this study shows, there is great technical potential for tackling this problem, and policy could be designed to realise this potential. The council has specified possible measures in earlier reports: levies on pesticides; promoting research and information campaigns in the field of integrated cultivation systems; improving production conditions in areas intended for agriculture; training; certificates for workers in the crop protection sector; deposit systems for plant nutrients, etcetera [8]. None of these proposals are new. However, they should be introduced at European level, and the fact that this will benefit both the environment and production should be an incentive to do so.

5. The possibility of conducting an active European nature conservation policy certainly exists, as far as land use is concerned, and there seems to be little conflict with agriculture. At European level the Netherlands could encourage the further development of a network of protected areas. A precondition is that a financing structure must be established for European nature conservation policy. A combination of government funds and private financing ('bonds for nature'), similar to the financing structure that has developed in the Netherlands, is an obvious choice.

6. As far as prospects for and threats to Dutch agriculture and horticulture in the longer term are concerned, the scenarios show that it is mainly land-based arable farming that is threatened. The same applies to a lesser degree to dairy farming. Prospects will have to be created mainly in those sectors of a less land-based nature, where other factors are of greater importance, such as sales organisation, knowledge, infrastructure and experience. Government policy can best be directed towards optimising conditions for the further development of these sectors. In addition, a reorganisation policy seems unavoidable for those sectors or farms whose future prospects are bleak.

[8] Netherlands Scientific Council for Government Policy (WRR), *Technologie en overheid. Enkele sectoren nader beschouwd* (Technology and government. A close inspection of some sectors – in Dutch); Reports to the Government no. 39, Sdu Uitgeverij, The Hague, 1991.
Netherlands Scientific Council for Government Policy (WRR), *Environmental policy: strategy, instruments and enforcement*; Reports to the Government no. 41, The Hague, Sdu Uitgeverij, 1992.

European agriculture: The boom in productivity

2

2.1 The success of agriculture in the EC

Major shifts are taking place in the rural areas of the European Community on account of sustained rises in agricultural productivity. The growth in productivity is attributable to greater knowledge concerning the development and production of crops and animals, radical changes in production conditions (e.g. mechanisation, land development projects, intensive fertilisation and improvements in soil fertility) and the availability of improved strains from plant-breeding. A marked rationalisation of production has occurred under the aegis of EC agricultural policy. In less than 20 years the Community has evolved from being a net importer of its principal foodstuffs into an exporter in the world markets. Table 2.1 shows the net exports of cereals, beef and milkpowder in recent years.

Table 2.1 Net EC exports of a number of leading foodstuffs, 1986-1989 (in ktonnes)

	'86/'87	'87/'88	'88/'89
Cereals	19939	19125	27536
Beef	429.5	335.8	587.1
Milkpowder	958.2	1206.4	922.8

Source: European Commission, *The future of agriculture in the Community. Report 1990*; Brussels-Luxembourg, 1991.

An end to this growth is not yet in sight. As will be explained in more detail, the circumstances in land-based agriculture are such that little if any agricultural land is being taken out of production [1].

In addition the expectation of continued growth is based on the present state of knowledge concerning the agro-technical potential and limitations. Assuming that the crop production potential is theoretically determined by soil and climatic factors and the properties of the crop in question, there remains a large gap between what is possible and the actual level of production in virtually all European agricultural areas. Even in intensively farmed areas such as the Netherlands, East Anglia, Schleswig-Holstein and the Paris Basin there is room for a further increase in yields, often by at least 30 per cent. In less well endowed agricultural areas, especially those on the peripheries of the Community, yields could theoretically be quadrupled.

On account of this rise in productivity and the consequent increase in production, the primary objectives of the Common Agricultural Policy (CAP) have been more than convincingly achieved. According to Article 39(1) of the EEC Treaty, the CAP originally had the following objectives:

1. to increase agricultural productivity by developing technical progress and by ensuring the rational development of agricultural production and the optimum utilisation of the factors of production, particularly labour;
2. to ensure thereby a fair standard of living for the agricultural population, particularly by the increasing of the individual earnings of persons engaged in agriculture;

[1] G. Meester and D. Strijker, *Europese landbouwbeleid voorbij de scheidslijn van zelfvoorziening*(The Common Agricultural Policy crossing the limits of self-sufficiency – in Dutch); WRR Preliminary and background studies no. V46, The Hague, Staatsuitgeverij, 1984.

3. to stabilise markets;
4. to guarantee regular supplies;
5. to ensure reasonable prices in supplies to consumers.

As noted previously the first of these objectives has been largely realised. The second objective has been realised by the large-scale introduction of price-guarantees for selected agricultural products. The third objective has been achieved by means of protective market policies. On the world market this policy of the EC has had a less favourable effect, on which more later. The attainment of the fourth objective has already been illustrated on the basis of the present level of self-sufficiency for the leading foodstuffs. No clear-cut conclusion can be reached with respect to the fifth objective. The system of price-guarantees has for example ensured that the price of cereals within the EC is some 70 per cent higher than that in the world market. The recent modifications to the policy of price-guarantees are aimed at eliminating this differential and may therefore be regarded as a step in the right direction.

All in all this amounts to a considerable success – but one that also has its drawbacks. At differing levels of scale, the Community currently faces problems that constitute a major challenge. This applies both to the EC as a whole and to the various member states and national regions. Partly as a result of the Common Agricultural Policy, there have been growing tensions in world trading relations, especially between the United States and the EC. The Community has been struggling for years with the ever rising costs of agricultural production, apart from which the benefits of the Common Agricultural Policy have been unevenly distributed geographically, leading to tensions in interregional relations that could threaten the cohesion of the Community. At regional level, developmental and environmental problems have assumed steadily greater importance.

The drawbacks of the growth have become so apparent that a reappraisal of the Common Agricultural Policy has become unavoidable. Partly because other aims of government policy in rural areas are at stake, the debate has been a lively one. The discussion about the MacSharry proposals has concentrated especially on the conversion of the market and price policy into one directed towards direct income-support. This would then decouple social policy from price policy while also seeking to bring prices back into line with market forces. The trade barriers created by EC agricultural policy have been reduced as a result of this radical reform, but the financial burden for EC policy has not (yet) been lightened – which forms one of the background factors in the debate about the reform of the Common Agricultural Policy.

It is however notable that the debate has centered especially on modifications to the set of policy *instruments* and the consequences thereof for elements of the rural community. The underlying goals have remained largely unchanged. The Council wishes to address this shortcoming in this report by examining the *policy goals* that are ultimately at issue and the extent to which these objectives can be realised and at what price. In this way the necessary strategic insight can be obtained for assessing the instruments on their merits.

The following sections briefly examine the problems that gave rise to this report and the aims and design of the present study.

2.2 Drawbacks of growth

2.2.1 World market position of European agriculture

In order to offset the consequences of the continuing rise in agricultural output, the EC has been dumping its surpluses on the world market. In this way the

Community has become an important agricultural exporter. The scope for further dumping has, however, become very limited. There is major resistance towards these practices and the consequent lowering of prices in the General Agreement on Tariffs and Trade (GATT). In the most recent round of GATT discussions known as the Uruguay Round, the liberalisation of trade in agricultural products and services was a highly controversial topic, ultimately leading to an impasse in the negotiations. At the behest of the United States a debate has got under way concerning the way in which various trading blocs protect their agricultural markets, with particular emphasis on cereals. The Cairns group, which includes Canada, Australia and New Zealand, has ranged itself alongside the US, demanding the far-reaching liberalisation of agricultural markets.

The acceptance of the MacSharry proposals has brought the successful conclusion of the GATT talks a step closer. The reduction in export restitutions has removed the sting from EC policy. Although the agricultural sector continues to be supported, this is being conducted in a manner more acceptable to the EC's negotiating partners in the GATT talks; the US also supports its agricultural sector, albeit in a different way from the EC. Their objections relate particularly to the trade barriers resulting from the fixed prices and import levies, which are a thorn in the side to the US and the Cairns Group. Developing countries are also increasingly opposed to the EC's price-support policy, which spoils their chances in the world market. They too would be served by a reduction in export restitutions.

Chapter 4 examines possible developments in the demand for agricultural products in the EC in relation to their supply in the world market.

2.2.2 The costs of the Common Agricultural Policy

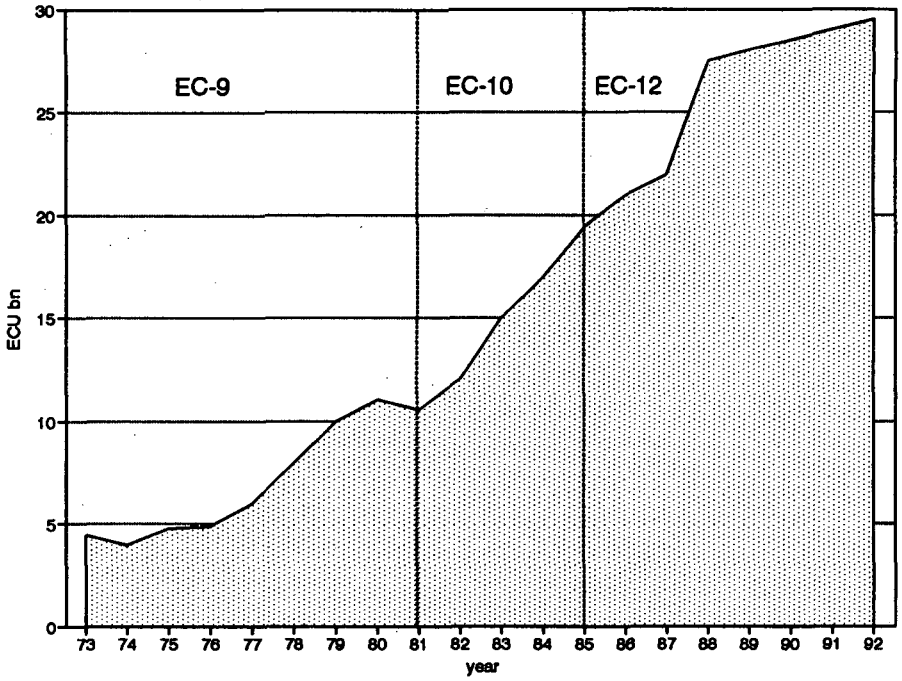
The Common Agricultural Policy has to date been characterised by a system of guaranteed prices, under which the EC purchases a limited number of agricultural products at a fixed price. The high internal price can only be sustained by protecting the internal market by means of import levies and export restitutions.

Given an increasing supply and virtually saturated demand for agricultural products in the Community, this system has led to substantial production surpluses for a number of products. Market forces no longer operate, so that there is no direct linkage with demand. This has confronted the Community with substantial budgetary problems as it has had to accumulate surpluses which can then only be disposed of on the world market with the aid of enormous subsidies. The budgetary problem is illustrated in Figure 2.1, indicating what the Community has spent on price-support in the agricultural sector in recent years.

Agricultural expenditure has risen so steeply in recent years that a change in policy can no longer be avoided. The dilemma is, how? Must (part of) agricultural production be curbed by means of a quota system or by taking agricultural land out of production, or must the existing system of market regulation gradually be abolished, thereby creating a free (or freer) market?

The European Commission has recently sought to reduce agricultural spending by means of both quotas and a system of stabilisers. Quotas are applied to dairy production. In 1984 a super-levy was introduced, laying down a production quota for each farm. In general the results of this scheme have been satisfactory, even though the build-up of surpluses has not been entirely eliminated.

Figure 2.1 Guarantee Fund expenditure, 1973-1992 (in billion ECU)



Source: M. Tracy, *Government and Agriculture in Western Europe 1880-1988.*

The set-aside scheme in arable farming, combined with extensification, may also be regarded as a type of quota. The assumption here is that the temporary removal from production of agricultural land and the extensive cultivation of the remainder will result in a drop in production. A simple calculation reveals the consequences of what – as previously seen – is a mistaken assumption. This may be illustrated with respect to cereals. In 1992/1993 the production of cereals in the EC amounted to around 180 million tonnes. Of this 140 million tonnes are required for domestic EC consumption, leaving 40 million tonnes. Of the latter, 30 million tonnes are dumped on the world market with price-support. The quantity that is imported (3 million tonnes) is roughly equal to the production lost from set-aside. Some 10 million tonnes will therefore be added annually to the European grain mountains. If productivity should grow less rapidly in future than at present, for example by 1 per cent a year, 200 million tonnes would be produced in 1998/1999. Given unchanged demand this would leave a surplus of 60 million tonnes. The course of the present GATT negotiations suggests a future situation in which at the most conservative estimate a maximum of 23 million tonnes could be exported and some 10 million tonnes would need to be imported. The surplus would then amount to 47 million tonnes. It seems unlikely that much less will be produced as a result of set-aside and extensification, so that 47 million tonnes will need to be destroyed. If the price were to fall to 100 ECU per tonne, a sum of 4.7 billion ECU would nevertheless be required on an annual basis in order to finance this surplus.

An example of a more market-oriented stabiliser is the until recently applied reduction in the intervention price for cereals, which was linked to output in the previous year. If the harvest exceeded a previously determined production ceiling this led to a reduction in the intervention price. The upper financial limit imposed under this scheme was not just designed to reduce the budgetary burden but also to curb the volume of production. As far as the latter was concerned, however, the strategy proved ineffective.

In the present circumstances the volume of production will remain unchanged or even rise slightly in response to a reduction in the price of cereals. For the individual grain-farmer, a cut in price provides a signal for switching to the production of commodities not subject to stabilisation or set-aside arrangements. Such products, however, account for only a tiny proportion of the total agricultural area. If a number of farmers switch to producing these commodities, the result will be a fall in the price. For the grain-farmer the production of cereals ultimately remains the only possibility of earning a living, even if he receives a lower guarantee price [2].

Those farms that are unable to hold out are forced into bankruptcy. The land that is then released is not, however, withdrawn from the area under cultivation. For the remaining grain-farmers survival means expanding the size of their farms, so that the land is bought up. For the survivors, moreover, it is worth boosting the productivity of their land – not least because the efficiency of the variable inputs rises upon an improvement in the cultivation situation. Investment in irrigation and drainage and soil improvement not only achieves higher yields but also means the lower use of fertilisers and crop protection agents per unit product [3]. These factors induce individual grain-farmers to continue producing cereals, especially on the better soils where higher production can be achieved.

The system of market-oriented stabilisers indeed proved to be an inadequate response to runaway agricultural expenditure. The recently adopted agricultural agreement opts for a radical reform by means of a sharp reduction in the intervention price for cereals, bringing these more into line with prices in the world-market. The price drop has, however, been fully offset by income-support in the form of acreage supplements linked to the level of production in previous years. On the basis of the argument outlined above, grain-farmers will continue to boost their production on the land left over after the compulsory set-aside. Since the best land is not taken out of production, it may moreover be anticipated that the set-aside of 15 per cent of the area under cultivation will result in a cut in production of 6 to 7 per cent. This means that at a conservative estimate of a 2 per cent annual increase in production, the production of cereals will be back to the old levels within four years.

The Commission estimated the increase in the agricultural budget resulting from its original proposals at 2,300 million ECU per year [4]. These proposals were however amended to such an extent in the negotiation process that the rise is bound to be higher. The upward trend in spending on the CAP is therefore likely to continue for sometime.

2.2.3 Regional problems

Within European agriculture there are major productivity variations. This is one of the reasons why agricultural output is not evenly spread over the member states or over the regions within those states.

[2] See S.L. Mansholt, 'Uitgangspunten voor een vernieuwd en sociaal verantwoord landbouwbeleid' (Starting points for a renewed and social acceptable agricultural policy – in Dutch), in: *Spil*, no. 79-80, summer 1989.

[3] The improvement of cultivation situations and techniques enables external inputs to be used more efficiently. Provided the various measures are taken in conjunction, synergies can be achieved as a result of which the additional output per hectare exceeds the additional variable costs. The way in which this can drive up production is examined by C.T. de Wit in 'Resource use efficiency in agriculture', *Agricultural Systems*, Vol. 40, 1992, pp. 125-151.

[4] Commission of the European Communities, *Development and future of the Common Agricultural Policy*; Bulletin of the European Communities, Supplement 5/91, p. 41 ff.

Since the spending on the Common Agricultural Policy by means of price-support through the Guarantee Fund is linked to production, the member states benefit very unequally from the policy, as illustrated by Table 2.2 [5].

Tabel 2.2 **Net contributions to and receipts from the EC of the various member states, 1986, 1988 and 1989 (in % of GDP)**

	1986	1988	1989
West Germany	−0.42	0.60	−0.61
France	−0.07	−0.22	−0.34
Italy	−0.03	0.02	−0.19
Netherlands	0.12	0.60	0.56
Belgium	−0.25	−0.79	−0.81
Luxembourg	−1.18	−1.21	−1.05
United Kingdom	−0.26	−0.30	−0.45
Ireland	4.83	4.22	4.40
Denmark	0.50	0.36	0.18
Greece	3.19	3.36	4.06
Spain	0.04	0.46	−0.01
Portugal	0.73	1.46	1.19

Source: M. Gijsen and W.G.C.M. Haack, *De financiële herverdeling van het EG-budget* (The financial redistribution of the EC budget – in Dutch); ESB, 11-12-1991.

Some member states have taken the disadvantage of agricultural subsidies for granted as they anticipated offsetting benefits upon accession to the EC, such as higher sales of industrial products. Now that agricultural spending has continued to rise, however, the uneven distribution of the benefits of the CAP has become more evident. Despite the amount of money absorbed by EC agriculture, a number of the weaker agricultural regions in the Community have not fared well. The resources have evidently not been used to effect an improvement in the structure of agriculture. In addition, the system of guarantee subsidies for milk, cereal and meat production benefits the stronger regions disproportionately.

This development has led to problems within the weaker regions as well as to tensions between regions and the governments of the countries in which those regions are located. The currently marginal agricultural areas are generally situated on the periphery of the Community in the south and the extreme west. The explosive development of agriculture in favoured regions (i.e. those with a favourable climate, good soil and a welltrained agricultural workforce) has conversely meant that the less well-endowed regions face increasing problems. It is therefore precisely in these regions that we find further marginalisation as a result of lower selling prices, the displacement of labour from the land and the withdrawal of agricultural land from production, leading to the decay of the cultivated landscape [6].

The already weak structure of the labour market in many of these areas is becoming even weaker on account of the developments outlined above [7]. There are not enough alternative forms of employment. In the EC-12 only 7.7 per cent

[5] These figures take no account of transit subsidies; the payment to countries such as Belgium and the Netherlands is overestimated because the final consumption of part of the imports subject to levies takes place elsewhere.

[6] J.H.A. Meeus, J.D. van der Ploeg and M.P. Wijermans, *Changing agricultural landscapes in Europe: Continuity, deterioration or rupture?*; IFLA (International Federation of Landscape Architects) Conference, Rotterdam, 1988.

[7] Commission of the European Communities, *Perspectives for the Common Agricultural Policy* (The Green Paper); Brussels-Luxembourg, 1985.

of the labour force was engaged in agriculture in 1988 [8] (in the Netherlands a little over 4 per cent), whereas in large parts of Spain, Portugal and Greece the figure in 1987 was around 30 per cent. It is clear that extra pressure on the labour market resulting from the accelerated displacement of labour from the land will be particularly difficult to absorb in the weak regions, possibly resulting in mass migration.

In rural areas where the population density has fallen below a certain level or where the age structure of the population has become unbalanced, the provision of facilities comes under pressure. Various public facilities such as education, health and transport fall short of the required utilisation levels and further decline is inevitable in the absence of extra support. The level of business services can also be threatened by continuing depopulation resulting from agricultural developments.

In this way a region can end up in a downward spiral: depopulation, the deterioration of facilities and the undermining of the economic base go hand in hand and threaten the quality of life. The loss of agricultural activities also reduces the care for and consequently quality of the landscape. This problem applies in all marginal areas – although the scale can vary markedly, as can the ability to do anything about it [9].

Although the EC has set up a comprehensive programme of regional support in order to sustain agriculture in these kinds of areas and has subsidised a wide range of development initiatives from the relevant regional funds, this is no more than a drop in the ocean. Partly this is because the funds in question are not disbursed in a clear and coherent manner. 'Distributive justice', or the laws of the negotiating process in Brussels, means that this source of finance is drawn on not just by unmistakably backward regions; comparatively wealthy countries such as the Netherlands are also eager to implement regional development plans with EC aid [10]. In so far as the support does accrue to genuinely weak regions, projects are often supported that do not really fit in with the overall policy of rationalising agricultural production. There can also be major implementation problems in certain regions when the local administrative infrastructure lacks the necessary bureaucratic capacity for realising EC projects [11].

In order to reduce the marked difference between central and peripheral areas, greater emphasis needs to be placed in the weak regions on the elimination of socio-economic backwardness across the board [12]. The recent reforms of the structural funds are a first step on the way to a more integrated approach of this kind. The agreement reached in the Maastricht Treaty to make greater efforts towards improving cohesion within the EC is similarly aimed at the elimination of socio-economic backwardness across the board [13]. In the meantime, however, improvements in agricultural techniques have meant that the same output can be achieved using less land, so that to achieve the desired equality, funds have to be provided for an ever increasing area.

[8] Commission of the European Communities, *The Agricultural situation in the Community. 1989 Report*; Brussels-Luxembourg, 1990.

[9] H. Hengsdijk, *Karakterisering van de landelijke gebieden in de Europese Gemeenschap* (A characterization of rural areas in the EC - in Dutch); Working Documents no. W51, The Hague, WRR, 1990.

[10] In many cases these concern infrastructural projects or improvements in the processing and sale of agricultural commodities (e.g. auction facilities and slaughterhouses).

[11] A number of the problems associated with the structural funds of the EC are examined in a study conducted by the SEO: D.D. van der Stelt-Scheele, *Regionaal beleid voor de landelijke gebieden van de Europese Gemeenschap; inventarisatie en evaluatie* (Regional policy for the rural areas in the EC – in Dutch); Working Documents no. W46, The Hague, WRR, 1989.

[12] See for example N. Slot, 'Structurele en regionale problemen in de EG-landbouw' (Structural and regional problems in EC agriculture - in Dutch), in: J. de Hoogh and H. Silvis, *EG-landbouwpolitiek van binnen en van buiten*; Wageningen, Pudoc, 1990.

[13] *Treaty on European Union. Protocol on economic and social cohesion*; Luxembourg, 1992.

These developments can lead to major interregional political and socio-economic problems that might threaten the unity of the Community, particularly if the contrasts become even more glaring as the EC expands. The achievements of European integration could then come under threat. For the Netherlands, with an economy that is closely geared to the European market and in which agriculture is an important sector, this is highly significant and in itself sufficient reason for taking the problems of the peripheral rural areas very seriously.

2.2.4 Environment and nature conservation

The developments outlined above result in the degradation of the environment and landscape in rural areas in two ways. In marginal areas the decline in agricultural activities can result in exhaustion of the soil, whereupon the loss of basic economic activity means that the landscape becomes neglected. In the highly developed agricultural areas of north-western Europe (including the Netherlands), by contrast, the excessive use of inputs can place such strains on nature, the environment and the landscape as to lower their quality. Examples include the immoderate use of fertilisers and crop protection agents, as a result of which local groundwater can become unusable, specific vegetation can disappear and the environment is in due course poisoned.

Agriculture is not merely of economic utility but also helps determine the appearance and permanence of the rural areas. In the Netherlands, for example, the term 'Countryside Maintenance Area' has been used since 1975 to designate an area in which farmers receive a payment for neglecting certain activities that would otherwise be harmful to nature and the cultivated landscape or are reimbursed for undertaking countryside maintenance measures. Similar schemes have got under way in West Germany, the UK and Denmark [14].

Although the relevant instruments are primarily concerned with the protection of nature and the environment there is also a close relationship with agricultural policy. These instruments will therefore need to taken into account in formulating policy options.

2.3 Aims and structure of this report

2.3.1 Nature of the agricultural debate

The problems identified above need to be resolved at Community level. The problems are too extensive and too closely bound up with all sorts of aspects of EC policy to be tackled on a regional basis. The development of the rural areas of the EC will therefore need to be examined as an integrated whole in formulating long-term policies. In addition the problems identified in the agricultural, environmental and socio-economic fields are so closely interrelated that any analysis must cover more than just one function of the countryside.

On the basis of this insight, the EC, individual member states and regional governments are currently seeking to formulate a policy for rural areas, as reflected by a continuous flow of policy documents and initiatives. A full-scale debate is also under way on this subject in the Netherlands.

[14] M. de Koe, *Relotienoto Grenzeloos; een vergelijkende studie over de Nederlondse Relatienota en soortgelijke regelingen Groot-Brittannië, West-Duitsland en Denemorken* (A comparative study on the Dutch Policy Document on Agriculture on Nature Conservation and similar regulations in the United Kingdom, West-Germany and Denmark – in Dutch); Utrecht, Stichting Natuur en milieu, September 1989.

At least two clearly different parties may be distinguished in this debate. One of these argues that the solution lies in direct production controls linked to price and/or income guarantees. In this respect the prices guaranteed by the EC would need to be geared to the cost price achievable on a well organised farm of a certain size. The scale in question is a political matter and needs to reflect the type and size of farms that society in Europe wishes to maintain. To this has recently been added the instrument of income support, the aim of which is to preserve agricultural incomes that would otherwise be eroded due to lower guarantee prices.

The other party argues that Europe cannot avoid market liberalisation, as called for in the GATT talks. Any proposals to reform the CAP will therefore need to be consistent with this path wherever possible. Ultimately, the liberalisation of trade in agricultural products will be to the benefit of the Netherlands since Dutch agriculture (with the exception of cereals) would remain highly competitive in a free market. Further advantages would include a reduction in the demands made on the Community budget, since income support would only need to be given to weaker farms; the possibility of producing 'green raw materials' because prices would fall substantially; and a reduction in the price of land, so that alternative uses would become economically viable.

At first sight the arguments of both parties appear reasonable. Nevertheless the results of the two approaches are almost diametrically opposed. A closer analysis clearly reveals why. Both approaches are based on a unidimensional goal for agriculture and hence agricultural policy. The former school of thought advocates what we may term in brief the concept of a 'viable countryside', while the latter advocates the minimisation of costs and hence the cheapest and most efficient possible agricultural production. The viability of rural areas is promoted by the safeguarding of agricultural employment, in which respect a form of product control is an effective instrument for reducing the present – and in all probability rising – agricultural surpluses. Minimisation of costs, by contrast, can best be achieved by allowing 'the market' to do its work.

The above antithesis is not of recent date. The objectives of the CAP have in fact been the subject of debate since the inception. Guaranteeing a fair standard of living for the agricultural community while at the same time achieving reasonable (i.e. low) prices for the consumer are bound to come into conflict. It is therefore clear that these objectives are so far apart that they cannot be realised by means of a single policy instrument. Since the conference of Stresa (1958), where the details of the CAP were fleshed out, it has been clear that apart from a Community market and price policy, a structural common agricultural policy was required in order to offset the marked regional variations that might otherwise threaten the unity of the agricultural market. This has, however, never really succeeded. In policy terms, the priorities have been safeguarding the food supply at a reasonable price and the guaranteeing of agricultural incomes. In this way an implicit structural policy has been conducted, aimed at the renewal and improvement of the conditions of production.

In recent years, however, there has been a clearly discernible shift in priorities in EC publications. In particular this has concerned the preservation of the countryside in a social and environmental sense [15]. In addition to the agricultural goal of rationalising production and the socio-economic objectives aimed at market stability, agricultural incomes and the prices of agricultural commodities, objectives concerned with the environment are therefore an increasingly important factor. In the day to day administration of policy, however, there has so far been little evidence of such a shift. Market and price

[15] Commission of the European Communities, *The future of rural society*; COM (88) 501 def., Brussels-Luxembourg, 1988.

policy continue to predominate. The broadening of the policy objectives has resulted in reforms of the structural funds, which promises a shift in emphasis towards (regional) structural policy, but if the policy effort is measured in terms of the resources involved, this forms a very small proportion. In 1987 approximately 0.8 billion ECU was allocated to agricultural structural policy, compared with 23 billion ECU for market and price policy. Other agricultural policy was therefore allocated no more than approximately 3.5 per cent [16].

As the debate has come to focus on the necessary instruments – i.e. product control versus market-oriented price policy – there is a tendency to forget the purpose for which the instruments are being deployed. All too often the debate is conducted in terms of expediency, entrenched convictions and considerations of principle. As always this does not provide a solid basis for consensus. The only firm foundation for a debate about the effectiveness of past or future policies is an evaluation of the extent to which the intended goals have been achieved.

On these grounds the Council has placed the focus in this report on the objectives of the official policy. The aims of this report may be defined as that of *providing insight with the aid of quantitative research into the interrelationships between a number of identifiable agricultural developments, wishes with respect to socio-economic and environmental variables and the consequences of these interactions for the rural areas in Europe.* The scenarios that have been developed each provide an alternative form of development for the rural areas in the long term. The scenarios extend for a period of 25 years, during which time the modifications in agricultural production envisaged in this report should be achievable.

2.3.2 Alternative scenarios: land use as the connecting link

The construction of alternative scenarios requires a common base, on which variations are then superimposed. The base selected for the scenarios in this report is the method of land use. Any form of regulation in agriculture, whether this involves departure from market prices or the imposition of production ceilings, necessarily entails a certain geographical distribution of the various land use activities. The input of labour, for example, is a determining factor in the method of land use – which to a certain extent also determines the impact on the environment.

In essence this report consists of a model-based analysis of possible variations in land use within the EC as a whole. On the basis of various preferences the report examines how much land can be used for a particular purpose and where and in what way this can best be done. The allocation of land is therefore governed by the relative value attached to the various goals. By distinguishing which goals are linked to which kinds of land use it may then be determined where these goals can best be realised within the Community.

The selected method enables the developments at EC level to be varied and not, as is often the case, to be regarded as given. In this way the consequences of particular policy choices are made explicit. The analysis then enables a considered choice to be made between the various options, in which respect pragmatic arguments – e.g. the availability of policy instruments – or the importance attached to a particular development can be decisive. The analysis indicates the consequences that such a choice would have for the EC as a whole.

[16] European Court of Audit, 'Annual report on the 1987 financial year'; in: *Journal of the European Communities*; C31, 12 December 1988.

The method adopted also contains a number of limitations in terms of both the subjects for examination and the nature of the analysis. In the first place only those activities are examined that have a direct relation to the soil. The most notable of these are therefore agriculture, forestry, nature development, nature conservation and recreation. Activities that are not or less land-dependent, such as horticulture and intensive livestock farming, are examined only in so far as they affect land-based production or are themselves influenced by the latter. Intensive livestock farming for example is discussed only in relation to the uptake of land resulting from the requirement for transport and the need for manure disposal arrangements in the case of land-based farming. Environmental problems associated with this form of production are left out of account; they were considered recently in the report issued by the Council on the relationships between the environment, economics and government [17].

Nor is regional economic development examined in detail. Land-based activities naturally have socio-economic consequences in the form of employment and income but the provision of an integral framework for regional development would require a study covering every economic sector, which would be beyond the scope of this report. Where activities requiring land use dominate the regional economy, however, the results may provide indications for the local developmental possibilities. This applies particularly to various regions in the south of the EC.

2.3.3 Derivation of policy goals

The policy goals that are examined in this report as an interrelated whole have as far as possible been drawn from policy documents issued by the relevant governments. Similarly the quantification has where possible been based on existing sources.

Since agriculture is the largest land-user in the EC, the aforementioned objectives of the CAP have been taken as the starting point. As far as agricultural production is concerned, the aim is a secure food supply for all the leading agricultural products at the level of the EC-12 as a whole. For the present this objective of food security has been couched in terms of self-sufficiency. This means that a fixed demand for agricultural products has been assumed, except where the production of raw materials for industry is concerned. Any surpluses should not be allowed to reach the point of distorting the world market.

The study is also based on the objective of convergence within the EC-12 and efforts to avoid divergence by narrowing the pronounced (socio-economic) regional variations. Apart from direct production goals, the objectives include the preservation of countryside, in the sense of both landscape management and environmental protection [18]. Apart from purely agricultural and socio-economic objectives, the scenarios therefore take into account environmental objectives.

2.4 Usability of long-range studies

Chapters 3-6 examine how the Council has investigated the technical possibilities for allocating the various forms of land use in the European Community. How useful, however, is this kind of long-range policy study?

[17] Netherlands Scientific Council for Government Policy (WRR), *Environmental policy: strategy, instruments and enforcement*; Reports to the Government no. 41, The Hague, Sdu Uitgeverij, 1992.

[18] Commission of the European Communities, *The future of rurol society*; op. cit.

The working method adopted means that the analysis is mainly concerned with identifying the consequences of particular choices rather than finding solutions to problems. It also needs to be borne in mind that it is a survey, not a forecast. By analysing the final outcome of given policy choices, possibilities are identified, although not necessarily probabilities – even though by demonstrating certain effects, attention can be focused on hitherto unsuspected problems and so have predictive value. The particular value of the method adopted is that it identifies the consequences for policy goals of normative choices, while at the same time bringing out conflicts between those goals and examining the scope for doing something about those conflicts.

In practice policy will not be able to confine its choices to possibilities. It will always be a matter of striking a balance: if policy concentrates excessively on possibilities it will tend towards the utopian, while if it dwells unduly on what is considered probable, it will tend towards conservatism. Policy is a matter of skilled manoeuvring between the two extremes.

In this respect a technical survey of the possibilities can set the context for estimating the necessary effort. In this way a frame of reference can be created for evaluating the strategic choices that the government and other actors need to make. Such a frame of reference makes for better policy choices as it can then be determined to what extent present policy fits in with trend-based developments and whether, and to what extent, the flow could be altered by other policies or whether it would be possible to go with the flow in achieving the desired goals.

Methodology 3

3.1 Procedure adopted for this report

For the purposes of this report the Council has developed the GOAL (General Optimal Allocation of Land Use) linear-programming model which enables scenarios to be drawn up showing the consequences of alternative policy goals for rural areas.

The GOAL model provides a reply to the question as to which regional distribution of land use at European Community level can best meet the assumed demand for agricultural and forestry products subject to fixed and variable restrictions.

The fixed restrictions are by way of technical constraints arising from the nature of the soil, climatic factors, crop characteristics and the available land and time. The variable restrictions relate to a number of policy goals that have been included in the model. These restrictions express wishes with respect to the desired land area, the desired volume of employment and the desired input of nutrients and crop protection agents.

With the aid of a procedure specially developed for these kinds of issues known as Interactive Multiple Goal Programming (IMGP) it is then established which combination of each of the policy goals in question can be realised. To this end the relationship with the various kinds of land use is determined for each of these policy goals, thus giving rise to 'goal variables'. This optimisation is set in a policy context by linking upper or lower limits to the various goal variables in the form of the aforementioned variable restrictions. By the stipulation of values in this manner a hierarchy of goals is built up in accordance with contrasting normative political philosophies concerning the appropriate policy for rural areas.

Such a philosophy may be defined as an entity of clearly interrelated preferences with respect to a number of selected policy goals. In this respect the relationships between the agricultural sector and the economic and physical environment play a significant part. The philosophies examined in this report are based on the main positions in the current debate on European agricultural policy. These may be summarised as follows:

- free market and free trade;
- regional development;
- nature and landscape;
- environmental protection.

Using the GOAL model an optimal scenario is next generated for each philosophy in terms of land use. Although all the goals play a part in each of the scenarios, the importance attached to each will vary in terms of the philosophy in question.

A number of policy goals associated with land use are not, however, readily incorporated into a linear programming model on such a large scale as the EC-12. In particular, wishes with respect to nature conservation and development need localised input. With this in mind this study has drawn up an initial outline for a network of protection areas in the EC-12. This in turn is based on the approach for the Netherlands in the Nature Policy Plan [1]. On the basis of

[1] *Natuurbeleidsplan* (Nature Policy Plan); Parliamentary Proceedings, Lower House, 1989-1990 session, 21 149, nos. 2-3.

existing nature reserves an expansion of the total nature reserve has been proposed so as to provide an optimal link-up between the component elements. This takes account of both the existing natural heritage and the ability to create new natural assets. A strategy of this kind provides the best guarantees for more sustainable nature conservation.

Under the procedure adopted, this information is then used in order to carry out a land requirement evaluation. A number of spatially determined objectives in the field of nature conservation and development are recorded on a map. The scenarios are then compared with the map. This form of physical assessment outside the model can identify incompatibilities that could affect the ultimate policy choices.

The scenarios are highly technical in nature. Model-based potential future land use scenarios have been determined purely on the basis of technical feasibility and a number of quantified policy goals. These are stylised portrayals of reality, of which one can only say that they indicate the outer limits within which future developments will take place.
A comparison between these scenarios and proposed and current policy provides the basis for the ultimate recommendations, in the form of a policy agenda. This agenda is primarily concerned with the kinds of policies that would be possible for the Netherlands given the potential developments within the EC. In addition – depending on the nature of the study – more regional and more community-oriented recommendations will appear on the agenda.

The procedure adopted for the study is as follows:

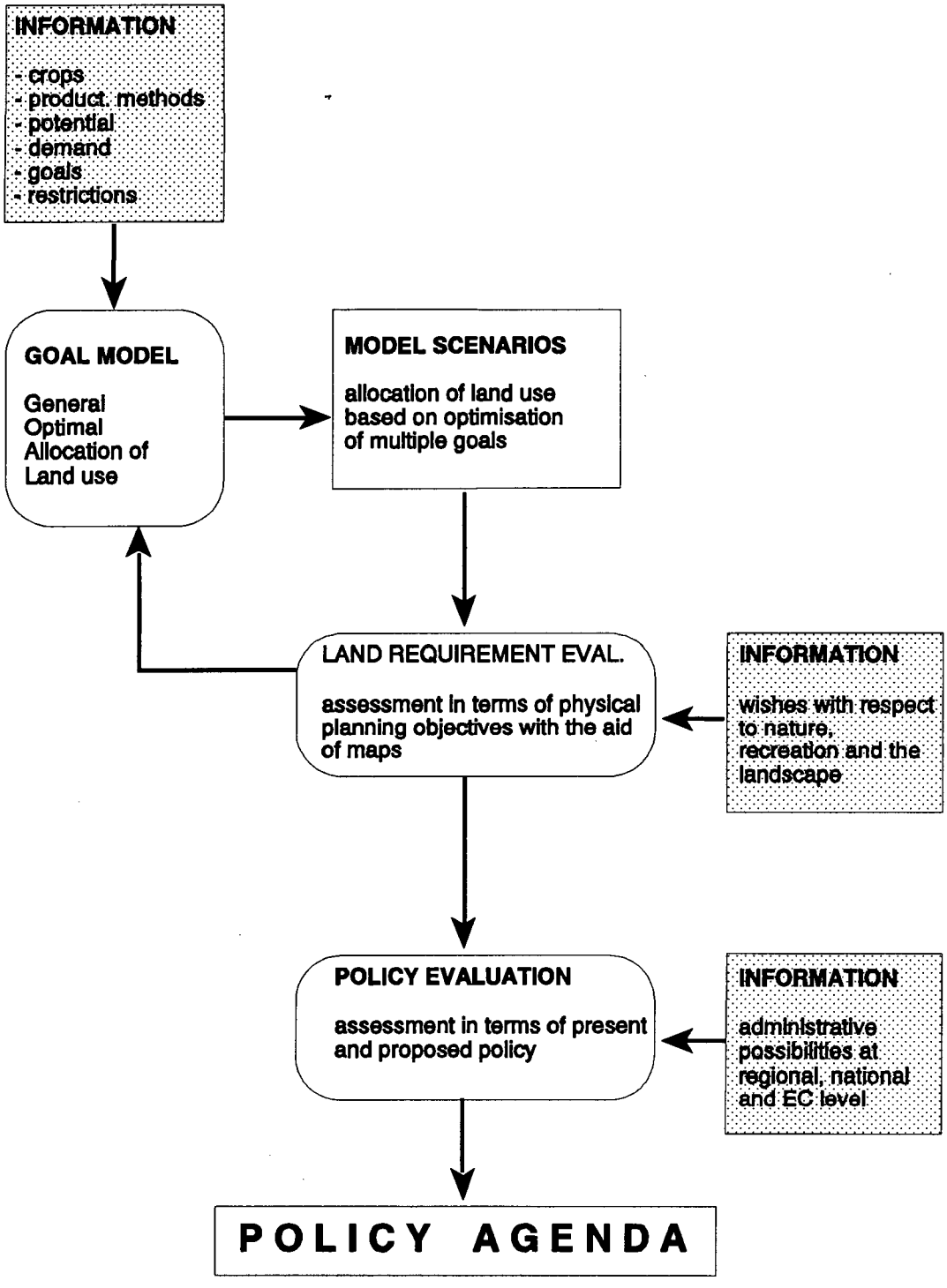
1. to begin with a number of policy goals are quantified in relation to land use;
2. strategic philosophies are then defined in terms of the priority attached to these goals. In this respect social reality is reduced to a limited number of well defined positions;
3. these philosophies are in turn used to flesh out the preferences with respect to quantitative policy goals in the GOAL model. This results in the compilation of a number of quantitative scenarios for land use in the EC;
4. these scenarios are assessed in terms of physically determined desiderata in the field of nature conservation and development;
5. the results of the scenarios are compared with present and proposed policy, thereby indicating evident differences between policy intentions and technical possibilities;
6. finally a policy agenda is compiled, on the one hand drawing on the outcomes of the GOAL model in order to set a framework for policy and on the other based on insights concerning the feasibility of the instruments that would be used in any one dominant philosophy.

These steps are shown diagrammatically in Figure 3.1.

The Council has adopted a similar approach in previous reports [2]. In particular, *A Policy-oriented Survey of the Future* was based on a number of contrasting political philosophies, although in this case these consisted of clearly identifiable ideological/political schools of thought. One problem encountered with the report was that many people who were deemed to support these political philosophies regarded the analysis in which those views were taken to their logical conclusion as more of a caricature than a portrait and consequently had difficulty identifying with the report's findings.

[2] WRR, *A Policy-oriented Survey of the Future. Part 2: Towards a Broader Perspective*; Reports to the Government no. 25, The Hague, Staatsuitgeverij, 1983.
WRR, *Scope for Growth. Threats to and opportunities for the Dutch economy over the next ten years*; Reports to the Government no. 29, The Hague, Staatsuitgeverij, 1987.

Figure 3.1 Working method adopted in the study



Source: WRR

In its report *Scope for Growth* the Council confronted this objection by working as little as possible on the basis of explicit normative assumptions. This, however, suffers from the disadvantage that, given the necessity of deciding between various options in drawing up scenarios, the use of a commonsense approach rather than a normative framework makes it difficult to assess the value of the resulting recommendations.

The strategy adopted for the purposes of this report has sought to do justice to both the more technical information in the form of model restrictions and normative information in the form of political philosophies that provide a frame of reference for the choice of technical alternatives and policy instruments. In this case the philosophies have been limited to attitudes concerning the desirable future of rural society in the Community. By avoiding any all-embracing role for these characteristic philosophies the risk of caricatures is reduced. The result also corresponds more closely with the real policy world, in which intermediate positions can be taken that combine elements from more than one strategic philosophy. The transition from the results of economic modelling to policy recommendations is achieved by allowing the underlying philosophy to have a bearing on both the preferences incorporated in the model and the subsequently described policy options for realising the scenario. By using the political philosophy as the connecting link, the technical models becomes less of a convenient peg on which to hang the development of policy options that fail to do justice to the inherent rationality and irrationality of policy processes.

The following sections begin by examining the input of fixed restrictions and goal variables in the GOAL model (sections 3.2 and 3.3), as well as the way in which policy goals outside the model have been handled (3.4). The use of various political philosophies as frameworks for the individual scenarios is also examined (3.5). For a more detailed discussion of the model we would refer to the separate working document [3].

3.2 The construction of the GOAL model: fixed restrictions

3.2.1 Geographical scale

Under the GOAL model land use is allocated on a regional basis. The choice of regional classification consequently determines the capacity of the analysis to generate solutions.

The geographical breakdown must of course be appropriate for generating insights that can lead to policy recommendations. For this reason the NUTS-1 classification has been adopted. Under this classification, drawn up by Eurostat (the EC's statistical office), the EC-12 has been divided into 64 regions. The Netherlands has been divided into four parts of the country [4]. Policies concerned with regional problems are often based on this territorial breakdown. A further advantage is the fact that much of the statistical data is also available at this level.

Not all NUTS-1 regions may be designated as rural areas. On the basis of two criteria, namely population density and the agricultural area (expressed in UAA = utilised agricultural area), this leaves 58 regions that may be designated as rural for the purposes of the analysis below (see appendix).

[3] D. Scheele, *Formulation and characteristics of GOAL*; Working Documents no. W64, The Hague, WRR, 1992.

[4] Commission of the European Communities, Regions, Nomenclature of territorial units for statistics N.U.T.S.; Luxembourg, Eurostat, 1989.

3.2.2 Time-frame

A report such as the present one needs to establish the time-frame to which its pronouncements relate. Even though it is true to say that a survey of this kind is not primarily concerned with the time-path but with developmental alternatives in the form of ultimate situations and does not go in for predictions as to precisely what will happen when, a number of assumptions concerning the background setting in which the scenarios are required to evolve are time-bound in both a technical and a policy sense.

Within the medium term (say 10 years) it is possible for potential developments in the field of agricultural technology to be narrowed to a certain range. Within this time-frame it is for example unlikely that agricultural production will change significantly as a result of biotechnological developments. While there may be considerable scope for improving the resistance of certain crops to disease and pests, e.g. with the aid of genetically modified strains, the more spectacular developments foreshadowed in the earlier years of recombinant technology (such as food crops that would draw nitrogen from the air or employ a different photosynthetic system) have not come to anything as yet. Nor is the structure of sales likely to alter radically in response to agrification (i.e. the production of raw materials for the non-food industry). Every development in this direction in recent years has more or less foundered on economic and/or technical obstacles.

For the purpose of calculating the possible allocation of land use, no constraints have been incorporated into the model with respect to such factors as farm size or type, the presence of processing industry, the available infrastructure for the transportation of products and the quality of the labour force in the region in question. This too is a time-bound assumption. Since the analysis presupposes the ability to conduct agriculture in every part of the EC with the same techniques, sharply contrasting scenarios can be generated. The limits to what is technically feasible are consequently described as explicitly as possible. The GOAL model does therefore not posit regional production potentials as these apply at present but assumes that the best technical means will be applied in each region. This means that methods will be used in every part of the EC that are at present conceivable and/or which have been tested in pilot situations. In this way the technically feasible production potential of the EC as a whole can be established. At the same time, traditional barriers will continue to exert a significant effect on the practical ability to establish farms. Secondly, in describing the possible consequences for the Netherlands of the various scenarios, the extent to which the ability to establish new farms is a factor will be examined in more detail, together with the ability to focus policy on this particular aspect.

The assumption that each form of land use can take place in every region implies that the analysis extends over a period of at least 10 years. With a view to overseeing future technological developments, 25 years must be taken as the upper limit.

3.2.3 Production ceilings

The continuing rise in productivity is limited by a well defined ceiling. Agriculture is based on the ability of plants to transform organic chemical elements with the aid of sunlight into biomass – the process known as photosynthesis. On the basis of the crop characteristics, soil quality and climate, the maximum feasible production to be obtained by photosynthesis may be calculated. This *potential* yield per hectare has been calculated for the purposes of this study for a number of important agricultural crops that can serve as indicators (see section 4.2). The word 'potential' indicates that these are yields that do not take any account of losses from disease, pests or mismanagement, etcetera.

The production ceilings in the various regions in the Community have been specified down to a very low level of detail (namely some 22,000 grid units in the EC-12). In those areas where the soil, topography and climate permit the cultivation of the indicator crops, the average yield has been simulated over a series of years with the aid of a crop-growth model. Climate data for the past 30 years have been used for this purpose. This production ceiling must be regarded as an absolute upper limit and can therefore serve as an excellent frame of reference.

3.2.4 The various forms of land use

This report examines the various allocations of land use that are possible in principle. As noted previously, certain categories of agriculture have consequently been left out of account as they involve little if any land use. This applies especially to open-ground agriculture, glasshouse cultivation and intensive livestock farming. Other forms of land-based agriculture (i.e. arable and pastoral farming, grasslands and long-term crops) have therefore been included in the analysis.

Expressed as the percentage of land used for agricultural purposes (UAA), the share of agriculture in the member states ranges from 43.5 per cent in Greece to 80.8 per cent in Ireland. Of the total agricultural area of the EC-12, 52.6 per cent consists of arable farming and 24.1 per cent of forestry. These figures are however subject to marked variations [5]. With respect to those forms of land use that have been taken into account, the analysis has therefore been based on agricultural subsectors, supplemented by forestry and nature reserves. These are listed in Table 3.1. In this way the vast majority of the EC land area has been covered, so that the model results relate to virtually the entire rural area of the EC-12.

Table 3.1 The six forms of land use in the GOAL model

	FORMS OF LAND USE
1	Cereals cultivation
2	Arable farming
3	Grassland farming (livestock farming)
4	Permanent crops (fruit, olives)
5	Forestry
6	Nature reserves

Within the various forms of land use a number of different production techniques have been defined, subject to the aforementioned production ceilings. Particularly in the case of arable farming, the same output can be produced in various ways and in various rotations, which will have differing consequences for the amount of land required, employment and the input of fertilisers.

3.2.5 Demand for agricultural products

The allocation of land use under the GOAL model is at all times subject to an exogenously determined demand for agricultural and forestry products. Various options may be specified with respect to the expected demand, in which respect two factors are particularly important.

[5] J. Lee, *Land use trends and factors influencing change in future land use in EC-12*; Paper presented at the European Agrarian Youth Congress, Groningen, June 1990.

In the first place the question arises as to whether consumers will change their diet in response to higher living standards. According to the historical evidence, rising incomes lead to a growing number of animal products in the diet.

Secondly there is the question as to whether the EC will continue to strive for self-sufficiency in the future or whether trade in agricultural and forestry products will be largely liberalised. In the latter case new equilibriums could be struck in the various submarkets, which could affect production within the EC.

In principle this leads to four different developments in demand:

1. self-sufficiency without a change in diet;
2. self-sufficiency with a change in diet;
3. unrestricted imports without a change in diet;
4. unrestricted imports with a change in diet.

These four possible developments in demand have been incorporated into the model study as alternatives (see Chapter 4).

3.3 Policy goals in the GOAL model: goal variables

3.3.1 Goal variable criteria

In order to translate a policy goal into a goal variable in the model two criteria have to be met. In the first place the goal variables must be capable of quantification in clear-cut dimensions. It must also be possible to link such quantification to various forms of land use at regional level. Secondly, the goal variables must represent conflicting choices, at least up to a certain level although not in total. If the goal variables simply form extensions of one another the model cannot then generate alternative allocations. If on the other hand the goal variables are totally opposed to one another, the results will be meaningless since the loss of one goal variable will automatically mean the gain of another, with a constant balance between gains and losses.

A certain degree of incompatibility and/or a relationship between goal variables that is unclear since it involves a number of complex intermediate steps is essential if a linear-programming model is to generate meaningful information on the possibilities for trade-offs in terms of land use.

In practice policy goals do indeed tend to be mutually incompatible up to a certain level. In general, policy goals concern divergent intermediate positions rather than mutually exclusive extremes. By nature the GOAL model is excellently equipped to generate results that are consistent with the real policy world. The requirement that the goal variables should be quantifiable necessitates careful selection. Such a selection has been made for a number of agro-technical, socio-economic and environmental policy goals.

3.3.2 Agro-technical policy goals

A substantial proportion of the land area of the EC-12 is used for agricultural purposes. The main objective of the Common Agricultural Policy for these areas is to increase productivity, both of the land and of labour. Many elements of the CAP are consequently aimed either directly (i.e. investment subsidies and the structure funds) or indirectly (by means of research, information and education) at increasing the level of productivity per hectare or per animal. Land productivity is therefore one of the most commonly used indicators for comparing and assessing land-based agricultural production.

In addition the efficiency of production can be measured in terms of the volume

of production factors concerned. With the aid of the GOAL model it is possible to establish how a particular demand for agricultural products within the EC can be satisfied. At a given level of demand, the minimisation of costs means that production needs to take place in the most cost-efficient way and for the factors of production to be used to maximum effect.

Maximisation of land productivity and minimisation of the costs of land-based agricultural production therefore form the two technical agricultural policy goals to be operationalised.

3.3.3 Socio-economic policy goals

The main socio-economic policy goals are employment and income. Many policy documents and official regulations emphasise the importance of safeguarding agricultural employment. Regional considerations are a particularly important factor in this respect; active efforts are made to prevent the loss of agricultural employment in particular regions. This aim is at variance with the desire of increasing productivity in agriculture. It is not just a matter of preserving regional levels of employment but also of the total level of employment. Elements of actual or proposed agricultural policy are directly related to preserving the volume of employment. The feasibility of an income support, for example, cannot be viewed in isolation from the (normatively determined) target level of employment. An estimate of the maximum feasible level of employment is therefore required for a survey of the technical extremes of possible developments.

Income has not been included as a variable in this study. The assumption that the best technical means will be employed everywhere in agriculture is not really compatible with (regionally) differentiated income. It has therefore been assumed that the remuneration of labour in every region remains at a constant level. That level has been (arbitrarily) set at the level of income currently earned in the wealthier member states.

Maximisation of the total and regional employment in land-based agriculture therefore form the two socio-economic policy goals to be operationalised.

3.3.4 Environmental policy goals

Increasing attention has recently been devoted at EC level to sustainable agriculture that can contribute towards the preservation of rural areas, both in terms of the landscape and environmentally [6]. Although sustainability is not something that can be defined in totally objective terms and there are various subjective choices that result in different conceptions of sustainable land use, the circumstances in which the rise in production is currently taking place nevertheless constitute a clear threat to sustainability.

By incorporating the environmental requirements in the scenarios as a policy goal a certain form of 'non-sustainability' is at least countered. Among other things, the information and insights from a previous preliminary study of the Council, 'Building-blocks for an integrated agriculture', have been used for this purpose [7].

[6] Commission of the European Communities, *The future of rural society*; COM(88) 501 def. Brussels/Luxembourg, 1988.

[7] *Bouwstenen voor een geïntegreerde landbouw* (Building-blocks for an integrated agriculture – in Dutch); by W.J. van der Weijden, H. van der Wal, H.J. de Graaf et al., WRR Preliminary and background studies no. V44, The Hague, Staatsuitgeverij, 1984.

The first environmental requirement relates to the minerals surplus generated by the widespread use of nitrogen and phosphates. In the Netherlands, livestock farming in particular adds greater quantities of minerals through fertilisers and concentrated feeds than its siphons off through its products. Taking nitrogen alone, dairy farming accounts for some 60 per cent of the total, arable farming and horticulture for some 7 per cent and intensive livestock some 30 per cent [8].

The surplus of nitrogen constitutes a threat to the drinking water supply in a number of places where the groundwater from which the drinking water is prepared contains excessive concentrations of nitrates. In other places nitrogen and phosphates end up in the surface waters, resulting in changes in vegetation. Plants species that flourish in low-nutrient water are displaced by species that can tolerate high nitrogen loads. In some cases the undesired addition of fertilisers to surface waters leads to an uncontrolled growth of algae, there by leading to lack of oxygen and the death of other aquatic plants and animals. The resultant pollution renders the water unsuitable for recreation purposes and/or consumption.

These problems are not confined to the Netherlands. The standard laid down by the EC Drinking Water Directive of 1975, namely that drinking water should contain no more than 50 milligrams of nitrates per litre of water, is exceeded in virtually all the EC-12 member states. This standard is consistently exceeded in France, West Germany and the United Kingdom. It has also been established that the average concentrations of nitrates are rising annually by one to two milligrams per litre. The rise is located in areas with intensive agricultural production [9].

In the case of phosphates, equilibrium fertilisation is in principle possible [10]. Taken on average over a number of growing seasons, as much phosphate can be generated as the crop requires, meaning there is no leaching. This is made possible because phosphate is fixed in the soil, thereby bridging the difference between the application of fertiliser (a one-off event) and absorption by the crop (a virtually continuous process).

By contrast nitrate is a highly mobile mineral which can easily disappear from the soil by leaching out into the groundwater, run-off into the surface waters or evaporation after conversion (i.e. denitrification). In terms of setting a target for the potential overburdening of the environment by the (excessive) use of fertilisers, nitrates are therefore the relevant substance.

Relevant here is the quantity of nitrogen that ends up in the environment. This can be approximately calculated from the difference between the input and the output of nitrogen in the agricultural system of the EC. The input consists of artificial fertilisers and manure, imported animal feedstuffs, deposition (i.e. air pollution) and the fixation of atmospheric nitrogen by organisms. Output may be calculated as the sales of agricultural products, both vegetable and animal. The difference may be designated as nitrogen use. To some extent this nitrogen will end up in the environment. There are various other ways in which the aim can be expressed more precisely: expressed in use per hectare it tells us something about the geographical burden on the environment; expressed in use per unit product it tells us something about the specific burden on the environment.

[8] H.G. van der Meer and F. Berendse, 'Nutriëntenoverschotten onevenredig groot' (Nutrient surplusses out of proportion – in Dutch); in: *Landbouwkundig Tijdschrift*, September 1990, vol. 102, no. 9, p. 30.

[9] M. Saull, 'Nitrates in soil and water'; *New Scientist*, 15 September 1990, Inside Science no. 37.

[10] E.E. Biewinga, 'Mineralenoverschot in de landbouw spoeding verleden tijd?' (Will mineral surplusses soon be history? – in Dutch); in: *Landbouwkundig Tijdschrift*, June/July 1991, Vol. 103 no. 6/7, p. 30.

Apart from the use of mineral fertilisers, the input of crop protection agents is a second major cause of land use-related environmental problems. Insecticides (against insect plagues), fungicides (against mould outbreaks), herbicides (against weeds), soil disinfectants (against germs) and the like are used in agriculture. Depending on the climate, farming methods, type of crops and growth-retarding factors, some of these agents will be more heavily used than others. Soil disinfectants and fungicides, for example, are important in intensive potato growing and herbicides in maize and sugar-beet cultivation.

Pesticides are designed to kill localised groups of organisms. The ideal pesticide therefore needs to have a highly specific effect and must also disappear rapidly from the environment. Many substances, however, are broad-acting and persistent, so that in practice there are nearly always toxic side-effects. Apart from the poisoning of organisms other than the target organisms in the agricultural areas themselves, organisms are also poisoned by the distribution of substances beyond the actual agricultural area (e.g. when sprays are borne by the wind in crop-dusting). Other organisms (including human beings) may suffer from poisoning because the poison is passed on in the food-chain. The use of herbicides also means that field verges are often sprayed as well, resulting in the loss of valuable vegetation.

In the statistics, the various substances referred to above are – insofar as the data exists – expressed in kilograms of active ingredients. The goal therefore becomes the minimisation of the use of pesticides expressed as the volume of active ingredients. In this respect it needs to be borne in mind that this measure tells us nothing about the toxicity of the ecological effect. Little is known about losses, so that for the purposes of this study, the input of crop protection agents has been used as the measure. Once again, the goal may be defined in various ways. Expressed in input per hectare, it tells us something about the possible direct effects on the environment. Expressed in input per unit product it provides a possible indication about the indirect effects via the food chain.

The minimisation of the use of nitrogen per hectare and per kg of output and the minimisation of the input of crop protection agents per hectare and per unit product are therefore the environmental policy goals to be operationalised in the GOAL model.

3.3.5 Survey of the policy goals incorporated into the GOAL model

To sum up, we are left with eight policy goals, subdivided into four groups, that will play a part in the calculations using the GOAL model. These goals are listed in Table 3.2.

Table 3.2 Policy goals related to land use in rural areas as incorporated in the GOAL model

ASPECT		POLICY GOAL
Agro-technical	1-	maximisation of land productivity
	2-	minimisation of costs of agricultural production
Socio-economic	3-	maximisation of total employment in land-based agriculture
	4-	maximisation of regional employment in land-based agriculture
Environmental	5-	minimisation of input of nutrients per hectare
	6-	minimisation of input of nutrients per unit product
	7-	minimisation of input of crop protection agents per hectare
	8-	minimisation of input of crop protection agents per unit product

3.4 Policy goals outside the GOAL model

The policy goals incorporated in the GOAL model cover only a proportion of the objectives for land use in rural areas. In particular, non-agricultural forms of land use have their own policy goals that cannot be incorporated into a model without further ado.

There may be a number of reasons for this. The relationship between land use and the policy goal in question may be insufficiently clear, or the relationship may be clear but does not lend itself to specification with sufficient precision. Finally the relationship between the goal and land use may vary sharply from place to place. Considerations of this kind apply especially to policy goals with respect to the landscape, recreation and nature conservation.

Landscape

The rural areas of the EC are subject to a process of landscape standardisation. The agricultural landscape, in particular, is undergoing enormous changes as a result of new methods of farm management [11]. On account of regional differences in the natural environment, social relationships, customs and market factors, these changes were formerly highly regional in nature. Increasingly, this is ceasing to be the case on account of rising mobility, improved communications and technological progress. The aim of creating uniform market conditions within the EC is another factor contributing towards standardisation.

By way of illustration, one per cent of linear planting (i.e. hedges, windbreaks and avenues, etc.) is disappearing each year in the intensive agricultural areas in north-western Europe. In some parts of France such vegetation is even disappearing at the rate of two per cent a year [12]. In purely commercial terms, the disappearance of such vegetation can bring advantages. It does, however, mean that a number of ecological functions of the cultivated landscape are lost, such as breeding biotype for birds, refuges for animals and corridors connecting more or less natural habitats. The landscape can also lose its attractiveness for recreational purposes if its scale is altered.

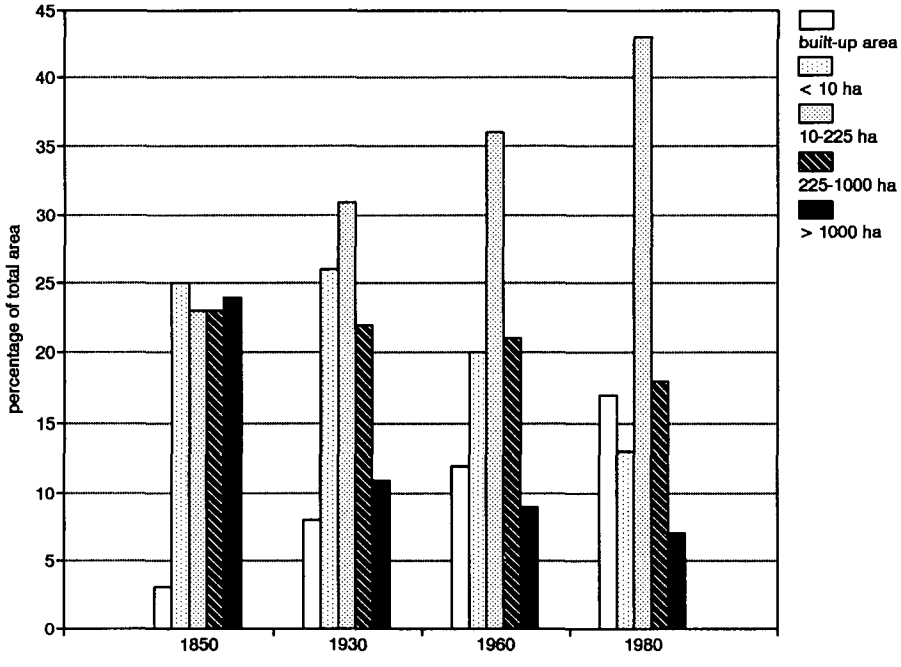
Small-scale landscapes are becoming larger in scale. The genuinely large-scale landscapes such as the Flevo polders in the Netherlands and the plains of northern France are also disappearing as a result of infrastructural projects that in turn reflect the growing intensity of countryside use. In the Netherlands research has been conducted into changes in scale by examining the changes in the density of linear planting and their physical location. This has revealed that both areas of less than 10 hectares in size and areas larger than 225 hectares are disappearing in favour of the middle category of 10-225 hectares [13]. This is shown in Figure 3.2.

[11] J.H.A. Meeus, M.P. Wijermans and M.J. Vroom, 'Agricultural Landscapes in Europe and their Transformation'; in: *Landscape and Urban Planning*, 1990 (18), pp. 289-352.

[12] A.L. de Regt, 'Kleinschalig landschap in een grootschalig Europa' (A small-scale landscape in a large-scale Europe – in Dutch); in: *Ruimtelijke Verkenningen 1989; Jaarboek Rijksplanologische Dienst*; The Hague, Ministry of Health, Physical Planning and Environmental Control, 1989.

[13] R. Kuysters and H.Z. NieuwBeerta, 'Landbouw en ruimtemaat van het landschap' (Agriculture and the scale of the landscape – in Dutch); in: *Signalen van Onderzoek en studie, Cahier no 4: Kleinschalige landschappen*; The Hague, National Town and Country Planning Department, 1988.

Figure 3.2 Average size of agricultural enclosures in the Netherlands, 1850, 1930, 1960 and 1980 (in % of the total area)



Source: National Physical Planning Agency.

In response to these developments, every country in the EC has developed its own policies for maintaining and developing the landscape. This has, however, given rise to problems. Although changes are clearly taking place in the cultivated landscape, the nature and direction of those changes cannot be simply linked to clearly defined changes in agriculture [14]. This makes it very difficult to indicate in a survey how a change might look in the long term. The lack of knowledge concerning the relationship between changes in agriculture and changes in the landscape mean that it is totally impossible to draw up a formal formula for a model.

Recreation

Recreation can contribute significantly to the development of rural areas. In 'The future of rural society' three reasons are cited why member states of the EC promote tourism in rural areas [15]. In the first place it meets the demand of a new category of tourists. Secondly, such tourism makes it possible to restore and preserve the cultural heritage. Thirdly this branch of tourism can create employment in rural areas. In addition the report concludes that the prospects are generally favourable, particularly since the existing infrastructure can be adapted to tourism without undue difficulty.

Although a relationship can be established between the quality of the environment and the opportunities for recreation, it is not possible to indicate the nature and scale of land use for recreational purposes precisely. Measurability turned out to be a particular obstacle in a survey into the potential of rural

[14] M. Wijermans and J. Meeus, *Karakteristieke cultuurlandschappen van Europa* (Characteristic Cultivated Landscapes of Europe – in Dutch); Working documents no. W58, The Hague, WRR, 1991.

[15] Commission of the European Communities, op cit.

areas in the EC [16]. For the present it is only possible to quantify tourism in terms of the demand for recreation, measured in the number of overnight stays. While there appears to exist a relationship between agricultural land use and the attractiveness of an area, it is not possible – at least at this stage – to specify that correlation with sufficient clarity for inclusion as a policy goal in a quantitative model.

Nature conservation

Nature conservation was one of the first non-agricultural objectives to play a significant role in the CAP. This significance is a direct consequence of the long-running debate about the relationship between agriculture and nature. In order to maintain a number of ecological features to which importance is attached, a certain form of human intervention is required. These are features that depend on 'cultivation', or what is sometimes termed 'secondary nature'.

Without dairy farming there can be no meadow birds and without arable farming no arable weeds. If however the impact of human beings on the environment grows stronger, a number of these ecological features disappear. Intensively fertilised and mown grasslands provide little sanctuary for meadow birds and highly mechanised arable farming with a substantial input of crop protection agents means the end of most wild plants in the field. In most cases, therefore, there is a potential optimum. In limitation agricultural activities can have a positive effect on nature, but once that impact reaches a certain point it can go into reverse. Other ecological features can only survive if they are spared the impact of agricultural (or other potentially disruptive) activities. These features, or 'primary nature', can only survive in a comparatively undisturbed environment. Importance can also be attached to an area as an entity instead of to individual ecological features, in which case the nature reserve needs to be screened from outside influences and interference.

This rather more complex relationship is all too easily overlooked in the debate about the relationship between agriculture and nature. The result is either/or argumentation: either agriculture should be given priority or agriculture should make way for nature. The introduction of the concept of integrated agriculture seeks to find a way out. The concept indicates that agriculture must (and can) take account of objectives other than just production. It is therefore a matter of agriculture with widened objectives. The solution as to what may or may not be perceived as a conflict is sought in the way in which agriculture is pursued.
In terms of the notion that this will not be enough in the long term to protect the natural environment effectively, the concept of a network of protection areas has been developed in recent years [17]. This concept serves to indicate a pattern of land use forms in which allowance is made for the necessary size of nature-conservation areas. It is not therefore just a matter of subjecting agricultural production to certain constraints but of deliberately setting aside certain areas for nature conservation. In addition there will be mixed agricultural/nature-conservation areas.

The most striking feature of this network of protection areas is that the underlying motivation for such areas will vary considerably from place to place. Some areas are designed to protect local plants and species, others to provide corridors for various groups of the same animal species and others again are required as resting and foraging areas for migratory birds.

[16] Netherlands Research Institute for Recreation Tourism, *Trends in Tourism and Recreation in the European Community. Outline Report*; Working Documents no. W60, The Hague, WRR, 1991.

[17] *Natuurbeleidsplan* (Nature Policy Plan); op. cit.

Although a distinct relationship can therefore be established between nature conservation and land use, there turn out to be a large number of differing relationships, which can vary markedly from place to place.

3.5 Four views underlying the GOAL model

Four different views have been formulated that have yielded as many different results of the GOAL model. Each of these results can be regarded as an explicit policy *aspiration* for the future development of rural areas and has been made explicit in a set of objectives. These policy aspirations are widely divergent so as to arrive at contrasting scenarios. Together, these scenarios encompass the major strands of opinion on the desired developments – or views – in rural Europe.

3.5.1 Model specification of policy views

Policy views elaborated using only the eight GOAL model objectives (see table 3.2) present a radical simplification of reality. But it is precisely this simplification that helps us visualise what can happen when a certain view is pursued to its logical conclusion, unhindered by the limitations of the real world.

Each of the views indicates the objectives they prioritise, while conceding that other objectives are also valid. As indicated in section 3.2.5, there are basically four variants in the demand for agricultural products. However, for the elaboration of the views only the variant has been considered that is consistent with the view involved.

View A: free market and free trade

The policy aspiration embodied in this view is sometimes described as the 'supremacy of the market'. In this view, agriculture is regarded as a normal economic activity that will take place where production costs are lowest. Therefore, the objective in the GOAL model for this view aims at minimising the costs of agricultural production. The location of agriculture will thus be fully determined by comparative advantages and disadvantages in the costs of production.
In this view government intervention is minimal. Hence, the free-import variant for demand is used.

View B: regional development

Regional development encompasses several objectives. Maintaining regional employment is a major EC objective and it is interesting to calculate its most extreme consequences for the regions in a scenario. Therefore, the objective in the GOAL model for this view is preservation of regional employment in the agricultural sector to the highest possible level. One major restriction has been set to this objective, though: no job should cost more per hour than the average agricultural wage.
This view complies with control of the market by the government. Hence, the self-sufficiency variant for demand is used.

View C: nature and landscape

Nature and landscape are primarily related to land: the policy aspiration is that as much land as possible be available for nature. Agriculture involves intervention in nature in favour of species selected for production. This inherently is at odds with nature. Therefore, the objective in the GOAL model for this view is to confine agriculture to the smallest possible area. In other words: the goal is the maximisation of land productivity. The proviso is, however, that

agriculture be practised in as ecologically sound a way as possible. This implies that, for this smallest possible area, as few nutrients and pesticides should be used as possible.

To be able to realise the policy aspiration embodied in this view, agricultural free trade – i.e. production outside the EC – is conducive. Hence, the free-import variant for demand is used.

View D: environmental protection

The policy aspiration embodied in this view is aimed at the elimination of harmful substances from the environment. Given the enormous problems in agriculture that are caused by pesticides and fertilisers at both national and European level, the attention in this view is focused on these substances. The objective in the GOAL model for this view requires that pesticides and fertilisers be used as little as possible.
This type of policy cannot embrace the export of environmental problems by importing agricultural products. Hence, the self-sufficiency variant for demand is used.

3.5.2 The relationship between the GOAL model and policy

Model studies are appreciated for their relative simplicity: goals can be clearly defined and their effects can be singled out. No interference with other factors, which in the real world is unavoidable, obscures the results. The question how an objective can be achieved in the real world will not be answered in such a model. As already stated, this is not the object of this study. Instead the consequences of a number of different, sometimes conflicting, objectives, are made visible.

This study emphasises the need for clear policy objectives in strategic policy planning. For each of the four views these objectives have been formulated above. The relationship between these model objectives and actual policy objectives is not unambiguous, and will vary from view to view.

In view A, the model seeks for the lowest possible agricultural costs, given the formulation of the objective. In the real world, however, this objective cannot actively be pursued. Policy will in that case be aimed at creating frameworks within which the market can function optimally. As a result the lowest cost for economic actors, including agriculture, may be achieved. Generally speaking, the policy aspiration embodied in view A excludes all subsidies and other forms of market intervention by the government.

In view B, the model seeks for maximum preservation of regional employment. As was stated above, regional development encompasses a much wider range of objectives. These objectives are part of almost all policy areas, be it focused on a specific region. Therefore, actual policy aimed at regional development is executed at different government levels and in different sectors.

In view C, the model allocates agricultural production in the smallest possible area. Thus, production is concentrated in areas where maximum productivity can be achieved. The policy objective of maximising productivity can be attained through the generation, transfer, and application of knowledge. In the real world this allocation does not call for government intervention: market forces will take care of this. In this respect there is no difference with view A. However, special attention for nature and landscape as another policy objective may lead to the use of additional policy instruments, e.g. the acquisition of agricultural land to create nature reserves.

In view D, the model forces agriculture to minimise the use of pesticides and the loss of fertilisers. In the real world this may be achieved by a system of government regulations consisting of setting standards, execution and enforcement. Thus, the role of the government in this is a prominent one, as opposite to the role of government in view A.

3.5.3 Input of policy goals outside the model

The GOAL model is unable to do justice to the land use goals in the field of nature conservation and development as it is not possible to formulate clear-cut and quantifiable restrictions at the level of the EC-12. Nor have goals in the field of recreation and landscape development been incorporated.

The way in which the policy goals that could not be incorporated in the model have been worked into the scenarios is discussed below.

The spatially determined policy goals are shown on a number of maps comparing the desired with the actual situation. The scenarios generated by the GOAL model are then compared with these maps in order to identify problem situations. The model results may for example suggest that further specialisation and intensification of land use should take place in a certain region, whereas nature conservation and development goals would call for these activities to be limited in the same region.

For the purposes of this evaluation a map has been drawn up as part of a separate study relating to the location and scale of the nature reserves to be protected and developed in the EC-12 [18]. The land use evaluation indicates whether a scenario satisfies the restrictions as imposed by these maps.

In addition maps have been drawn up in relation to the recreational attractiveness of individual regions, based on the demand [19], as well as a description of cultivated landscape types in the EC-12 [20]. These maps do not lend themselves to a genuine land use evaluation, but the resulting descriptions can be used in assessing the scenarios.

[18] N.T. Bischoff and R.H.G. Jongman, *Development of rural areas in Europe: the claim for nature*; WRR, forthcoming.

[19] Netherlands Research Institute for Recreation and Tourism, op. cit.

[20] M. Wijermans and J. Meeus, op. cit.

Results of the information gathering

4

4.1 Introduction

For inputting purposes in the GOAL model the Council has gathered together new data concerning:
- the crop production potentials of the various regions in the EC-12;
- the existing and possible production techniques;
- the potential demand for agricultural and forestry products.

In each of these three areas the results differ in part markedly from the present situation. The results for each of these aspects are discussed below with a view to generating greater insight into the results of the model, in which these elements are of course linked up (see Chapter 5).

4.2 Crop production potentials

The productivity of the land that has been achieved within the EC-12 varies considerably. To some extent these differences stem from factors not directly related to the soil, such as the structure of the agricultural sector, the share of the agricultural workforce and demographic factors. In order to arrive at a classification of the various NUTS-1 regions, their characteristic features have been described in terms of a large number of properties [1].

The data on the respective regional features (i.e. socio-economic, physical, environmental and agro-technical) have been drawn from EUROSTAT. Twenty separate features have been used in order to classify the regions into groups.

On the basis of socio-economic, agro-technical and physical/ecological characteristics, the regions of the EC may be divided into four types, namely:

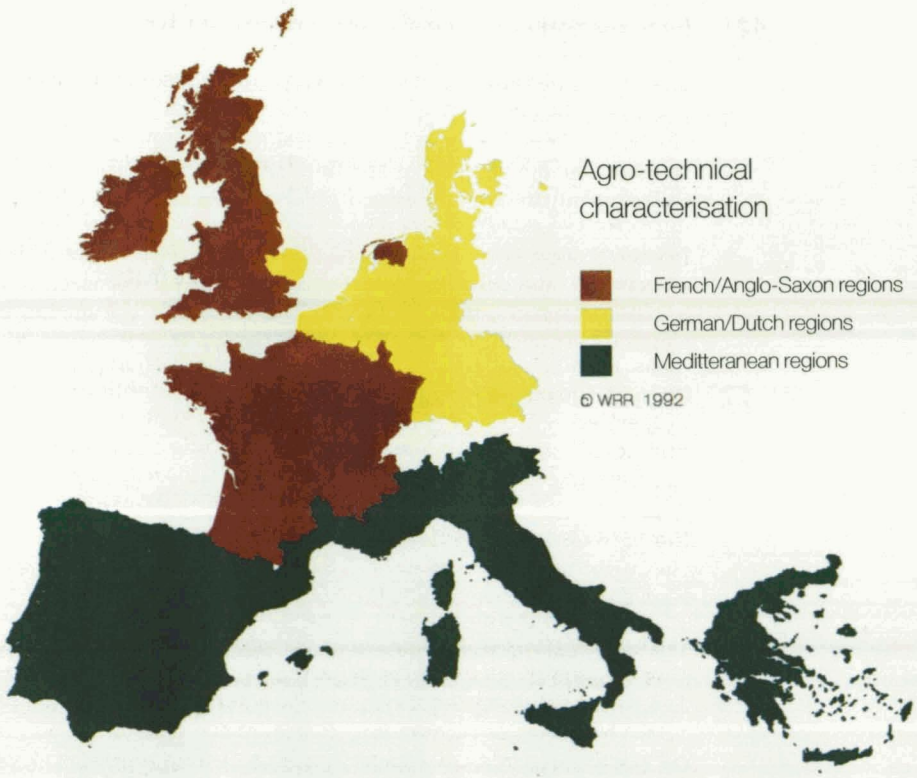
1. the *marginal rural areas* (i.e. the extreme south of the EC apart from North Italy), characterised by small-scale comparatively unproductive agriculture suffering from natural handicaps such as drought and steep slopes. Nevertheless the agricultural sector is a significant pillar of the regional structure in these areas. The scope for alternative economic development is limited;
2. the *transitional rural areas* (West Germany, North Italy, Denmark and Belgium), characterised by a comparatively well industrialised regional economy. Characteristic features of agriculture in these areas are, on the one hand, natural handicaps (i.e. topography) and, on the other, increasing independence from land;
3. the *extensive rural areas* (the bulk of the United Kingdom and France), characterised by large-scale farms with a lower soil productivity than the EC average;
4. the *intensive areas* (Netherlands, Ile-de-France and East Anglia), characterised by both a high population density and an extensive agricultural demand for land as well as an agricultural sector that is of subordinate importance in economic terms but with very high agricultural productivity.

A striking feature is the extent to which these differences apply to the member states en bloc. Only in the case of the United Kingdom and France are there significant interregional variations within these countries.

[1] H. Hengsdijk, *Karakterisering van de landelijke gebieden in de Europese Gemeenschap (A characterization of rural areas in the EC – in Dutch)*; Working Documents no. W51, The Hague. WRR, 1990.

If we confine our attention to agro-technical indicators, three clearly defined groups may be distinguished (Fig. 4.1).

Figure 4.1 Agro-technical classification of NUTS-1 regions



Source: WRR.

a. *French/Anglo-Saxon regions*, characterised by large-scale pastoral and cereal farming. Although the latter are comparatively few in number they produce over 50 per cent of the total EC cereals output on less than one third of the EC cereals area.

   Measured in ECUs, the output of the animal sector is twice that of the horticultural/arable sector. This category accounts for over 38 per cent of the total EC cultivated area.

b. *German/Dutch regions*, characterised by intensive forms of agriculture, in which the financial return per hectare is particularly high. Non-land-based forms of agriculture are a particularly important factor in these countries. A high volume of fertilizers and crop protection agents is used per hectare. Here again, expressed in ECUs, the output of the animal sector exceeds that of the horticultural/arable sector. This category accounts for just 17 per cent of the total EC cultivated area.

c. *Mediterranean regions*, characterised by relatively low agricultural productivity and a high share of horticultural/arable production. Vegetables and fruit are particularly important. At 28 per cent of total EC output, cereals production is low, particularly when it is considered that this category accounts for over 46 per cent of the total EC cultivated area.

This broad classification indicates that the agricultural productivity in substantial tracts of the EC is below the EC-average. There would therefore appear every scope for development in these regions. In order to determine whether this really so, a land use evaluation has been conducted which is summarised in the following sections.

4.2.1 Land use evaluation: qualitative and quantitative

The land use evaluation conducted for the purposes of this report examines the theoretically possible yield of a number of indicator crops on the basis of crop characteristics, the soil and climate [2]. This land use evaluation has been conducted at LEU (Land Evaluation Unit) level. An LEU consists of a combination of 546 units derived from the EC soil map [3] and a classification into 109 agro-climate zones on the basis of the Agro-climatic Atlas of Europe [4]. This produces some 220,000 physically separated combinations, which can however be reduced to around 4,200 LEUs with the same features.

The land use evaluation is conducted on both a qualitative and a quantitative basis. In the case of the *qualitative land use evaluation* the suitability of a given area for the cultivation of a particular crop is established on the basis of soil properties. Relevant factors in this respect include the topography, stoniness and acidity of the soil. Under this evaluation a substantial proportion of the land area of the EC is ruled out for agricultural purposes. The fact that different crops have different demands in terms of soil mean that the results for the indicator crops tend to vary considerably.

In those areas where the cultivation of an indicator crop is possible, the maximum crop production potential of that crop in that place is established on the basis of the *quantitative land use evaluation.* A simulation model is used for this purpose in which the crop growth is calculated over a series of years. On the basis of time-series of climatic data going back 26 years, the model calculates the average production potential of the crop over that period. Relevant factors in this respect include incoming solar radiation, the length of the growing season and the photosynthetic properties of the crop. Losses due to diseases and pests, mismanagement and other external circumstances have been left out of account, but allowance has been made for differences in weather conditions from year to year.

[2] This study was carried out by the Staring Centre in Wageningen. The results are contained in a series of separate working documents:

J.D. Bulens, A.K. Bregt, *Crop production potential of rural areas within the European communities, I: GIS and data model*; Working Documents W65, The Hague, WRR, 1992.

G.J. Reinds, H.A.J. van Lanen, *Crop production potential of rural areas within the European communities, II: A physical land evaluation procedure for annual crops and grass*; Working Documents W66, The Hague, WRR, 1992.

G.J. Reinds, G.H.J. de Koning, J.D. Bulens, *Crop production potential of rural areas within the European Communities, III: Soils, Climate and Administrative Regions*; Working Documents W67, The Hague, WRR, 1992.

G.H. de Koning, C.A. van Diepen, *Crop production potential of rural areas within the European Communities, IV: Potential, water-limited and actual crop production*; Working Documents W68; WRR, forthcoming.

H.A.J. van Lanen, C.M.A. Hendriks, J.D. Bulens, *Crop production potential of rural areas within the European Communities, V: Qualitative suitability assessment for forestry and fruit crops*; Working Documents W69, The Hague, WRR, 1992.

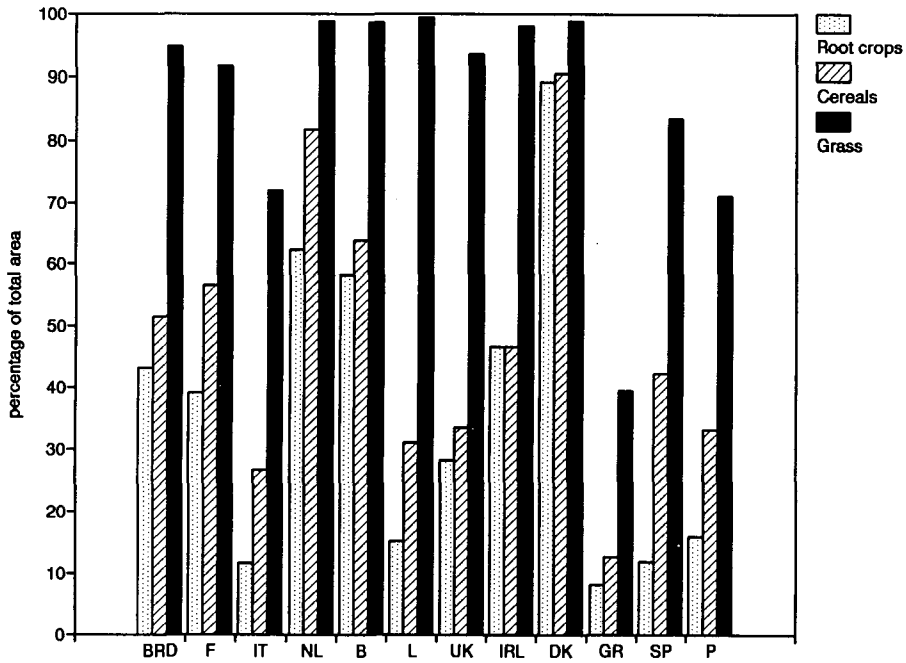
[3] Commission of the European Communities, *Soil map of the European Communities*, 1 : 1,000,000; Luxembourg, Directorate-General for Agriculture, 1985.

[4] P. Thran and S. Broekhuizen, *Agro-climatic atlas of Europe. Vol. 1: Agro-ecological atlas of cereal growing in Europe*; Amsterdam, Elsevier, 1965.

4.2.2 Suitability of individual regions for the cultivation of selected indicator crops

The initial result to be obtained from the qualitative land use evaluation is the available area of land suitable for the indicator crops in question. In itself this already provides information on the development potential of land-based agriculture within the EC. Figure 4.2 shows the share of the total area in each EC member state deemed suitable for the cultivation of root crops, cereals and grass.

Figure 4.2 **Percentage of agricultural area suitable for root crops, cereals and grass.**



Source: Staring Centre.

Two conclusions emerge. In the first place *the differences between the member states are particularly marked*, particularly when it comes to root crops and cereals. In Greece only 8 per cent of the total area is suitable for the cultivation of root crops, compared with nearly 90 per cent in highly fertile Denmark. In the case of cereals Greece trails the field with 12.5 per cent of suitable land, while Denmark heads the table with over 90 per cent. The contrast between the northern and southern member states also emerges from the differences in the suitable land area in the remaining countries.

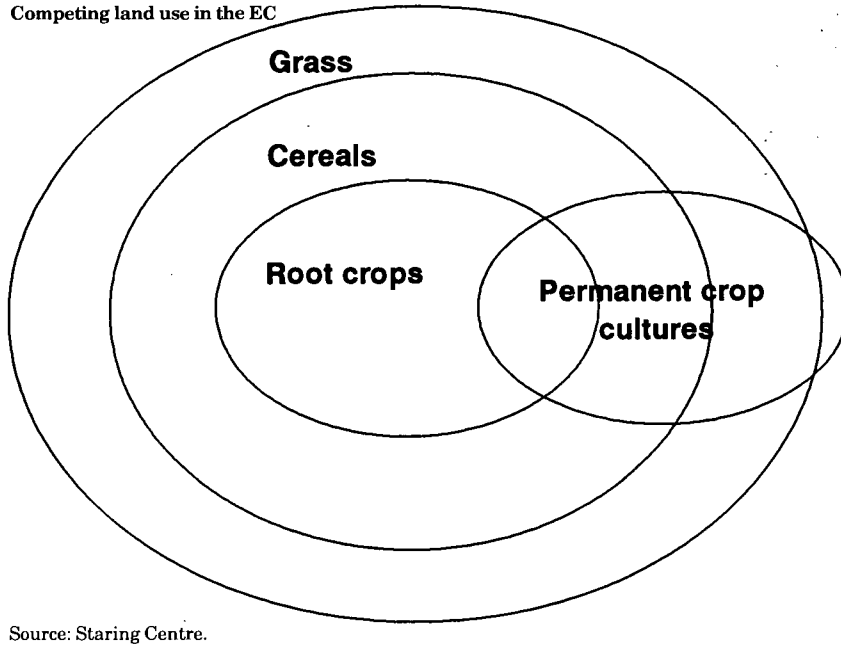
Hilly terrain, in particular, rules out the possibility of cereal cultivation. Some 40 per cent of the total area of the EC has a gradient in excess of 15 per cent. Stoniness is another major factor: some 25 per cent of the EC area is too stony to permit mechanised grain farming. Significant but lesser factors are poor drainage and excessively shallow soil; 8 per cent and 5 per cent of the EC area respectively is unsuitable for cereal cultivation for these reasons. When it comes to the application of mechanised agriculture, therefore, only a small proportion of the total area is suitable for agro-technically advanced forms of land use such as cereal cultivation. Any duplications (e.g. steep slopes combined with stony soil) have been eliminated in these figures.

Secondly, it is evident that *the requirements which the soil must satisfy decline from root crops to cereals and finally grass*. In the latter case a distinction is drawn between pasture management, where the requirements virtually

correspond with those for cereal cultivation, and grasslands, which are much less demanding and also far less productive. In every member state the area suitable for root crops is the smallest, followed by a larger area suitable for cereals; pasture management and grasslands are almost universally possible on a large scale, with the exception of Greece, where only 40 per cent of the area is suitable for grasslands. Portugal comes in second place with an area of roughly 70 per cent suitable for grass.

On the basis of this qualitative land use evaluation a *system of competing land use* has been drawn up. The hierarchy of root crops, cereals and grass has been supplemented by that of the area suited for permanent crop cultures such as citrus and other fruits. The result is the classification shown in Figure 4.3. As may been seen from the figure, the areas in question partly overlap.

Figure 4.3 **Competing land use in the EC**



Source: Staring Centre.

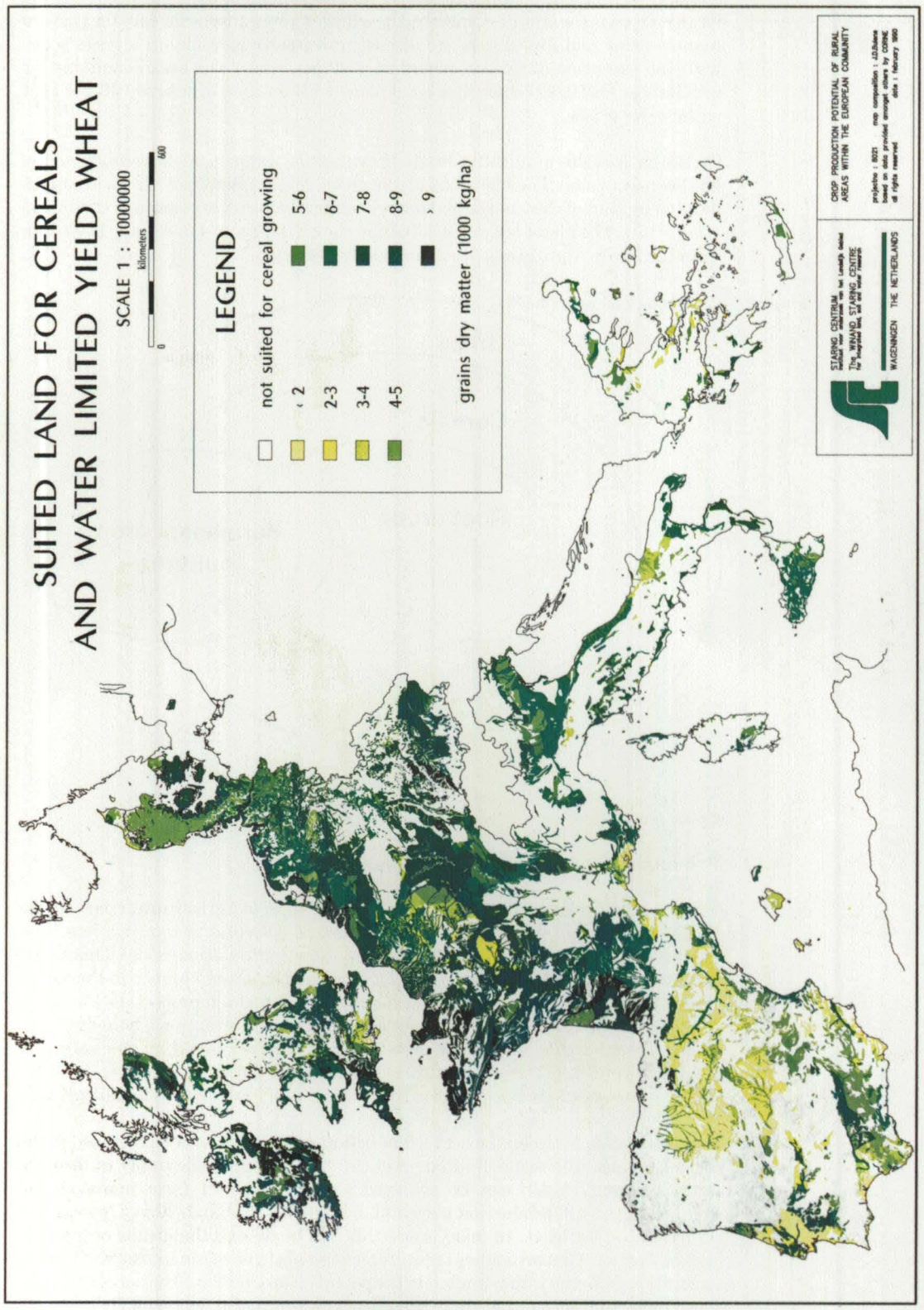
4.2.3 Production potential of selected crops

For those areas deemed suitable for the cultivation of agricultural crops on the basis of the qualitative land use evaluation, a *quantitative analysis* has been conducted with the aid of the WOFOST crop-growth simulation model. This model simulates the growth of production of a crop and the water balance in the soil in stages of a single day, subject to weather conditions and soil properties. The simulation has been carried out for two different production situations, namely:

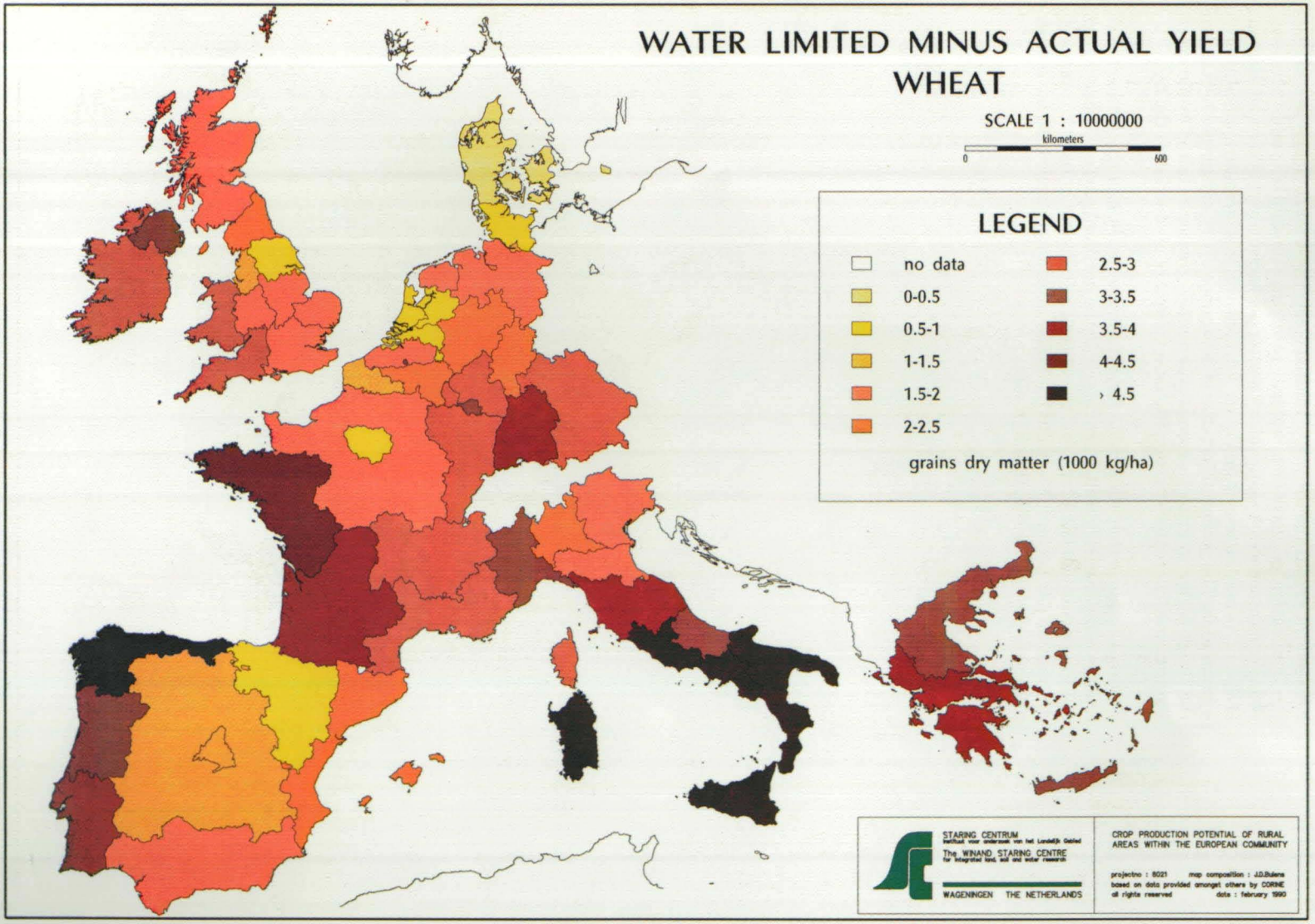
a. *water-limited yields*, where the growth of the crop is limited by the naturally available volume of water (i.e. surplus respiration);
b. *potential yields*, where the growth of the crop is limited only by the climate and soil.

The distinction between these two production situations has been included in the model because the water-limited yield can be approximated simply in terms of 'good farming'. Much can be achieved simply by better farm management. Achieving the full production potential, by contrast, demands heavy investment in irrigation facilities. In many cases this will be beyond the means of the individual farmer. This investment requirement needs to be taken into account in the transition from the water-limited to the potential production situation. It will also need to be established that there is sufficient water in the region for irrigation.

Figure 4.4 Area suitable for cereals and water-limited wheat yield



Source: Staring Centrum.

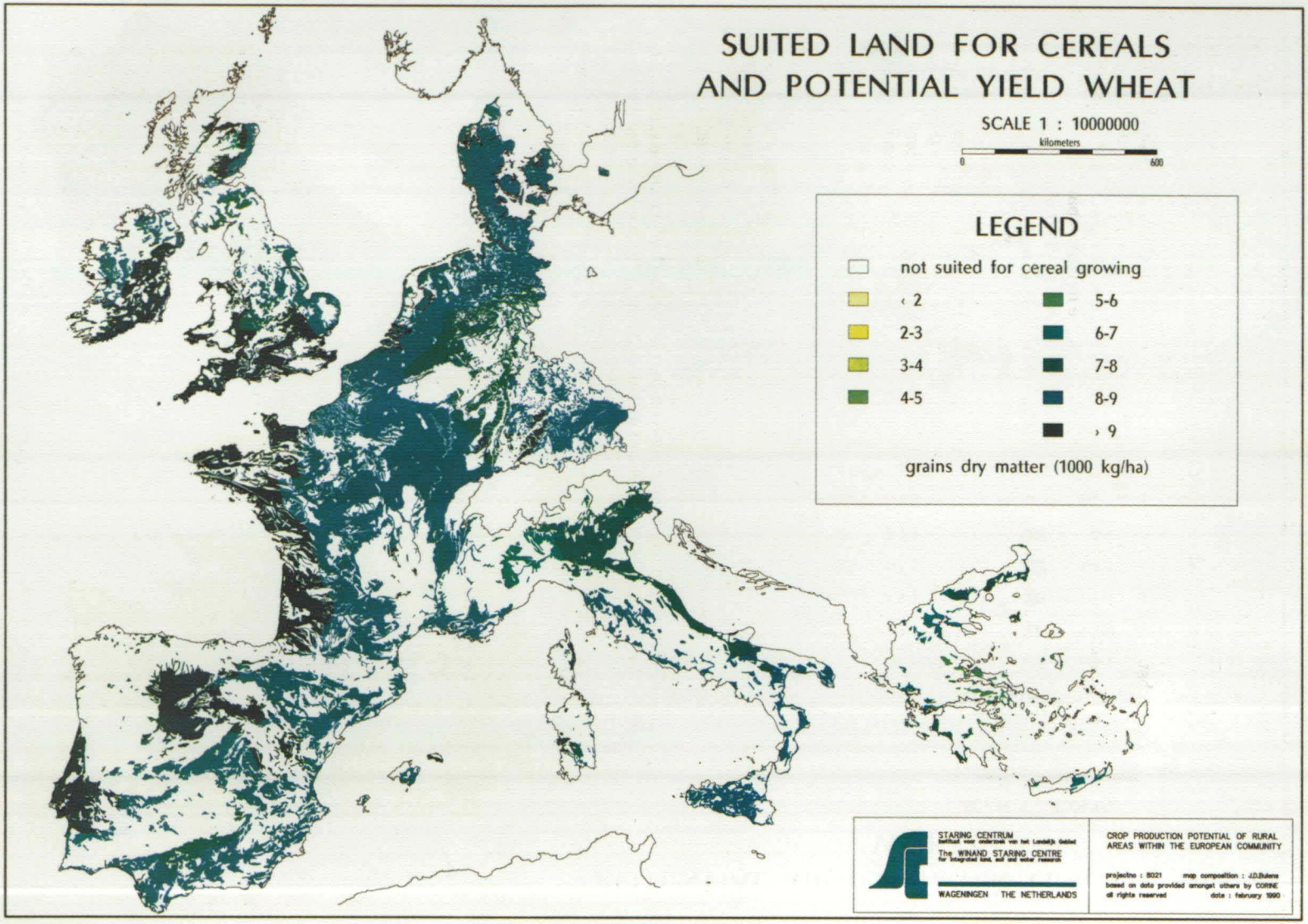


Source: Staring Centrum.

Figure 4.5 Difference between the water-limited and actual wheat yield (per NUTS-1 region)

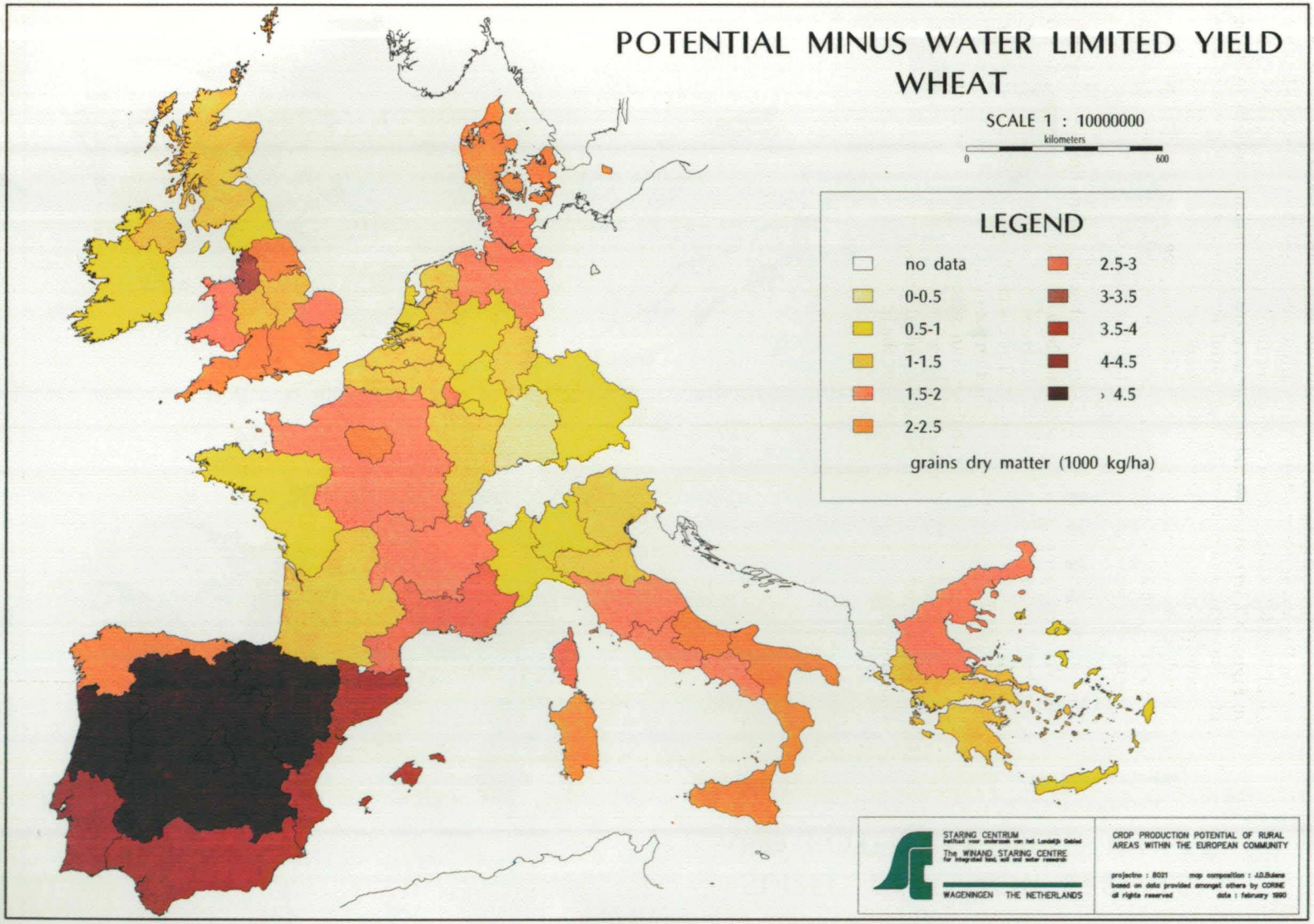
Figure 4.4 shows the results of the simulation calculations for cereals in the water-limited production situation while Figure 4.5 shows the difference between the actual and the water-limited yield. These maps clearly reveal that the application of 'good farming' can result in substantial yield increases, rising to as much as 5-6 tonnes of dry matter per hectare in the Noroeste Region of Spain. As may be seen from Figure 4.4, however, this increase applies to only a small area. The potential increase of 3-4 tonnes of dry matter per hectare in the Ouest region in France extends over a much greater area and would exert a substantially greater effect on the total volume of production in the EC.

Figure 4.5 shows that the arable farmers in Denmark and the Netherlands emerge comparatively well. Particularly in the northern part of Denmark, the difference between the actual and the water-limited yield is just 0.75 tonnes of dry matter per hectare. Productivity would accordingly appear to have been pushed to close to the maximum in these areas.



Source: Staring Centrum.

Figure 4.6 Land suitable for cereals and potential wheat yield

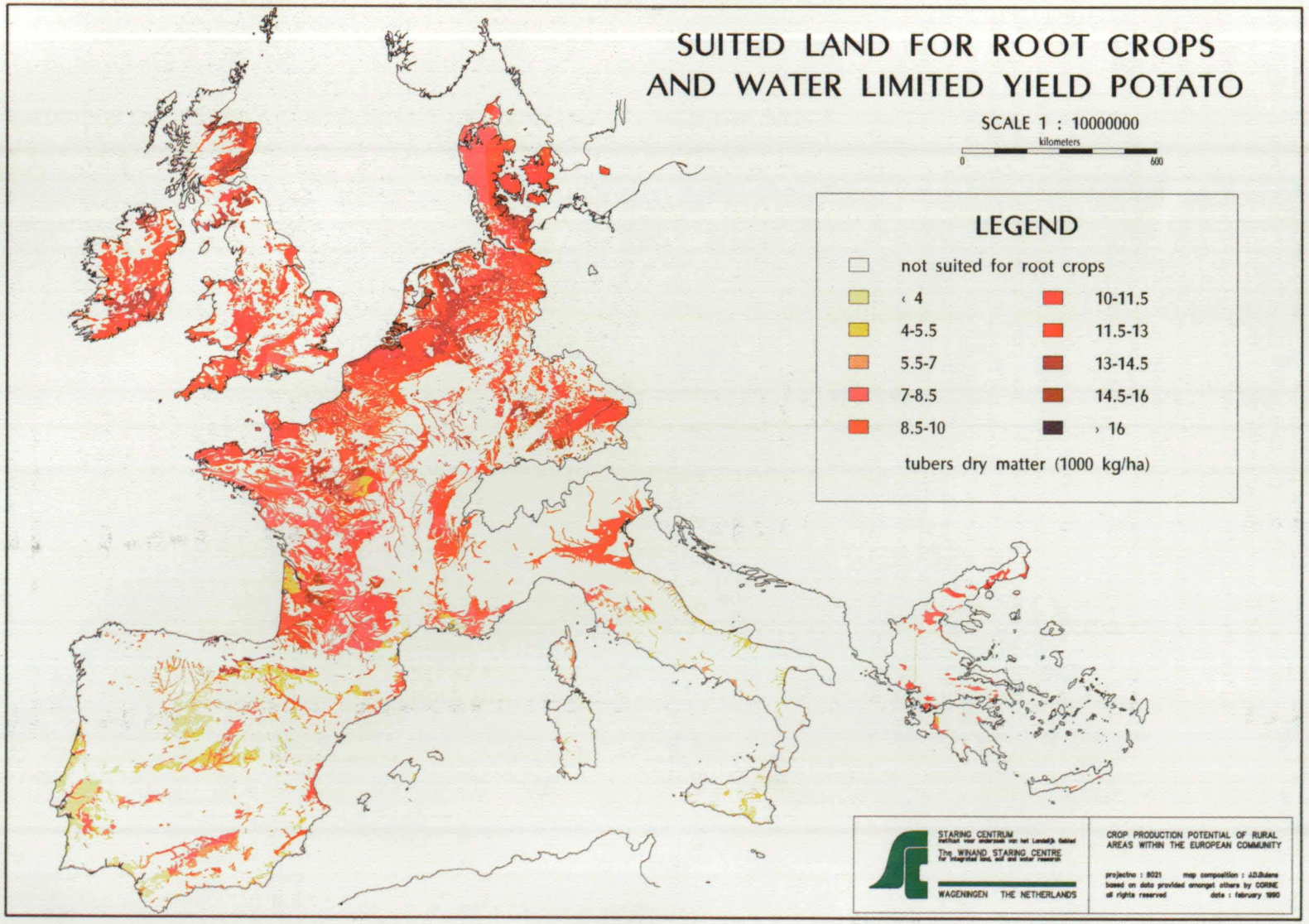


Source: Staring Centrum.

Figure 4.7 Difference between the potential and water-limited wheat yield (per NUTS-1 region)

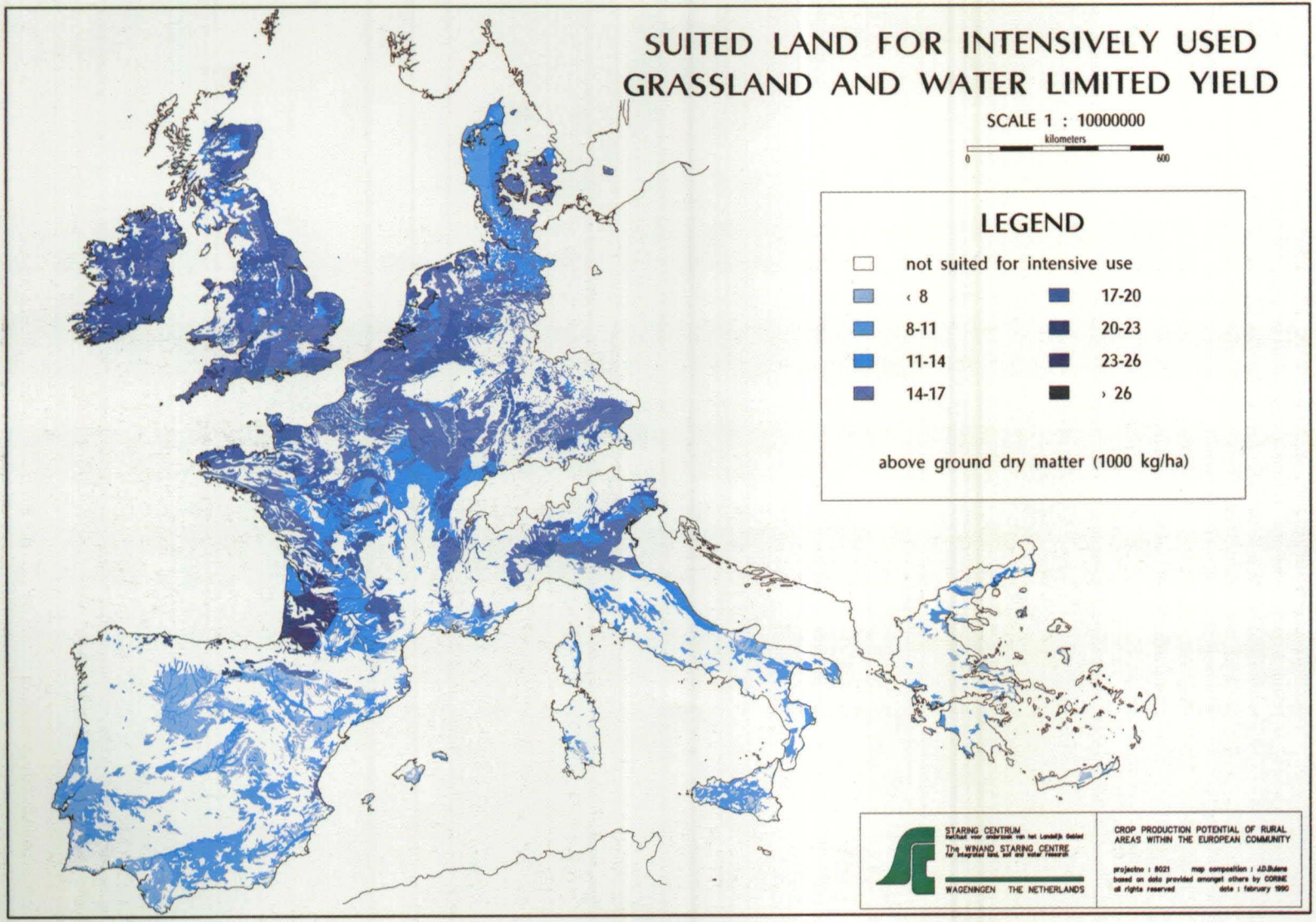
If the water constraints on the cultivation of cereals are eliminated, production per hectare could rise substantially in virtually every part of the EC. The results of these simulation calculations are shown in Figure 4.6. Particularly in the Iberian peninsula the results are much larger than the water-limited yield. The differences between the water-limited and potential yield are shown in Figure 4.7. Irrigation would appear an attractive option especially in Spain and Portugal, where there is a potential for an increase in yields of over 3 tonnes of dry material per hectare. Whether or not this can be realised naturally depends on the availability of water in the area in question and whether the rise in yields would outweigh the costs of establishing these irrigation systems. The potential, at least, is certainly available.

The same applies to the other crops for which calculations have been carried out. Various product groups, represented by a single crop, have been examined for this purpose. The area on which root crops, represented by potatoes, can be cultivated is less than that for cereals. The distribution of that area is shown in Figure 4.8. Here again the crop production potentials are much higher than the actual yields. The results for pasture management (i.e. grass cultivated as a crop) are shown in Figure 4.9. The area virtually corresponds with that of cereals. The results of the simulation calculations indicate the existence of enormous potential gains, even without the introduction of irrigation.



Source: Staring Centrum.

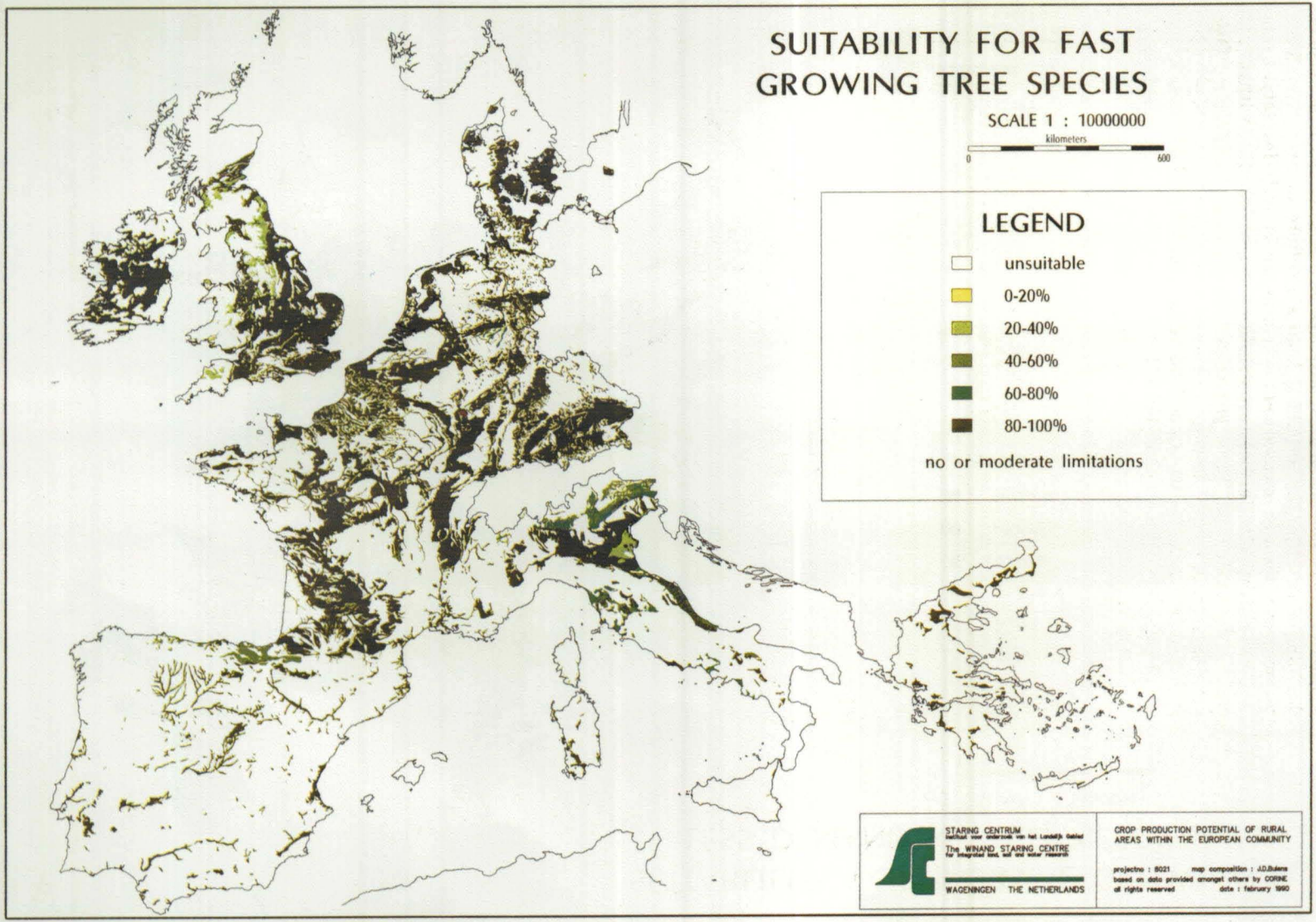
Figure 4.8 Land suitable for root crops and water-limited yield potato farming



Source: Staring Centrum.

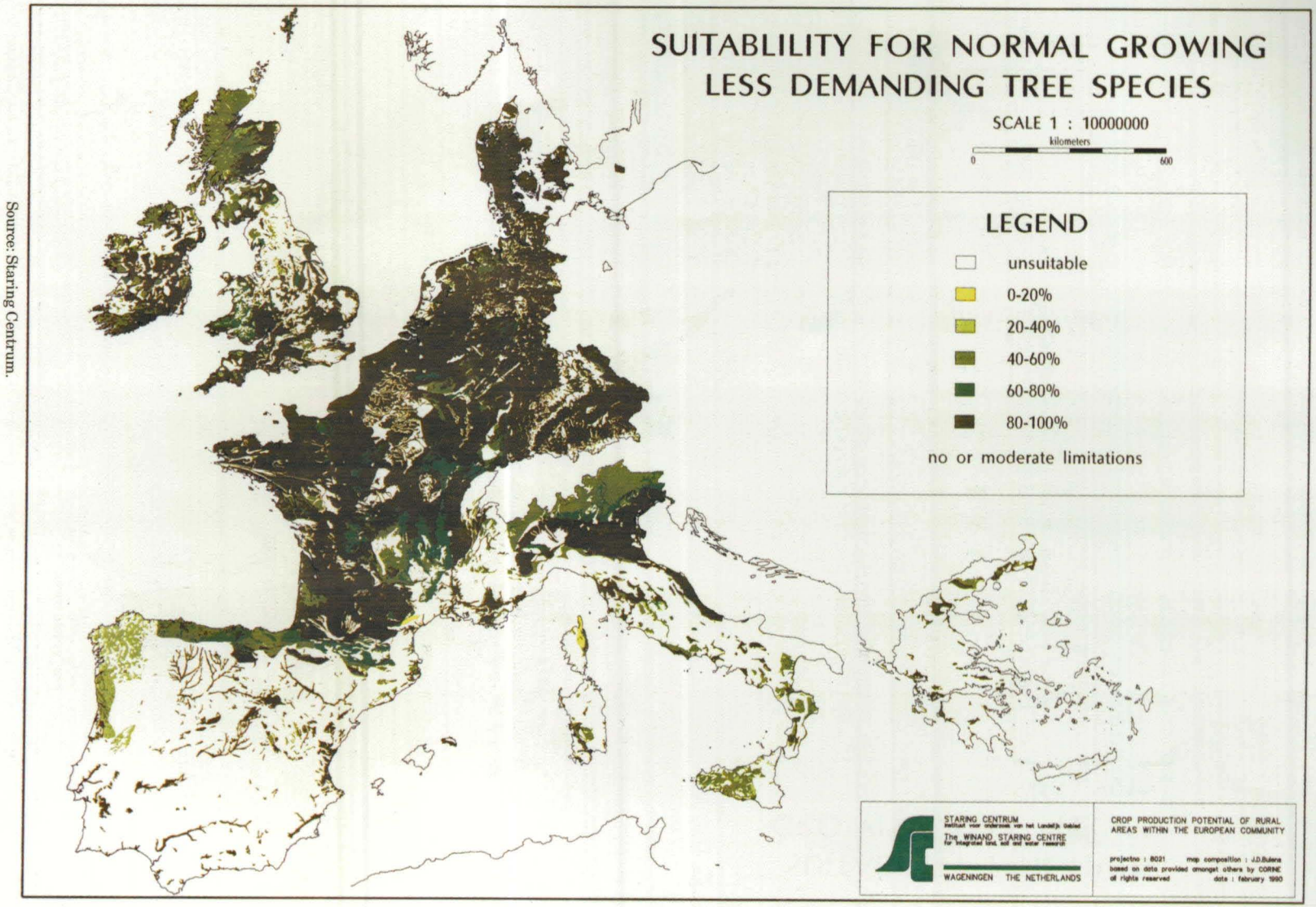
Figure 4.9 Land suitable for intensively used grassland and water-limited yield

A land use evaluation has also been conducted for forestry. Especially in the southern regions, forestry is often advanced as a solution to the problem of declining agriculture. By switching from agriculture to forestry in these regions part of the area released could still be used effectively. To establish this more clearly, the potential for forestry in the EC may be identified with the aid of land use evaluation. Three groups of trees may be distinguished: fast-growing species, normal-growing species on rich soils and normal-growing species on poor soils. The results of these calculations for the former and latter group are shown in Figures 4.10 and 4.11.



Source: Staring Centrum.

Figure 4.10 Land suitable for fast-growing tree species



Source: Staring Centrum.

Figure 4.11 Land suitable for normal-growing tree species on poor soils

No quantification has been carried out as part of this evaluation. On the basis of the soil and climatic features, as well as the properties of the various tree species, it has been established which areas in the EC are suitable for agriculture. What stands out immediately is the overlap between the areas suitable for forestry and those suitable for cereal cultivation. Forestry also requires good soils in order to achieve high yields. Even if yield expectations are scaled back, forestry stands a much better chance on better agricultural soils. This illustrates once again how difficult it is to find solutions for the genuine problem areas.

4.2.4 Availability of water and irrigation

The agricultural production potential is to a large extent determined by the availability of water. The potential demand for irrigation water in a NUTS-1 region may be deduced from the difference between water-limited production and the potential production. The extent of the need for irrigation projects has been examined at the level of NUTS-1 regions [5].

Water management is concerned with three principal categories: drinking water, industry and agriculture. The total demand for water must be met from surface-water and groundwater supplies. In this respect the water supply will first of all need to cover the demand for drinking water and industrial use, with the remainder being available for irrigation.

The potential irrigation requirement is determined by the difference in water availability (i.e. the precipitation surplus) and the amount of water required by the crop on the basis of the potentially achievable production levels. In order to calculate the maximum demand for irrigation in each region, grass has been used as the indicator since it needs the most water and has the least demanding soil requirements. We are dealing here therefore with intensively used grasslands or pasture management.

The demand for irrigation water is not constant over time but at a peak in the warmest months of the growing season. The irrigation systems need to be geared to that peak. This relates primarily to canals, pumps, pipelines and irrigation machines; reservoirs are in principle geared to the total seasonal demand. The net peak demand for a representative crop has been calculated for each region. This peak has been calculated in such a way that with the annual variations in precipitation, the peak demand of the crop will be higher than the given value only once in every five years. The southern regions show the highest deficits.

Of the 58 regions, 19 have difficulty meeting their own water requirements. These 19 regions fall into two categories. First of all there are the regions with a high industrial demand for water. These are mainly in the north-west of the Community. The second group of regions are in southern Europe; these are areas where the soil is suitable for pastoral farming but where the surplus precipitation is inadequate to meet the demand for water.

An analysis has been carried out to establish whether these shortages could be met by the redistribution of water between regions in the same drainage area. This can give rise to all manner of complications. The Iberian peninsula provides a good example. The Noreste and Este regions in Spain both suffer from a water shortage. The two regions are traversed by the River Ebro, from which water is drawn in order to meet the shortfall. Meeting the deficit in one region, however, results in larger deficits in the other. The present average

[5] *Irrigatie en waterhuishouding in de EG* (Irrigation and watermanagement – in Dutch); internal WRR memorandum, December 1990.

annual discharge of the Ebro at Zaragoza (Noreste) considerably exceeds the potential deficits in both regions. Irrigation would however mean an increase in evaporation via the plant cover and from the soil (i.e. evapo-transpiration), thereby reducing the discharge of the Ebro, fed by the run-off from Noreste. The Madrid and Centro regions drain via the Douro into Norte-do-Continente and via the Tajo and the Quadiana into Sul-do-Continente, both Portuguese regions. Norte-do-Continente has a positive water balance, meaning that in principle water could be transferred to both Spanish regions and indirectly to southern Portugal. The water deficits in Centro are, however, so substantial that this would not afford an adequate solution.
A limitation has been incorporated in the model for each region indicating the regional availability of water on the basis of annual precipitation, the maximum extractable supply of groundwater and the maximum saveable run-off. The exploitable groundwater supply is between 5 and 10 per cent of the annual level of precipitation, while the maximum extractable run-off for a region has been arbitrarily set at 50 per cent. For a number of regions this means that not enough water is available for the entire area to be irrigated.

4.3 Analysis of production techniques

A description was provided in the preceding sections of the way in which the crop production potentials in the various regions of the EC can be determined on the basis of indicator crops. This also provided a simple means of making interregional comparisons.

In practice, however, an analysis based on indicator crops is of limited significance; in the case of land-based agricultural production - especially arable farming – the decisive factor is the crop rotation system. The potentials for a region do not therefore depend on a single indicator crop but on the ability to operate various systems within the one region.

To this end an analysis has been made of the *potential production techniques* in the EC. This analysis has been conducted on the basis of agro-technical know-how in combination with an expert judgement [6].

4.3.1 Best technical means

Potential production techniques may in principle be analysed in two different ways. In the first place, inputs and outputs may be established on the basis of current farming practices. The techniques that emerge as the best can then be elevated into a yardstick for what may be expected everywhere in the near future.

Although this is an attractive approach, it is subject to a major disadvantage. A survey of this kind will be distorted by major variations in yield stemming from structural factors. In a given region, the yields may be comparatively low as a result of a below-average level of education, smaller than average farm size and, in general, a business structure that does not permit the technical optimum to be achieved. While these factors do determine the actual performance in the sector in question, they will have a distorting effect on any analysis of future development possibilities.

For this reason the second approach has been adopted, under which a comparison is made of systems in the various regions that comply with the 'best technical means' criterion. Differences in management and business structure are therefore not taken into account, in which respect it is implicitly assumed

[6] G.H.J. de Koning, H. Janssen, H. van Keulen, *Input and Output Coefficients of Various Cropping and Livestock Systems in the European Communities*; Working Documents W62, The Hague, WRR, 1992.

that these factors will not be decisive for regional output variations in the somewhat longer term. This assumption applies that within that time-frame, there will no longer be any differences in education level and industrial structure within the EC-12. In the light of present developments such an assumption appears plausible. The on-going process of economic integration means that knowledge and expertise in the field of agriculture is rapidly being distributed throughout the EC-12.

For the rest of the analysis, it must first be established what is meant by 'best technical means'. In a general sense, the term refers to production techniques in which inputs are used with maximum efficiency. A more detailed analysis of the concept is provided below.

From a scientific point of view, agriculture can be characterized as the productive use of the process of photosynthesis. Green plants make sugars from carbon dioxide and water, using the sun as a source of energy. Of course, agriculture has many faces because of the multiplicity of crops, systems, and types of cultivation it encompasses. But behind all those different faces, photosynthesis forms the basis.

From this scientific basis a number of rigid restrictions on agriculture can be derived. No matter how many improvements are introduced to farm management – either by individual farmers or by entire agricultural systems backed up by research, education, and extension services – and no matter how much more productive crop species become, the bounds of what is possible are still set by the capacity of green plants to use light for the conversion of carbon dioxide and water in usable sugars.

This process has been well-researched: detailed knowledge is available on how much light different plants can absorb, how much carbon dioxide those quantities of light can convert, and on the quantity of nutrients necessary. Moreover, experimental research has revealed that this process works in accordance with Von Liebig's Law of the optimum. This law states that the level of photosynthesis is determined by the input that is least available. If, for example, there is only a limited amount of light, there is no point in adding more nutrients in the form of fertiliser, since the available light puts a limit to the level of photosynthesis.

This knowledge can be used to calculate maximum agricultural yields in any given situation. There are two relatively immutable factors in agriculture: soil quality and climate. In addition, a farmer has only a limited direct influence on the availability of water. For that purpose, irrigation and/or drainage must be used. As already stated in section 4.2.1, the potential yield of a particular area is thus determined by a combination of climate, soil conditions, and the availability of water. In the short term this combination will hardly change. This combination of factors is called the *production situation*. In a given production situation, crop growth simulation models based on photosynthesis can be used to calculate what other inputs are necessary in order to achieve potential production. Thus, given a certain production situation the ratio between nutrients – nitrogen, phosphorus, and potassium – is fixed.

In both good and poor production situations the most efficient use of nutrient inputs can be pursued. In good production situations – i.e. good water availability, drainage and soil fertility – this efficiency will generally be achieved at high production levels. In poor production situations – i.e. poor water availability, limited soil fertility, etc. - the optimum will be at lower production levels.

The highest efficiency per input will, however, be achieved at higher production levels in good production situations, because the stability of these situa-

tions reduces unavoidable losses. In poor production situations, a relatively large proportion of the inputs is lost for various reasons. This may be due to water deficiency or shallow rooting depth in parts of a certain area. In better production situations, circumstances are much more equable. As a result, this type of loss is much less serious. Therefore, when structural improvements are made to convert bad production situations into good ones, there appears to be a synergetic effect. The optimum application of production factors will be achieved at higher levels of production, and thus the efficiency of each of the inputs increases at a disproportionately high rate.

In both bad and good production situations the optimum application of inputs can be denoted as best technical means. The technique is selected under which the input of each resource is minimised to the point that the other inputs can be used to their best effect. This point is then determined for all inputs. De Wit employs this definition in establishing a link between the efficiency of nutrient inputs per unit product and the realised yields per hectare [7]. 'Efficiency' is therefore interpreted as *technical efficiency*. The input of resources is minimal, which also means a minimal burden on the environment at a given production level. Any increase in the input of a given resource will interfere with the maximum utilisation, resulting in increased losses, for example in the form of emissions of nitrogen to the groundwater.

In practice, the best technical means amounts to the most efficient application of the various resources required for a crop to grow. The analysis leading to the formulation of that optimum requires a considerable body of experimental data combined with expert judgement, especially since the individual crop level is inadequate, and the analysis needs to be directed to crop-system level – that is, the entire rotation system.

In a separate study production techniques have been described that – given the present state of technology and knowhow as well as current experience with agricultural production systems – comply with the description of best technical means [8].

Although, with best technical means, the input ratios for nutrients are fixed, substitution is possible for input factors that are not required by photosynthesis. Labour and machinery inputs, for example, are not dictated by the chemical reaction formula of photosynthesis. For instance, the use of pesticides can be minimised by more frequent monitoring. Relative prices – for example, those of energy and labour –, can be used to define economic efficient production techniques. In this way all inputs needed for a given output can be determined.

This type of approach allows only limited substitution between input factors. From the outset methods that are relatively labour-intensive, such as weeding by hand rather than mechanically or chemically, are excluded. Although these methods might be feasible in agro-technical terms, present relative prices obstruct the substitution of mechanical weeding by weeding by hand. From a farm-economic point of view, these labour-intensive methods are too expensive. Otherwise, market conditions may cause substitutions resulting in production techniques that are sub-optimal from an agro-technical viewpoint. For instance, the overuse of pesticides and nutrients, which is common in many production situations in Dutch agriculture, is partly a result of the fact that the prices of these inputs hardly influence the income of the farmer. Governments can influence the relative cost of these factors, and thus promote optimum cultivation techniques.

[7] C.T. de Wit, 'Resource use efficiency in agriculture'; Agricultural Systems Vol.40, 1992, pp. 125-151.

[8] G.H.J. de Koning, H. Janssen, H. van Keulen, op. cit.

This shows that the economic and agro-technical optimum can differ. Because the study is focused on technical possibilities, the principle of best technical means is primarily based on technical knowledge, most of which is derived from integrated crop and animal production. Next, the efficiency in farm-economic sense is taken into account, which allows several types of substitution. Also other external inputs – for example needed to reduce risks – can become apparent. An example is the use of pesticides. The best technical means described in CABO report are based on the latest knowhow and possibilities. They will be open to improvement as knowhow and technology themselves improve.

4.3.2 Yield-oriented, environment-oriented, and land use-oriented production

Under the influence of the various requirements that may be imposed on production techniques, this study allows some substitution between labour, capital, and land.

The application of best technical means as defined in section 4.3.1 leads to a number of agricultural techniques, all of which give optimum results in agro-technical terms. These techniques may be referred to collectively as 'yield-oriented agriculture' (YOA).

YOA indicates the possibilities at the level of agricultural production systems within the EC. If these techniques were indeed to be applied this would lead to major differences from present practice in most regions as many of them do not use inputs efficiently; the over- or underutilisation of inputs is the rule rather than the exception.

The realisation or approximation of YOA would also largely eliminate the adverse impact on the environment. As noted above, the government is in a position to promote the agro-technical optimum by bringing the costs of inputs and outputs more closely into line, e.g. by means of levies and taxes on inputs. The over or underutilisation of inputs is the main cause of the environmental problems related to agricultural production.

YOA is however a form of production that aims at maximising the efficiency of production with the highest possible yield. From an environmental viewpoint, such an improvement in production may not be adequate. In environmental terms there may remain a requirement for the input of resources per hectare to be further reduced, even at the expense of yields per hectare. Since the input per unit output has already been minimised under YOA, a reduction can only be achieved by the lower input of production resources per hectare, at the expense of the efficiency per unit product. The utilisation of external inputs for production therefore rises in total but falls per hectare – which may be desirable in environmental terms. Here again a distinction may be drawn between the production situation and the production level.

In defining the production techniques that satisfy these tightened environmental requirements, the concept of 'best technical means' needs to be supplemented by a criterion under which the environment-oriented aspects are operationalised. To this end the term environment-oriented agriculture (EOA) has been employed. EOA amounts to YOA in which the use of pesticides per hectare has been further reduced. In the case of certain crops this means smaller harvests, in some cases by as much as 20 per cent.

The selection of a maximum figure of 20 per cent as an acceptable drop in the harvest is arbitrary in so far as this criterion is not based on specific data concerning the quality of the environment. In principle that would have been desirable, but this was unfeasible at this stage.

The environmental aspect is not the only way in which the objectives of YOA may be broadened. Land use is also a significant motive force behind the adaptation of techniques. As revealed by the surveys discussed in section 4.2, there are vast differences between present and potential yields. If demand ceases to grow appreciably, YOA will inevitably lead to a large surplus of land. Some of this land can be used in different ways, but for much of the rest a different form of agriculture would be a possibility, under which much more land could be used than at present for the realisation of a given volume of production. Examples include extensive forms of livestock farming (e.g. beef cattle on rough grazings) and extensive forms of cereal cultivation along Australian lines. This form of production will henceforth be designated as LOA (land-use-oriented agriculture).

4.3.3 Production techniques

In arable farming it is customary for crops to be grown on a rotation basis. This is done partly on commercial grounds and partly for agrotechnical reasons. The incidence of disease, for example, can be reduced by the judicious rotation of crops.

The fact of rotating crops has also been used in order to spell out in more detail the three categories of production techniques (i.e. production-oriented, environment-oriented and land-use-oriented). The gaps between the rotation crops are particularly important for the extent to which the impact on the environment is avoided. In addition irrigation or non-irrigation of the crops has been used in the elaboration of these categories since irrigation (generally in combination with drainage) is one of the most important means of improving the production situation. If irrigation takes place on good soils this has consequences for the production level at which the best technical means applies.

The use of agricultural inputs such as nutrients, pesticides and water differs within the individual production technique categories according to the nature of rotation and the extent of irrigation. In general the use of nutrients is higher when irrigation is used. Tight rotations require more pesticides than loose ones. Specific regional factors such as climate, soil type and topography also play a role in the requirement for agricultural inputs. A tentative attempt has been made to spell out these influences [9].

This is reflected in the input-output tables that have been drawn up. These reflect the differences in production situations, as the optimal production levels and production techniques employed differ. Given the general lack of basic regional data, it has often been necessary to make do with estimates. In these cases conservative estimates have been used.

Not only the input of fertilizers and pesticides varies according to the rotation and irrigation system employed; the same applies to the input of labour and capital. Irrigation is highly labour-intensive. The capital requirement can vary according to the crops being combined, in that a rotation system can mean that certain forms of equipment are used more intensively.

Fewer individual techniques have been elaborated for the category of land-use-oriented production techniques than for the two other categories. The examination has been confined to highly extensive cereals cultivation or extensive grasslands without irrigation. Tillage has been kept to the minimum and the yields are correspondingly low. Crop protection agents are not used.

[9] Ibid.

The techniques for fodder production have been worked out analogously to those for arable farming, although rotation has been left out of account. The main crops here are green maize and grass. In the case of grassland farming a distinction is drawn between pasture and hay systems.

The techniques for pastoral farming correspond with those for roughage production. In essence a division has been made between techniques aimed at the highest possible yield per animal and techniques under which the available resources are used efficiently but the yield per animal is not the primary concern. Feeding on the basis of pure roughage is the decisive factor. Further distinctions in the techniques of pastoral farming relate to the alternative between housing and pasture systems. In the spirit of the assumption of best technical means, it has been assumed that the farmyard manure will be effectively used.

Of the permanent crop cultures, only olives and fruit have been included in the survey. In the case of olive cultivation a distinction has been drawn between an intensive and an extensive maintenance variant. In the case of fruit cultivation a distinction is drawn in terms of the use or non-use of irrigation.

In the GOAL model a distinction has been drawn between existing forestry and types of forestry that could be introduced on agricultural lands that are released. The present forestry yields range between 2.0 and 9.0 cubic metres of timber per hectare per year. In the case of new planting three classes of tree species have been distinguished in the model. Tree species within each of these classes exhibit an annual growth in the same order of magnitude. This growth varies according to the suitability of the soil and climatic factors. This study assumes annual yields per hectare of 20 to 30 cubic metres for fast-growing timber species, 15 to 20 cubic metres for normal growing species on better soils and 10 to 15 cubic metres for normal growing species on poorer soils.

The fact that the current yields are so much lower may be attributed to a number of factors. In the first place forests in Europe tend to be unfavourably located. Historically, a situation has evolved in which the best lands have been reserved for agriculture and the poorer soils for forestry. Secondly, timber production is not generally the prime concern of forestry in Europe, as it is barely profitable. In many European countries the availability of subsidies is an important motivation for forestry.

4.3.4 Evaluation: comparison of the results with the present situation

The production techniques described above differ widely from the existing practice in most parts of the EC. In order to obtain an impression of the actual extent, some fairly rough calculations may be made on the basis of existing data. A comparison of the present differences in labour productivity can for example help illustrate the labour requirement in the scenarios. To this end the labour requirement in land-based agriculture in the EC may be calculated on the assumption that the productivity of labour in the most efficient region were to apply throughout all of the EC at the present level of production. It may then be assumed that the currently most efficient regions can serve as a model for describing the production techniques based on the best technical means. Since the input of labour has been drawn from the practical results on pilot farms for the purpose of defining these techniques, this assumption will not be entirely correct. Nevertheless it will provide a rough indication of the extent to which the production techniques described differ from the existing practice.

The regions in which various kinds of agriculture can be carried out the most efficiently may be determined from various sources. By the most efficient region is understood that region requiring the lowest input per hectare for a

given value of production per hectare. The possibility of substitution between labour and land is left open in this formulation. A higher input of labour at a higher production value per hectare cannot be described as less efficient than a lower input of labour at a lower production value per hectare.
Table 4.1 shows the outcome of such a calculation. The reduction in employment has been calculated on the basis of two different sets of figures, namely those of the European Commission and Eurostat.

Table 4.1 **Indication of reduction in employment in land-based agriculture upon application in all regions of the currently most efficient production techniques (in per cent)**

West Germany	35
France	25
Italy	50
Netherlands	15
Belgium	15
Luxembourg	15
United Kingdom	15
Ireland	45
Denmark	15
Greece	55
Spain	25
Portugal	80
EC-12	40

Source: WRR, on the basis of: European Commission, *The agricultural situation in the Community. 1990 Report*; Brussels-Luxembourg, 1991.
EUROSTAT, *Farm Structure. 1985 Survey.*

The figures in Table 4.1 need to be interpreted with caution. Less importance should be attached to the absolute magnitude of the figures than to their rank-order. The fact that labour is used the most efficiently in the most northerly member states scarcely comes as surprise. The situation is less favourable in West Germany and Ireland. Despite the fact that part-time farming is a widespread phenomenon in West Germany, the proportion of time devoted to farming is not used efficiently. The data indicate the extent to which the average is depressed by the southern states in Germany. In many branches of agriculture, the northerly regions of France head the table in Europe.

The conclusion to emerge from this exercise is that on the basis of the definition of production techniques alone, a substantial reduction in employment may be anticipated in the model calculations, rising to as much as 80 per cent in Portugal.

4.4 The demand for agricultural and forestry products

The demand for agricultural and forestry products has been introduced into the model as an exogenous variable. The problem of the likely level of demand has been tackled in an exploratory study. In the case of agricultural products, the demand for domestically produced products depends on two factors which cannot be incorporated into the model. In the first place, dietary patterns may change. If Europeans start to eat more meat as living standards rise, this will have significant consequences for the demand for cereals (used as animal feed) and hence for the demand for agricultural land. Secondly, international trade policy is a major factor. If the GATT negotiations were ultimately to lead to the far-reaching liberalisation of trade in agricultural products, this would undoubtedly affect the demand for agricultural commodities produced within

the EC. In order to make allowance for these uncertainties, the model calculations include a number of variants. In the case of forestry, a more or less objective future demand may be derived from existing research. More detailed analysis is required in the case of agricultural products. The results of the detailed analysis of demand are provided in the following sections.

4.4.1 The demand for forestry products

Forecasts for the five main categories of demand for timber and timber products have been presented in the European Timber Trends Study (ETTS-IV) [10]. The study contains both end-use analysis and analysis based on the interrelationship between the demand for timber and macro-economic variables. The study presents forecasts for the year 2000, for both a high and a low scenario. The five categories of demand (sawnwood, pulp, paper/paperboard, firewood and pitwood) have been converted by means of standard conversion factors into demand for roundwood and other timber (in cubic metres). The same study also provides an estimate of the anticipated timber production in a large number of European countries. This comparison of supply and demand forecasts is designed to generate a discussion about the imbalances between the two. In doing so allowance has been made for the fact that part of the demand for paper and paperboard will be covered by recycling. The results of the study are shown in Table 4.2.

Table 4.2 **Forecasts of the demand and supply of timber in a low and high scenario for the EC-12, 2000 (mill. tonnes)**

	DEMAND		SUPPLY	
	low	high	low	high
roundwood	109.3	130.0	64.6	72.4
other wood	135.4	157.7	70.3	79.2

Source: ETTS-IV, assuming the absence of intermediary imports and exports.

On the basis of the present forest cover, the figures reveal that the EC would be able to meet slightly more than half the demand for timber in due course. Self-sufficiency can be promoted by planting new areas of forest. Since certain species require a lengthy growing period before felling, the EC could only become self-sufficient in roundwood in the long term. If, however, neighbouring timber-producing countries were to join the EC, the picture could change radically. The demand for other timber could be met within the period covered by the study by the planting of fast-growing species. The possibilities for doing so are explored in the GOAL model calculations. For part of the timber market, therefore, it will not be possible to achieve self-sufficiency within the period covered by this report.

In addition, land use evaluations suggest that the forest cover in various parts of Europe exceeds the area suitable for high-yielding forestry. This confirms the impression that forestry in the EC is a marginal activity. Good soils are reserved for agriculture, while forestry is confined to soils on which agriculture is impossible. For the purposes of the calculations using the GOAL model, it has been assumed that the yields of existing forests will equal the ETTS-IV forecasts in the period covered by the study.

[10] United Nations FAO/ECE, *European timber trends and prospects to the year 2000 and beyond*; New York, United Nations, 1986.

4.4.2 Dietary changes

Two levels of future food consumption have been specified in this report in order to analyse the sensitivity of agricultural land use to patterns in food consumption. The first level is based on the present dietary pattern while the second is based on a modified diet with greater emphasis on high-protein products. Historical experience shows that as living standards rise, the consumption of basic food requirements flattens out, in both absolute and per capita terms. The total consumption of food, however, continues to rise on account of a shift in demand towards more expensive, high-protein products such as meat and cheese.

The first level of food consumption may be derived from the statistics. The following considerations are relevant in estimating the second level, i.e. a changed high-protein diet.
Consumer spending on food is determined by:

a. population growth;
b. the increase in real disposable income;
c. inflation.

Food consumption is limited by:

d. human metabolism.

a. *Population growth*

According to Eurostat's population projections for the European Community, the total population of the EC-12 will rise by less than 0.1 per cent per annum between 1990 and 2010 [11]. Population growth will not therefore be a significant factor in changes in total food consumption. The impact of the changing population structure (i.e. the ageing process) may also prove limited as elderly people in the future may have different dietary habits from those today.

b. *The increase in real disposable income*

During the period 1971-1989 the annual growth in private consumption at constant prices was 2.8 per cent, while the population grew by 0.3 per cent. On the basis of similar growth over the next 20 years, a growth rate of 2.5 per cent may therefore be expected [12].

c. *Inflation*

Inflation is the subject of greater uncertainty. On the basis of the development of the implicit price index for agricultural products over a series of years, agriculture is suffering from a real fall in prices. Over the next 20 years, however, a 30 per cent cut in consumer prices is conceivable for a series of products given the development of producer prices in recent years and the pressure to eliminate the high level of protection for European agriculture [13].

The reactions of consumers to changes in prices or income levels may be expressed in terms of elasticities. This is a convenient way of making rough estimates, but also involves a gross oversimplification of a complex state of affairs. It is, for example, empirically well established that as income rises the

[11] Eurostat, *Population statistics 1989*; Population and social conditions, Series C; Luxembourg, 1989.

[12] Commission of the European Communities, Directorate-General for Economic and Financial Affairs, *European Economy, Series A 'Economic Trends'*; various issues.

[13] Commission of the European Communities, *The agricultural situation in the Community. 1990 Report*; Brussels-Luxembourg, 1991, Statistical information pp. T/1 ff.

proportion spent on food not only falls, indicating an income elasticity of less than unity, but that the elasticity also declines. As food consumption rises, however, the ability to respond to price changes grows. Price elasticities need not, therefore, fall given increasing food consumption but may even rise.

d. *Human metabolism*

The long-standing awareness of the link between diet and health makes it likely that the European diet of the future will need to satisfy more stringent minimum standards with respect to the quantity of protein, fats and carbohydrates.

The present diet already more than meet the energy requirements (amounting in the Netherlands to 2150-2850 calories per day for a person with a moderate level of physical activity). In the early 1960s the availability of food for direct human consumption in Western Europe was already 3110 calories, which rose to 3390 calories per head per day in the 1980s. The composition of the diet has gradually changed since the 1960s. In terms of calorific value the share of cereals, root crops and tubers has fallen while the share of other vegetable products such as sugar, vegetables, fruit, oils and fat and alcohol has risen, along with animal products [14].

Further substantial shifts in the diet could take place in order to comply with health standards. According to current medical insight, 20 to 35 per cent of the diet should take the form of fats. Little is known as far as proteins are concerned, but a substantial increase above 11 per cent of the calorific intake (which has long been the level of consumption in the Netherlands) would not appear realistic [15]. The present composition of the diet more than meets the minimum requirements for the intake of carbohydrates.

Changes in the diet: conclusion

Various model studies have been used to derive the income and price elasticities for the demand for food categories included in the GOAL model [16]. These elasticities have been confronted by an assumed real fall in prices of 30 per cent and an assumed real increase in private per capita expenditure of 2.5 per cent a year. (Second-order effects deriving from cross-price-elasticities have not been taken into account in estimating the development of demand.) The demand for food calculated in this manner has been taken as the upper limit for the consumption of the various food categories and the present level of consumption as the lower limit. Within these limits the maximum share of animal products in the diet has been explored while taking account of the health standards noted above for the basic elements of the diet, namely carbohydrates, proteins and fats. The daily calorific intake from the food products included in the model (excluding alcohol and the like) has been kept equal to the intake under the present diet.

In this way, taking account of all the specified elements of demand, the possibility has been investigated of a shift in the present diet towards one with a maximum quantity of animal products. The results are shown in Table 4.3.

[14] *World agriculture: Toward 2000. An FAO Study*, ed. by N. Alexandratos; London, Belhaven Press, 1988.

[15] *Het voeden van Nederland, nu en in de toekomst* (Food suply in the Netherlands, now and in the future – in Dutch), by M.J.L. Dols, J. de Veer, C. Engel; The Hague, Stichting Toekomstbeeld der Techniek, 1971.

[16] Organisation for Economic Cooperation and Development, *Ministerial Trade Mandate. Model specification and elasticities*; Paris, OECD, 1988.

J. Michalek, M.A. Keyzer, *Estimation of a two-stage LES-AIDS consumer demand system for eight EC countries*; Paper to EAAE congress, 1990.

Table 4.3 **Possible future composition of the diet (kg per head)**

	Present diet	More animal food
Cereals (gross)	108.2	86.6
Sugar	31.6	43.1
Potatoes and potato products	96.4	116.6
Oil	17.3	16.2
Fruit	62.3	80.3
Beef	23.3	35.1
Pork	38.5	38.5
Poultry	16.7	24.3
Eggs	13.2	22.5
Sheepmeat	3.8	6.5
Fresh dairy products	95.9	138.2
Butter	5.3	7.1
Cheese	13.5	20.3
Full milkpowder	0.6	0.9
Skimmed milkpowder	0.9	1.2

Source: EUROSTAT, WRR.

4.4.3 The international framework: liberalisation versus self-sufficiency

The international position of the Community

The European Community's export position in agricultural products was appreciably strengthened in the 1980s. This applies especially to the net export shares of cereals and beef. The net export shares of dairy products, pork and poultry remained unchanged in relation to total world trade.

The EC's strong position in the world market for agricultural products is not attributable to an efficient structure of production. On the contrary: the producer prices – which to some extent reflect the marginal costs of production – are considerably higher in the EC-12 than those of the leading competitors elsewhere. A comparison of producer prices with those in the United States, Canada, Australia and New Zealand is provided in Table 4.4.

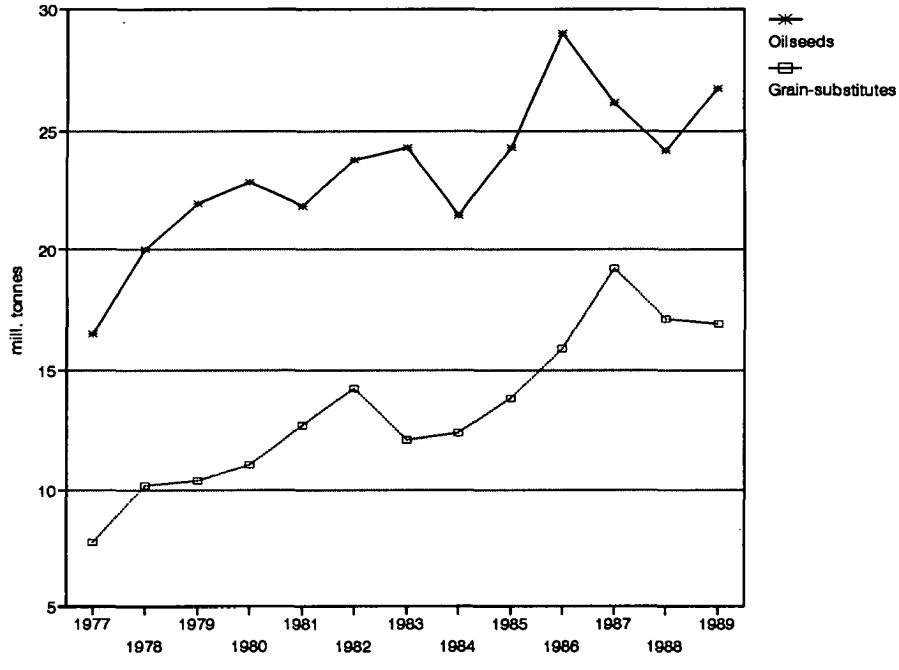
Table 4.4 **Producer prices 1989 (ECU/tonne)**

	EG	United States	Canada	Australia	New Zealand
Wheat	132	102	89	103	133
Sugar	250	206	160	141	
Milk	229	194	235	145	128
Beef	2194	1105	2127	1229	1170
Pork	1384	633	778	1259	1213

Source: OECD, *Agricultural policies, markets and trade. Monitoring and Outlook*; Paris, OECD, 1990.

The strong export position has been artificially created by the marked protection of the internal market combined with subsidies for dumping exports outside the European Community. This protection of the European agricultural market exhibits 'holes' for a number of product categories. In the Dillon Round of the GATT (1962) a zero tariff was virtually adopted by the European Community for grain-substitutes and oilseeds. In volume terms, the Community's net imports of these products are of the same order of magnitude as the European grain exports, while the European price level is directly linked to world market prices. Imports over time of these products, known as 'the Rotterdam hole', are shown in Figure 4.12.

Figure 4.12 **Imports of oilseeds and grain-substitutes, 1977-1989 (N.B. the figures from 1977 to 1985 apply to the EC-10 and those from 1986 onwards to the EC-12)**



Source:European Commission.

The consequences of free trade in model studies

A number of theoretical models have been developed in agricultural economics for analysing a partial or total liberalisation of the world market in agricultural products. The results of these analyses exhibit many differences, which may generally be traced to the reference period in question, the degree of liberalisation and sometimes also to the values of the elasticities used. Apart from these differences there are also similarities. This is illustrated by the results of a number of model studies summarised in Table 4.5.

According to most of the analyses, world market prices would rise if the protection of *beef and dairy products* produced in the European Community were to be removed in a liberalised system of trade in agricultural products. Internally, however, prices would fall in both the European Community and the United States. In both regions this could provide a stimulus for an increase in consumption and a contraction in production. The rise in world market prices would provide other producers with an incentive to increase their output. The analysis conducted by the OECD with the aid of the MTM model [17] and the IIASA analysis [18] suggest that dairy production in both the European Community in the United States would shrink. The United States would concentrate more on beef production and dairy exports by the European Community could fall by a third.

[17] H.B. Huff and C. Moreddu, 'The Ministerial Trade Mandate Model'; in: OECD, *Modelling the effects of agricultural policies*; OECD, Economic Studies no. 13, Paris, OECD, 1990.

[18] *Towards free trade in agriculture*, by K.S. Parikh, G. Fischer, K. Fronberg, et al.; Dordrecht/Boston, Martinus Nijhoff Publishers, 1988.

Table 4.5 **Estimated percentage change of the world market price for a number of leading agricultural products resulting from trade liberalisation by the member states of the OECD according to a number of different model studies**

	Wheat	Barley/ maize	Meat	Dairy	Sugar
AndersonTyers	25	3	43	95	22
Zietz en Valdés	3	−3	10		15
OECD MTM	−5	−10	5	31	9
USDA SWOPSIM	27	16-22	16	84	29
IIASA BLS	18	11	17	31	
Burniaux RUNS	15	81	81	1	57
OECD WALRAS	17		10	14	

Source: 'The implications of agricultural trade liberalisation for developing countries'; in: I. Goldin and O. Knudsen, *Agricultural trade liberalisation, Implications for developing countries*; OECD, 1990.

According to the FAO-2000 study the consumption of meat and dairy products in developing countries could rise rapidly, thereby generating an import demand for both animal products and feedgrains. Developments of this kind could slow the decline in dairy exports by the Community. This trend could also affect the European Community's trading position in beef. Nevertheless most model studies suggest that the net export of beef would fall under a system of free trade or even switch into a net import requirement.

The world market prices for *cereals* could either rise or fall. The fall would apply especially to feed grains. This is explained by the reduced import demand of the beef industry. The production of dairy products and beef in the EC-12 would shrink given the liberalisation of agricultural trade. For the Community, the sharp fall in cereals prices could affect imports of grain-substitutes and oilseeds. The feedgrains produced at world market prices within Europe would form an alternative to imported concentrates. The supply of grain-substitutes in the world market could then squeeze the prices for feedgrains even more than is the case at present.

Following trade liberalisation grain exports by the Community would be a thing of the past. Although there are certain parts of the Community in which wheat can be produced at much the same cost as that in other exporting countries such as the United States, Canada and Australia [19], average production costs in the Community are significantly higher than those in competitor countries. In the absence of export subsidies the Community would therefore be unable to sustain its present position in the world market given the liberalisation of agricultural trade. A part of the existing export flow would find its way onto the internal market as animal feedstuffs and could therefore replace some of the present massive level of grain-substitute imports.

[19] J.C. Blom, 'Une évaluation des instruments de la politique céréalière de la CEE'; in: *Cahier d'Economie et Sociologie Rurale*, no. 18/19, Paris, Institut National de la Recherche Agronomique, 1991.

The Community's trading position for *poultry and pork* would not be seriously undermined given trade liberalisation. The present level of protection of poultry in the Community is geared to the price differential between feedgrains in the internal market and the world market. Although this protection would disappear, the bio-industry would be able to take advantage of feed inputs at world market prices.

A number of model analyses have shown that the rising level of income in *developing countries* generates a higher demand for animal products. This can mean a rise in imports of dairy products, meat and feedgrains for domestic production. Sugar imports could also rise. The consequences of trade liberalisation for the developed market economies could be ameliorated by the rising consumption in developing countries.

Implementation in GOAL

The results of the model studies summarised in Table 4.6 differ widely, but taken as a whole nevertheless provide a qualitative impression of the import and export flows for the various agricultural commodities. While it is not possible to determine any absolute figures, the overall trend can be established, in the sense of whether there will be any imports or exports or whether these will rise or fall. GOAL does, however, require quantitative specification and, on the basis of the qualitative impression, a potential quantification has been drawn up of imports by the European Community.

Assumptions have also been made concerning the volume of trade under a liberalised system in respect of various products with a smaller volume of trade. The Community could, for example, remain self-sufficient in potatoes. In the case of sheepmeat it has been assumed that the Community could remain 75 per cent self-sufficient, although this is not of course a forecast.

Table 4.6 summarises the possible trading implications for the EC of liberalisation.

Table 4.6 Net import flows (mill. tonnes) allowed for in the GOAL model on the assumption of free imports

	Existing situation	After liberalisation
Cereals	−18.9	1.9 to 2.3
Oilseeds	13.7	15.0
Coarse meal	10.4	10.0
Grain-substitutes	17.5	0.0
Sugar	−3.3	1.0 to 1.4
Potatoes	−0.5	0.0
Beef	−0.4	0.8 to 1.1
Sheepmeat	0.2	0.3 to 0.5
Pork	−0.3	0.0
Poultry products	−0.3	0.0
Butter	−0.4	−0.2
Cheese	−0.3	−0.1
Full milkpowder	−0.3	−0.2
Skimmed milkpowder	−0.5	−0.1

Source: European Commission, *The agricultural situation in the Community. 1990 Report*, and WRR on the basis of various sources.

4.4.4 Four production variants

Changes in the composition of the diet have consequences for the scale of the final demand for agricultural commodities. Combined with a possible change in the imports and exports of agricultural and forestry products this results in four different situations that may be introduced as variants in the GOAL model.

These four variants are:

1. self-sufficiency (i.e no imports and exports) and no shift in the diet;
2. free trade (i.e. imports and exports) and a shift towards greater animal protein in the final demand;
3. self-sufficiency and a shift towards more animal protein;
4. free trade and no shift in the diet.

These variants will affect the land use in the EC. If the final demand contains more animal protein the area required for livestock grazing will expand considerably. The amount of animal feedstuffs that can be imported will, however, be a relevant factor. The combination of both factors will have a major bearing on future land use in the EC.

European agriculture in the future: four scenarios

5

5.1 More detailed elaboration of the scenarios

This chapter presents the four scenarios based on the various political philosophies concerning the way in which European agriculture should evolve. As noted in the previous chapters, these scenarios have been constructed by using the GOAL model to calculate how much land needs to be used where and how in order to meet a given demand for agricultural products in line with the priorities of that particular philosophy.

To this end the GOAL model employs two categories of input data. In the first place a large number of technical data have been quantified concerning agricultural and forestry techniques, regions, soil suitability and water availability. These particulars are the same for all scenarios. Together they form the parameters of the agricultural system in the EC-12. In model terms they form the technical restrictions (see further Chapter 3).

The second category varies per scenario. This relates to input data concerning productivity, socio-economic development and the environment, the quantification of which depends on the weight attached to that aspect in the philosophy in question. In model terms these are known as goal variables, the value of which is determined by the restrictions introduced in line with the various policy preferences (see Chapter 3).

Eight policy goals have been distinguished.

In the agro-technical field:
1. maximisation of land productivity;
2. minimisation of costs of agricultural production.

In the socio-economic area:
3. maximisation of total employment in land-based agriculture;
4. maximisation of regional employment in land-based agriculture.

In the environmental field:
5. minimisation of the use of nutrients per hectare;
6. minimisation of the use of nutrients per unit product;
7. minimisation of the use of pesticides per hectare;
8. minimisation of the use of pesticides per unit product.

The scenarios are generated by combining in the GOAL model (a) the demand for agricultural products (in principle the same for all scenarios; see however section 5.2.2); (b) the technical restrictions (the same for each scenario) and (c) the four sets of goal variables (differing for each scenario). In this way the implications of the various philosophies for the future of land-based agriculture in the EC-12 become visible.

The scenarios generate two types of results. In the first place they tell us something about the *mutual compatibility* of goal variables. At issue here is the technical compatibility and policy acceptability of restrictions imposed on a number of goal variables in the optimisation process. By means of an iterative procedure with the aid of the GOAL model the values assumed by the restrictions imposed on these goal variables in a scenario are determined. The iteration results in a trade-off of goal variables: a tighter requirement in respect of one goal variable generally means a lower attainable value for the remaining objectives. The values determined in this way should therefore not strictly be

regarded as results of model calculations. They are instead produced by the interactive multiple goal programming forming part of the model and which – in the light of the philosophy in question – generates an optimal land use scenario.

'Genuine' results are the values assumed by the remaining goal variables once the restrictions have been introduced, as well as the regional distribution of different types of land use.

By means of this combination of imposed values and model results the consequences of giving priority to certain goals (i.e. the selected restrictions) in relation to goals with a somewhat lower priority (the unrestricted goal variables) become visible.

As noted earlier, the scenarios generated in this way are idealised in nature. The calculation is solely based on agro-technical restrictions. Socio-economic and institutional obstacles have not been incorporated in the model. Nor has allowance been made for the fact that in practice, policy is always a matter of compromise. Finally it is assumed that agriculture is conducted on a rationalised basis without wastage, i.e. according to the best technical means. As such the scenarios may in no way be regarded as predictions. The surveys are purely instrumental in nature; but precisely because a 'purified' picture of the future is built up, various potential situations, as well as the sensitivity of those situations to policy initiatives, come clearly to the fore, and it is in this sense that the scenario outcomes are of relevance.

Before examining the conclusions to be drawn (section 5.4), the following sections examine the quantification of the goal variables. This is followed by the presentation of the four scenarios (given two separate dietary patterns). In the interests of mutual comparability the scenarios are first examined in conjunction and then individually. Finally the scenarios are analysed from a number of angles of relevance for the policy goals.

5.2 Quantification of the goal variables

5.2.1 Extreme values

In order to quantify the goal variables in the scenarios, the 'playing field' must first be defined. To this end the extreme values which the goal variables can assume need to be calculated. These extreme values must also be known in order to determine the position of restrictions and to assess the true value of the results.

These extreme values of the goal variables have been calculated in a 'zero round'. The latter is based on an assumed demand for agricultural products, subject only to the technical restrictions; the compatibility of the goal variables within any one strategic philosophy has therefore not been examined.

In determining the demand a distinction has been drawn between two differing situations with respect to international trade and two differing situations with respect to the development of consumer demand for agricultural products. In the case of international trade a situation of free imports has been distinguished as well as one of continued protection of the EC agricultural market; in the case of consumer demand a distinction has been drawn between the present diet and a shift in favour of more protein. This therefore results in four possible variants in the demand for agricultural products produced within the EC.

The results of the zero round for each goal variable are shown in the following section. The extreme value which the variable can assume within the European

system of agriculture, as described in the GOAL model by means of the technical restrictions, has been calculated. Extreme values are thus found: these cannot turn out higher (or lower, depending on the goal in question). In this way the theoretical scope for the future development of the European agricultural system, expressed in goal variables, is rendered visible.

5.2.1.1 *Agro-technical goal variables*

The *land productivity and land use* of the primary land-based agriculture are treated here as an entity since there is a fixed relationship between these values at a given level of production. The extreme value is found at a level of demand generated by free imports and an unchanged diet.

	Now	Extreme value
Cultivated area (in mill. ha)	127	21

Under these assumptions, the present level of agricultural production in the EC could theoretically be realised on a sixth of the present area. The maximum land productivity corresponding with this extreme value is expressed below, taking account of the (albeit low) differences in land productivity within the area of 21 million hectares.

	Now	Extreme value
Cereals	4.7	11
Oilseeds	2.4	5
Grass	4	19

(in tonnes per hectare; the yield for grass relates to the total quantity of dry substances per hectare, in the case of oilseeds and cereals the figures relate only to the ultimate product in dry substances per hectare).

These figures reveal that the technical possibilities leave room for a spectacular increase in productivity, especially on the better soils.

The costs of land-based agriculture have been calculated by adding up the costs of the intermediary and factor inputs, except land, together with the costs of irrigation. These costs may be juxtaposed against the value of the total agricultural end-production in the EC-12. These values are not of course entirely comparable. Eurostat figures indicate a total value of the end-production for 1989 of some 180 billion ECU. In the zero round an extreme value is found for the costs given a demand generated by free imports and a continuation of the present diet.

	Now	Extreme value
Agricultural production costs (in ECU bn)	180	70

5.2.1.2 *Socio-economic goal variables*

In the case of *employment* the maximum value has been calculated in the zero round given unrestricted imports and the present diet. This has been based on the time currently taken to perform certain agricultural operations in efficient agricultural enterprises.The extreme value has been found for a level of demand given free imports and a modified diet.

	Now	Extreme value
Employment (in mill. of MPU = manpower units)	6	4.7

Under these assumptions, production in land-based agriculture could sustain no more than three-quarters the present level of employment.

Apart from the total volume of employment the distribution of employment over the regions is an important factor. The maximum regional employment in land-based agriculture has been calculated in the zero round. The extreme value indicates that in the region with the lowest productivity of labour, 52 per cent of the employment in land-based agriculture cannot be retained; in that region employment would therefore fall by slightly more than half.

5.2.1.3 *Environmental goal variables*

Environmental priorities are expressed by the extent to which the use of nutrients is permitted in the various scenarios, together with the permitted use of crop protection agents.

The *minimisation of the use of nutrients* has been reduced in the model calculations to minimising the use of nitrogen. That use has been defined as the difference between (i) nitrogen imports from outside the EC-12 (in the form of artificial fertilisers and animal feedstuffs) as well as the nitrogen fixed by plants from the air and atmospheric deposition and (ii) nitrogen removal via agricultural products. A part of this difference will leach out into the groundwater and hence exert an impact on the environment. Since this cannot be precisely calculated it has been assumed to be the entire difference, designated here as nitrogen use.
Nitrogen use may be shown per unit product and per hectare. The extreme values are found for a level of demand given free imports and an unchanged diet.

	Now	Extreme value
Nitrogen use (in mill. tonnes N)	11	1.5
Average per hectare (in kg N per ha)	85	26

The minimisation of nitrogen use in agriculture by the application of efficient, environment-oriented production methods means that a substantially lower input of nutrients could suffice.

The *use of crop protection agents* can also be shown per unit product (in millions of kg of active ingredients) and per hectare. The extreme values are found for a level of demand given free imports and an unchanged diet.

	Now	Extreme value
Input of crop protection agents (in mill. kg a.i.)	400	9.7
Average per hectare (in kg a.i. per ha)	3.2	0.2

On the one hand the figure for present use is an underestimate since Spain and Luxembourg have not been included, but on the other it is an overestimate because it relates to all forms of agricultural production.

Given the efficient use of crop protection agents by means of integrated and targeted application systems and by the use of crop rotation in a preventive sense, the quantities used could be considerably reduced. If a certain loss of productivity is also accepted, the total use comes down spectacularly.

5.2.2 Changing assumptions with respect to demand

In the zero round the extreme values for the goal variables are first calculated subject to assumptions not bearing any relation to the various strategic philosophies. The assumptions are not, however, neutral when it comes to the way in which the demand for agricultural products can be satisfied. By nature some of the philosophies have consequences for the way in which the demand can be met. The minimisation of costs is for example consistent with free imports, but where the main concern is with regional development, self-sufficiency will be the aim in order to keep agricultural employment as high as possible.

In drawing up the scenarios, therefore, the extreme values must be known that are consistent with *the various positions in the strategic philosophies*. As has been seen, the extreme values are also sensitive to changes in the structure of demand resulting from modifications in the diet. Table 5.1 therefore provides a survey of the extreme values in four variants resulting from (i) free and restricted imports (i.e. self-sufficiency) and (ii) the present and a modified diet.

In the case of six of the eight goal variables the extreme value applies given free imports and the present diet. For the remaining two goal variables the extreme values apply in the case of self-sufficiency and a modified diet. The size of the demand has a dominant impact on the value of the goal variable. Goal variables vary in proportion to the size of the demand. The demand for domestically produced agricultural products is smallest given free imports and the present diet. For goal variables that are minimised, the lowest value is therefore also found at that demand. If total or regional employment is maximised, higher production generates higher values. The demand variants associated with the highest demand for domestically produced agricultural products generate the highest values.

Table 5.1 **Extreme values of the goal variables in the four demand variants in the zero round**

	Free imports & present diet	Free imports & modified diet	Self-sufficiency & present diet	Self-sufficiency & modified diet
Area [mill. ha]	21	31	28	42
Total employment [mill. MPU]	4.1	4.7	4	4.6
Regional employment [%]	48	58	41	47
Nitrogen use [mill. tonnes N]	1.5	2.3	1.9	2.8
Nitrogen use per hectare [kg N ha^{-1}]	26	29	34	38
Use of crop protection agents [mill. kg a.i.]	9.7	19.1	31.3	53
Use of crop protection agents per hectare [kg. a.i. ha^{-1}]	0.2	0.3	0.6	0.7
Costs of land-based agriculture* [ECU bn]	70	101	81	121

Source: WRR.

* Costs of arable farming and livestock farming, including costs of irrigation.

5.3 Quantification of the scenarios

5.3.1 Internal comparison

In order to formulate the scenarios, an optimisation procedure was carried out in the zero round in which the demand variants are inputted for each scenario. The extreme values obtained in the zero round are then used in order to impose the restrictions on the goal variables in the relevant philosophy in question. In this way conflicts are generated between the goal variables (which are all policy goals, of differing priority). The GOAL model reveals these conflicts. Restrictions are then imposed on the goal variables in such a way as to generate an optimal land use scenario.

The goal variable accorded priority in the philosophy in question achieves a value in line with that philosophy, while at the same time satisfying the other policy goals acceptably.
The four scenarios are:

a. free market and free trade;
b. regional development;
c. nature and landscape;
d. environmental protection.

The scenarios are examined below in relation to the goal variables. This is done in relation to both the present diet (Table 5.2) and a modified diet (Table 5.3).

Table 5.2 Four scenarios compared on the basis of the goal variables given an unchanged diet

	A_0 Free market	B_0 Regional development	C_0 Nature and landscape	D_0 environmental protection
AREA [mill. ha]:	42.2	76.8	26.4	60.7
arable farming	16.8	45.9	12.7	29.2
of which intensive	9.5	16.5	12.7	19.7
roughage [mill. ha]	25.1	30.1	13.5	31.2
of which intensive	12.8	11	13.5	13.8
EMPLOYMENT:				
total [mill. MPU]	1.5	2.2	1.8	2.2
regional employment [%]	5	23	5	5
NITROGEN USE:				
total [mill. tonnes N]	2.1	2.8	2.1	2.1
av. per ha [kg N ha^{-1}]	59.2	42.4	80.4	34.8
CROP PROTECTION:				
total [mill. kg a.i.$^{-1}$]	60	89.1	21.2	33
av. per ha [kg a.i. ha^{-1}]	1.7	1.3	0.8	0.5
COSTS [ECU bn]	71	90.4	90.5	101.1
of which:				
arable farming	34.4	51.2	44.7	53.5
livestock farming	33.4	35.7	34.5	37.2
irrigation	3.2	3.5	11.3	10.4

Source: WRR.

Table 5.3 Four scenarios compared on the basis of the goal variables given a modified diet.

	A_+ Free market	B_+ Regional development	C_+ Nature and landscape	D_+ Environmental protection
AREA [mill. ha]:	61.6	91.6	31	79.8
arable farming	19.7	44.5	15.8	35
of which intensive	12	26.4	15.8	35
roughage [mill. ha]	41.6	46.7	21.4	45.2
of which intensive	21.2	17	21.4	16.1
EMPLOYMENT:				
total [mill. MPU]	2.2	2.8	2.5	2.9
regional employment [%]	5	29	5	5
NITROGEN USE:				
total [mill. tonnes N]	3.1	3.7	2.9	2.9
av. per ha [kg N ha^{-1}]	60.4	49.5	78	36.8
CROP PROTECTION:				
total [mill. kg a.i.$^{-1}$]	90	153.6	28.8	54.5
av. per ha [kg a.i. ha^{-1}]	1.8	2.1	0.8	0.7
COSTS [ECU bn]	102.3	128.2	122.8	145.3
of which:				
arable farming	48.1	67.1	56.9	75.4
livestock farming	51.5	54.9	51.7	55.6
irrigation	2.7	6.2	14.2	14.3

Source: WRR.

5.3.2 Commentary on the results

Scenario A

In scenario A demand is exogenously imposed given a system of free trade in agricultural products. This is consistent with the normative assumptions of this scenario (i.e free market and free trade). Only a limited restriction is imposed on the goal variables in the scenario. The ultimate minimisation is imposed on the costs of agriculture. In the other scenarios, too, this is the goal variable which (after any intermediate steps and tightening of the restrictions) is minimised in the final step.

In scenario A restrictions are imposed on the minimal regional level of employment, loss of nitrogen and input of pesticides. The restriction on the minimum level of regional employment must be regarded as a basic parameter and is imposed on all scenarios. The reason for the basic parameter is that a certain level of employment in agriculture is maintained in all cases at the level of NUTS-1 regions. The imposition of this restriction avoids agricultural production from being limited to a small number of regions. The restriction necessarily introduces an element of regional distribution in the model, albeit at minimal level.

In addition restrictions have been imposed in this free market/free trade scenario on the use of nitrogen and the input of pesticides. These restrictions have been chosen in such a way as to exert little if any impact on the ultimate cost minimisation. In a narrow sense these restrictions are 'free'. The total costs do not rise significantly on account of these two restrictions (namely a maximum use of 2.1 mill. tonnes N and a maximum input of pesticides of 60 mill. kg, measured in active ingredients).

The results of the calculations reveal that the total costs of agriculture under scenario A amount to at least 71 billion ECU (given the present diet). The supplementary restrictions (regional employment, nitrogen use and input of pesticides) therefore collectively lead to an increase of one billion ECU in relation to the extreme value found in the zero round.

The preservation of at least 5 per cent of employment in land-based agriculture can be realised at low surplus cost in relation to the zero round by the redistribution of dairy farming. The surplus costs relate solely to roughage production. Livestock farming techniques do not vary regionally.

If a change in the diet is assumed the same picture emerges. In this case the input of pesticides is limited to 90 million kg of active ingredients and the use of nitrogen to 3.1 million tonnes. The associated costs amount to 102.3 billion ECU, only fractionally higher than the extreme value in the zero round.

The consequences of a change in the diet are clear. The inclusion of more (animal) protein in the modified diet involves a substantial expansion in primary agricultural production. This is reflected in the area required (61.6 versus 42.2 mill. ha) and in the productive resources required (i.e. more labour, nitrogen and pesticides).

Scenario B

Scenario B assumes an exogenous demand for agricultural products in a situation of self-sufficiency. The scenario is based on the normative principle of regional development, interpreted here as the strengthening of regional employment in the agricultural sector. This principle is not readily combined with a demand arising from the free imports and exports of agricultural products

since conditions in the (world) market will largely determine the viability of regional agricultural employment. If the principle is accepted that the government must make every effort to ensure regional employment in agriculture, market regulation is a necessary precondition.

In contrast to the general restriction of 95 per cent, a fairly tight parameter has been imposed in scenario B with respect to the maintenance of regional employment. The restriction has been quantified iteratively by establishing at which percentage of maximum regional employment the average additional costs of production per man-hour created (which may be derived from the increase in total costs for agriculture and the total associated volume of employment) correspond with exogenously determined average wage costs in agriculture. Given an unchanged diet this value turns out to be 23 per cent, meaning that in at least one region employment will amount to only 23 per cent of the present level.

A word of qualification is in order at this point. By taking the *present* level of employment as the reference point, regions with a comparatively low productivity of labour are advantaged, in the sense that, in the extreme case, 23 per cent of what is at present on average an excessive volume of employment can remain in such regions. In the case of regions with a high productivity of labour this percentage is of course at the same level, but the much lower scope for an increase in labour productivity amounts to a de facto tighter restriction in terms of the present production capacity. In the light of the primary objective – the preservation of regional employment – such a restriction can, however, be defended.

If demand is determined by a modification in the diet, the regional level of employment holds up a little better, at 29 per cent of the present level. This is understandable in view of the greater scale of primary production upon a modification of the diet.

Scenario B is also subject to a restriction concerning the use of nitrogen and the input of pesticides. As in scenario A, the values of these restrictions have been based around a minimal effect on total costs.

The restrictions therefore indicate what is possible given the two restrictions of maximising regional employment and minimising the total costs. Given a demand determined on the basis of the present diet, these costs come to 90.4 billion ECU, and given a modified diet to 128.2 billion ECU.

Scenario C

Scenario C seeks to create as much space as possible for the natural environment (i.e. agriculture is conducted on the smallest possible area), while using environment-oriented production techniques. Apart from this, agriculture can be allowed to develop freely on this minimal area. For these reasons, the exogenous demand under this scenario is (among other things) determined by free imports and exports of agriculture products. In addition the normative assumptions on which this approach is based mean that agriculture needs to be conducted in a comparatively clean way.

In order to find a restriction for the maximum permitted agricultural area, the latter has to begin with been minimised by applying the restriction that environment-oriented techniques only are used. When this is done, it may be seen that the demand for food products can be satisfied by a production of respectively 26.4 million hectares (current diet) and 37.6 million hectares (modified diet).

Once these restrictions have been determined, the use of nitrogen and input of pesticides are minimised in scenario C by finding restrictions for these two goal variables. This reflects that fact that under a scenario aimed at preserving nature and the landscape, agriculture may not be conducted in such a way as to exert a negative impact outside the area assigned to it. These minimisations in scenario C result in a restriction on the use of nitrogen of 2.1 million tonnes N and an input of 21.2 million kg active ingredients under the present diet. If the demand is determined by a modified diet, these restrictions come to 2.9 million tonnes N and 28.8 million kg active ingredients.

In the latter calculation the costs of agriculture have once again been minimised subject to the restrictions for the maximum agricultural area, the maximum use of nitrogen and the maximum input of pesticides. Here too the general restriction on regional employment naturally also applies. The calculations reveal that the costs of agriculture rise to 90.5 billion ECU given the present diet and 122.8 billion ECU under a modified diet.

Scenario D

In Scenario D the main emphasis is placed on reducing the potential impact of agriculture on the environment. To this end severe restrictions are introduced on the use of nitrogen and input of pesticides. This underlying aim necessarily assumes a system of strict government regulation. Imports of substitute agricultural products that are not produced subject to the same stringent environmental standards must be avoided. For this reason this scenario assumes a level of demand that is in part determined by self-sufficiency within the EC.

As in scenario C, the restrictions on the use of nitrogen and input of pesticides have been found by first minimising these goal variables. Minimal values for the use of nitrogen of 2.1 and 2.9 million tonnes N respectively have been found for the present and a modified diet. For the input of pesticides these figures are 33 million and 54.5 million kg active ingredients respectively. The results indicate that the costs rise to 101.1 million ECU given the present diet and 145.3 billion ECU given a modified diet.

5.3.3 Comparison in terms of policy aspects

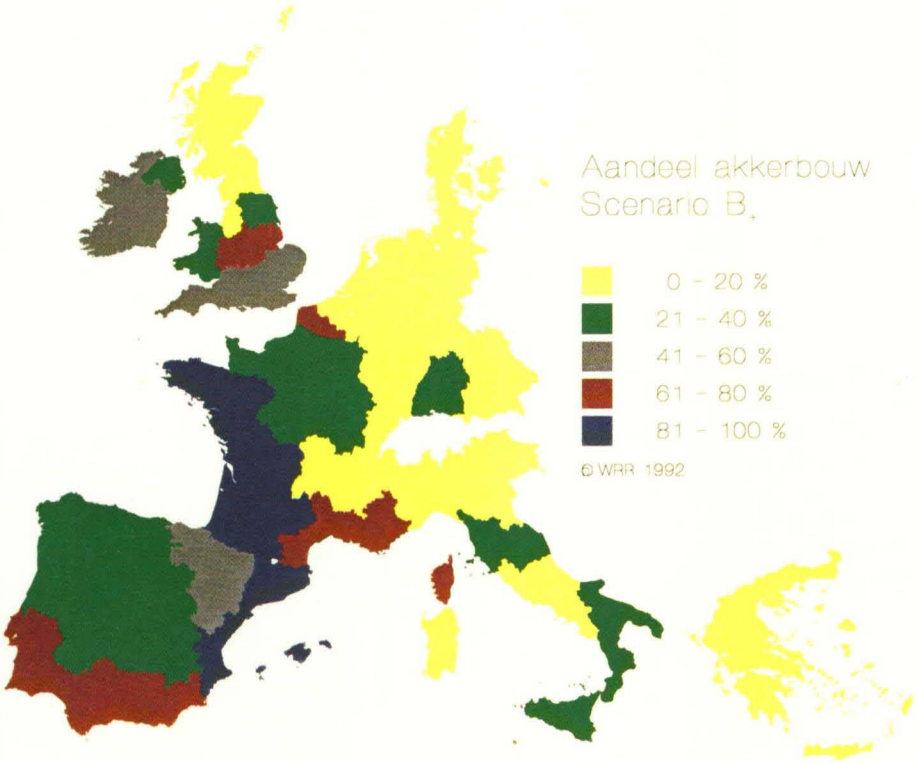
In the following discussion the scenarios based on a level of demand given the present diet have been designated A_0, B_0, C_0, and D_0, and those given a modified diet as A_+, B_+, C_+ and D_+.

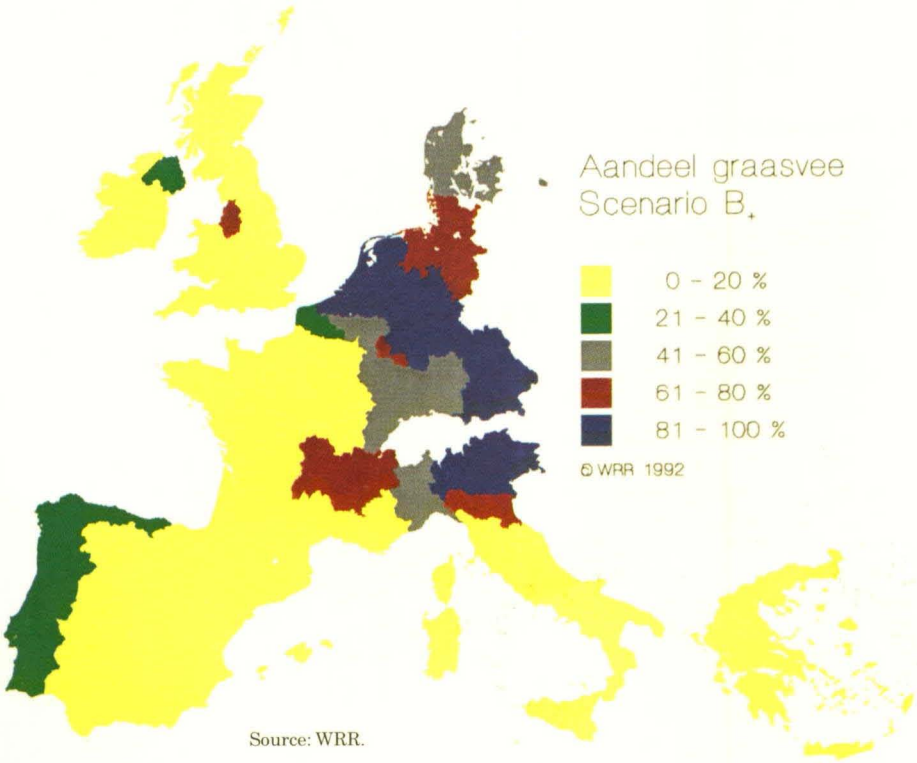
5.3.3.1 *Land use*

The first thing to emerge is that the outcomes are heavily influenced by the composition of the diet. A shift in favour of a greater intake of animal foods results in an increase in the supply of animal feedstuffs by a factor of 4 to 8. Depending on the system employed, 4 to 8 kilos of grain-equivalent in the form of animal feedstuffs are required for each kilogram of meat. A much greater area is therefore needed in order to produce these animal feedstuffs.

The outcomes that are produced on the smallest possible area therefore apply to the 0-scenarios. This may be seen in Figures 5.1 and 5.2 on the basis of the results for scenarios B_+ and C_0 respectively.

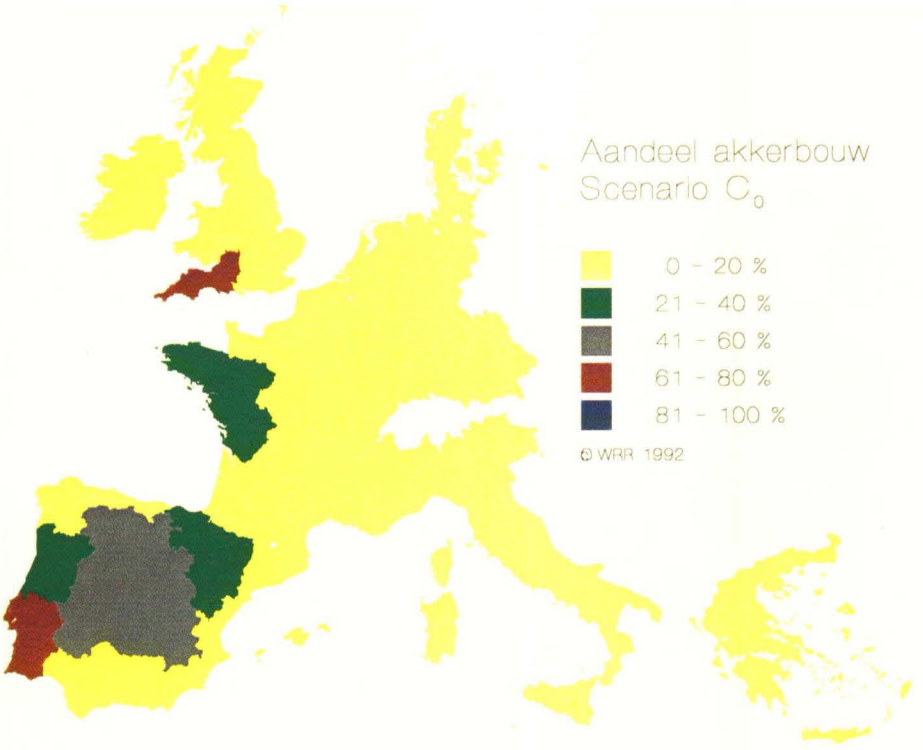
Figure 5.1 **Distribution of agriculture in scenario B_+ shown as the percentage of the cultivated area in use for arable farming ('akkerbouw') and for livestock farming ('graasvee')**

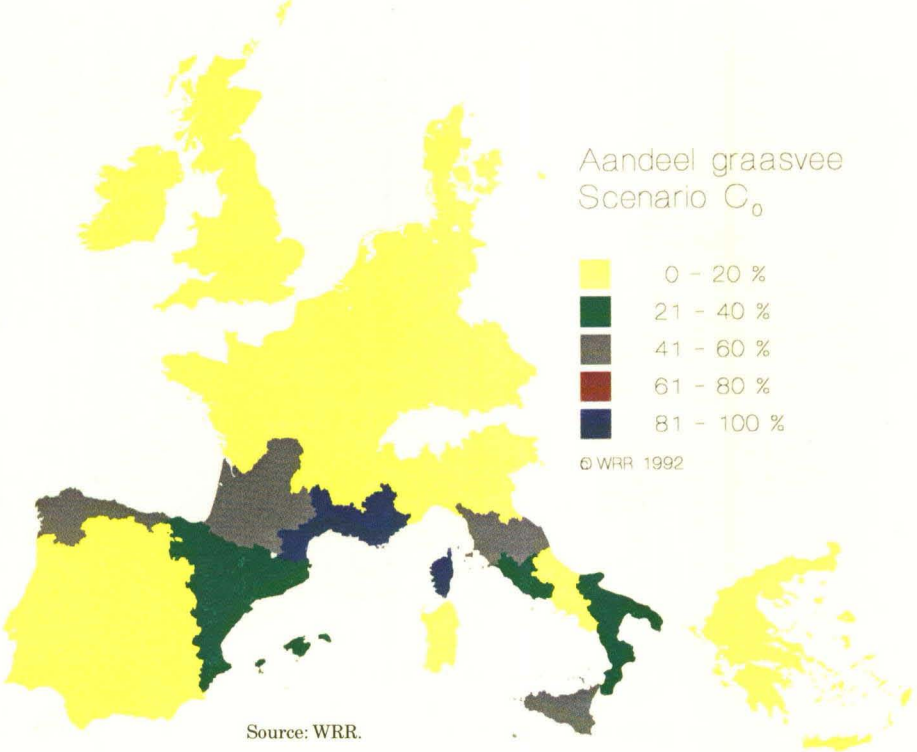




Source: WRR.

Figure 5.2 **Distribution of agriculture in scenario C_0 shown as the percentage of the cultivated area in use for arable farming ('akkerbouw') and for livestock farming ('graasvee')**



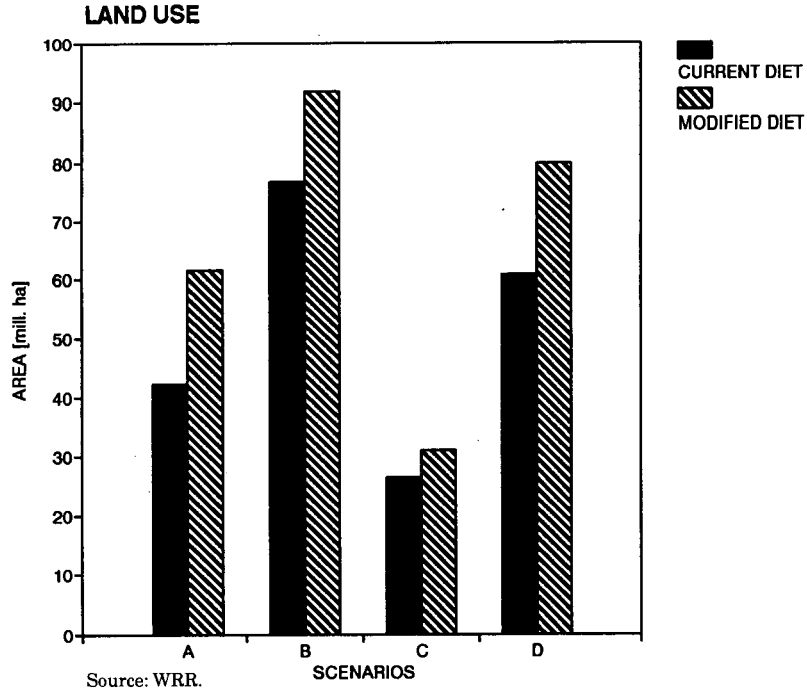


Source: WRR.

Figure 5.3 shows the land use in the various scenarios. The smallest area (just 26.4 mill. ha) occurs for scenario C_0, as might be expected since this scenario's restrictions involve releasing the largest possible area for nature and scenic areas. The result is related to the production techniques employed. In scenario C, environment-oriented techniques only are applied, apart from which it is also based on irrigated forms of agriculture, so that the average land productivity is extremely high. A comparison with the outcome for scenario A_0 (42.2 mill. ha) reveals that virtually no environment-oriented techniques are applied in the latter scenario. In addition some 30 per cent of the production is achieved by non-irrigated means and a further 30 per cent in the form of extensive agriculture. The average land productivity is consequently well below that in C.

The greatest area is required under scenario B. In B_+ this rises to over 90 million hectares. The average land productivity is therefore lowest in this scenario. This is because employment is preserved in B in regions with a comparatively low productivity of labour and evidently also a low land productivity. In addition numerous land-use-related agricultural techniques are used in B.

Figure 5.3 **Differences in land use between the four scenarios**



Source: WRR.

The scenarios include the cultivation of fast-growing timber on land currently forming part of the cultivated area. The area in question has been calculated in all four scenarios on the assumption of self-sufficiency in this segment of the timber market. This has also been done for those scenarios that are based not on self-sufficiency in agricultural products but on free trade. The fact that the timber cultivation takes place on good soils means that high yields are possible. No more than four million hectares are required in any of the scenarios for this condition to be fulfilled.

The necessary area ranges between 2.9 and 3.9 million hectares. Timber yields are highest in the south of the Community.
Timber cultivation is situated in this part of the Community in scenario A, and

an area of 2.9 million hectares is sufficient to meet the demand for timber in a system based on self-sufficiency. In scenario C the cultivation of roughage shifts to the south, where high potential yields can be achieved with the use of irrigation. In these circumstances timber cultivation is displaced to other regions with lower yields and the necessary area rises to 3.9 million hectares.

The main focus of land use in the EC-12 differs in the four scenarios. In *scenario A* agricultural activity is concentrated in the north-west of the Community, with arable farming largely confined to the centre (i.e. the southern part of West Germany and eastern and western France) and to Ireland. Roughage cultivation is primarily located in western, northern and eastern France and the western part of West Germany. Forestry takes place in the centre and south of Spain and Portugal while solitary cereal cultivation takes place in the southern regions of Italy and Scotland and Northern Ireland. Fruit is grown in southern Portugal and in Sicily. In this scenario – which is based on the lowest costs – agricultural production is therefore concentrated in West Germany, France, Belgium, the Netherlands and Ireland. The production of timber takes place in the south of the EC.

A shift in the diet does not result in any major modifications. Apart from some expansion here and there the distribution remains unchanged. Denmark, Greece, Spain and Portugal continue to be marginally endowed in both the O-variant and the +-variant.

Agricultural land use is the most widely distributed in *scenario B*. This reflects the maximisation of regional employment in agriculture in this scenario. Nevertheless the distribution does exhibit some areas of particular concentration; these vary according to the diet in question.

Arable farming is concentrated in the south-west and west of France, Ireland and several regions in Britain, but given a modified diet greater areas of France come into play for both arable farming in general and cereal cultivation in particular. Cereal cultivation is well distributed, with particular concentrations in the Paris Basin and central Spain in the variant based on the present diet. In the variant with the modified diet the French cereals area is extended to the west and a spur in the south-west. Roughage production extends into Bavaria and north-east Italy under the present diet; given a modified diet areas of particular concentration are northern Italy (Nord-Ovest, Nord-Est, Lombardia and Emilia-Romagna), but Bavaria maintains a significant share. Under the present diet forestry is primarily concentrated in south-west France and eastern and southern Spain. Given a modified diet forestry takes place in north-east, central and southern Spain and in the Madrid region. Under this variant south-west France concentrates especially on cereals and roughage production.

In scenario B it is evident that the most labour-intensive production, mainly dairy farming, takes place where the present level of agricultural employment is highest. These are mainly the Mediterranean countries and Bavaria, where roughage production is also situated as the model assumes that roughage is produced in the region itself.

Under *scenario C* arable farming is largely confined to the western flank: the south-west of England, western France and the north-west, north-east and central parts of Spain and Portugal. Under this scenario roughage cultivation is concentrated in the south: the south-west, centre-east and Mediterranean maritime area of France, the centre and south of Italy and Sicily, the north, east and south of Spain and the northern part of Portugal. Forestry is largely concentrated in the north: Schleswig-Holstein and Lower Saxony, the northern, eastern and western parts of the Netherlands, Luxembourg, various parts of Britain and especially Ireland and Denmark.

Under this scenario – which employs the smallest area for agriculture – agricultural production is largely concentrated in France, Italy, Spain and Portugal and Britain and forestry in the north. Production is in all cases irrigated, meaning that particularly in the south, high production is achieved on a small area.

West Germany, the Benelux, Ireland and Denmark remain on the margins in both demand variants, although in both variants a substantial (and equal) area of forestry is located in Denmark and Ireland.

In respect of this scenario, too, virtually no shift takes place in the allocation of land use upon a modification of the diet, except in Spain, where arable farming in the north is replaced by roughage production.

Agricultural production under *scenario D* is reasonably spread over the Community, with the exception of the Benelux and Ireland, which are marginally endowed in the variant based on the present diet: the regional distribution in the two variants differs considerably.

Arable farming given the present diet reveals a concentration in the south-western corner of the Community (i.e southern Portugal and north-east, eastern, central and southern Spain) and in the north (Denmark, Ireland, Northern Ireland and Scotland). Specialised cereals cultivation is concentrated in the Paris Basin, northern Italy, northern Portugal and Lower Saxony. Under this demand variant roughage cultivation is situated in the south and centre. Forestry is fairly well distributed, with particular concentrations in North Rhine-Westphalia and south-west France.

Given a modified diet arable farming disappears from France and the German regions, with the exception of Lower Saxony, where the area is nearly halved in comparison with the 0-variant. In Italy cereals production shifts from the north in the present diet to the south in Sicily and Sardegna, where cereals are grown in rotation. A substantial area of arable farming is transferred to Ireland under a modified diet, while the Spanish regions receive the largest share of such farming.
These shifts are mirrored in the areas devoted to extensive meadowlands and forest. The Benelux remains marginally endowed under a modified diet.

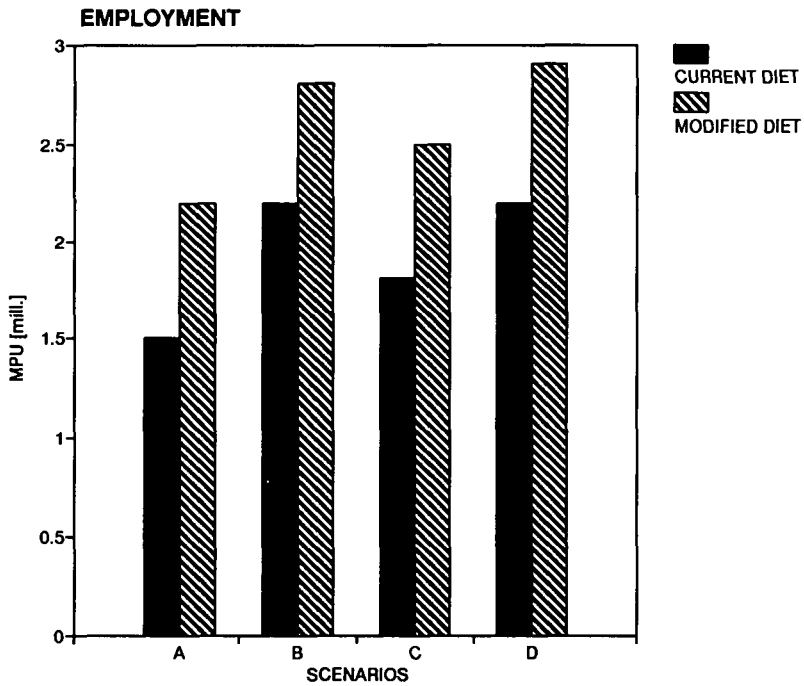
To sum up, arable farming in scenario A occurs in the westerly regions, southern West Germany and north-east France. Roughage cultivation is concentrated in France, West Germany and the Benelux. In scenario B both arable farming and roughage cultivation are spread throughout the Community. Arable farming is concentrated more in the westerly regions and roughage cultivation more in the east. In scenario C arable farming has been displaced to the western flank of the Community and roughage cultivation is concentrated in the southern regions. In scenario D there is no clear focus of concentration.

The outcomes of the scenarios indicate that shifts in the underlying assumptions and the weighting of the goal variables result in substantial changes in the distribution of agricultural production within the EC. Although there are physical differences and shifts take place if different priorities are attached to the various goal variables, the sensitivity is nevertheless fairly great. This means that other production-location factors that are not included in the model, but which can be influenced by government policy (e.g. the available infrastructure, market outlets, and investments in irrigation), can be decisive for developments. The scenarios indicate the possibilities.

5.3.3.2 *Employment*

One of the most striking features to emerge from a comparison of the scenario outcomes is that agricultural employment falls in each of the scenarios.

Figure 5.4 **Differences in total employment between the four scenarios**



Source: WRR.

Employment benefits from a change in the diet in favour of animal foodstuffs. The outcomes in which employment is maximised therefore apply to the +-scenarios. The absolute peak occurs in scenario D_+, where strict environmental restrictions result in the higher input of labour. But even under this scenario the volume of employment falls by over 50 per cent (from some 6 mill. MPU to 2.9 mill. MPU).

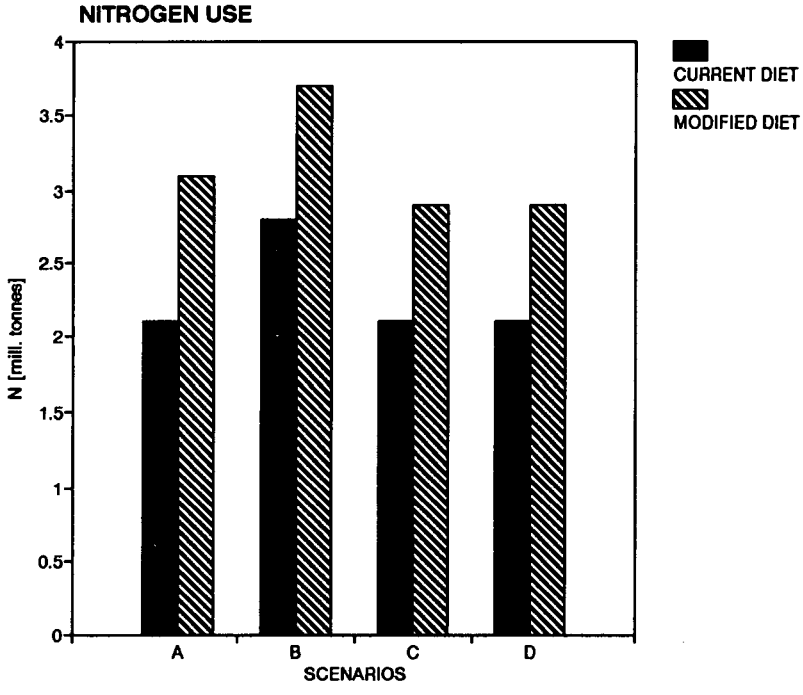
The difference between the D and B scenarios remains marginal. In B, however, the emphasis is placed on preserving the *regional* distribution of employment but this does not mean that the largest possible *total* volume of employment is achieved.

The lowest values are encountered in scenario A, where the marked rationalisation of production inevitably leads to a loss of jobs, to as little as 1.5 million MPU in scenario A_0. The difference compared with the highest attainable value under the present diet is not, however, great (2.2 mill. MPU in D0). The differences between the scenarios are also limited given a modified diet (2.2 mill. MPU in A_+, 2.9 mill. MPU in D_+).
In all scenarios the distribution of employment over the regions has been placed at at least 5 per cent, i.e. even in the region where the greatest volume of employment is shed, at least 5 per cent of the present level must be retained. This minimum level can be attained without placing an undue burden on the remaining goal variables (i.e. costs!). In particular, dairy farming can be more widely distributed over the regions at little extra cost. Under the regional development scenario B, 29 per cent of the present volume of labour can therefore be retained in every region (given a modified diet). If the diet remains unchanged the figure falls to 23 per cent.

5.3.3.3 *Environment*

In each of the scenarios the impact on the environment from agriculture is substantially less than that at present. To some extent this may be explained in terms of the underlying assumptions, namely that production is based in all the scenarios on the best technical means. In addition, however, there are different environmentally beneficial factors in each scenario.

Figure 5.5 Differences in total use of nitrogen between the four scenarios



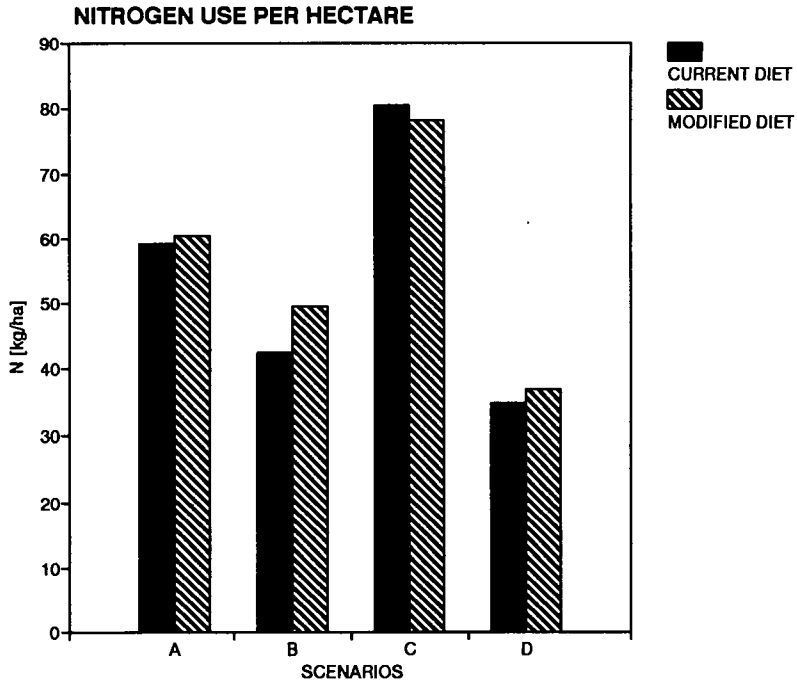
Source: WRR.

Nitrogen

As may be seen from Figure 5.5, the total use of nitrogen in the various scenarios does not vary greatly. As expected, the use rises under a modified diet.

It is notable that under both the present and a modified diet the use of nitrogen in scenario B is higher than in the other three (2.8 mill. tonnes N under the present diet compared with 2.1 mill. tonnes N in the remaining scenarios and 3.7 mill. tonnes N given a modified diet, compared with some 3 mill. tonnes N in the remaining scenarios). This is associated with the assumptions with respect to free trade and imports in the various scenarios as well as differences in the priority accorded to the environment.

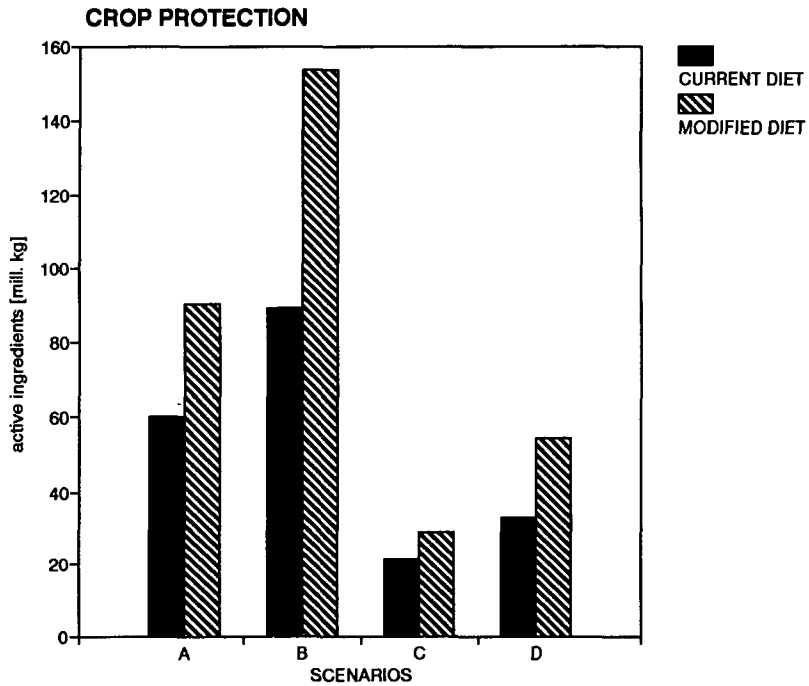
Figure 5.6 Differences in nitrogen use per hectare between the four scenarios



Source: WRR.

The total figure does not, however, tell us anything about the average use per hectare as this depends on the area of production. The differences between the scenarios in the use of nitrogen per hectare are shown in Figure 5.6. Not surprisingly, the lowest value occurs in scenario D, where a restriction was formulated for the use of nitrogen per hectare. Scenario B follows in close second place. The low value in this case is due primarily to the comparatively large area under cultivation in this scenario. A somewhat 'unnatural' outcome is encountered under scenario C, where the use of nitrogen per hectare is highest (ca. 80 kg N per ha under both the present and a modified diet). This high figure is caused by the very low area used in this scenario. Despite the restriction that only environment-oriented techniques are permissible, this results in a comparatively high figure.

Figure 5.7 **Differences in the input of crop protection agents between the four scenarios**

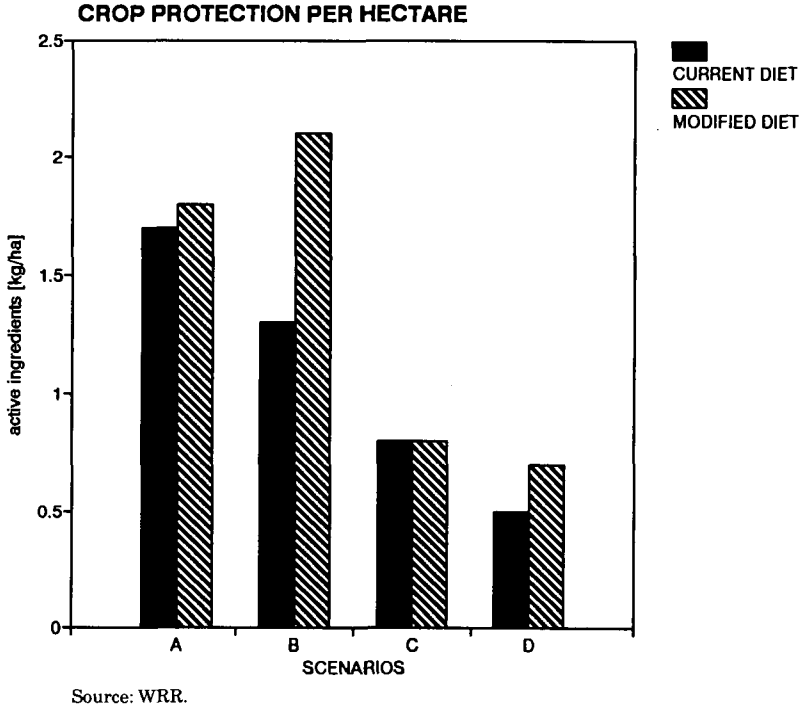


Source: WRR.

Crop protection

In the case of crop protection, too, a distinction needs to be drawn between the total use of crop protection agents and the use per hectare. The total use of crop protection agents in the four scenarios is shown in Figure 5.7. Here we find the lowest figures for scenario C (about 20 mill. kg a.i. (active ingredients) given the present diet and about 30 mill. kg a.i. given a modified diet), closely followed by scenario D (about 35 mill kg a.i. given the present diet and about 55 mill. kg a.i. given a modified diet). In scenario C this may be explained by the exclusive provision for environmentally-oriented production techniques; and in scenario D by the incorporation of a minimising restriction with respect to this aspect. The highest use of crop protection agents relates to scenario B_+, in which more than 150 million kg a.i. is used. Once again this may be explained in terms of the comparatively large area in this scenario.

Figure 5.8 **Differences in the input of crop protection agents per hectare between the four scenarios**



Source: WRR.

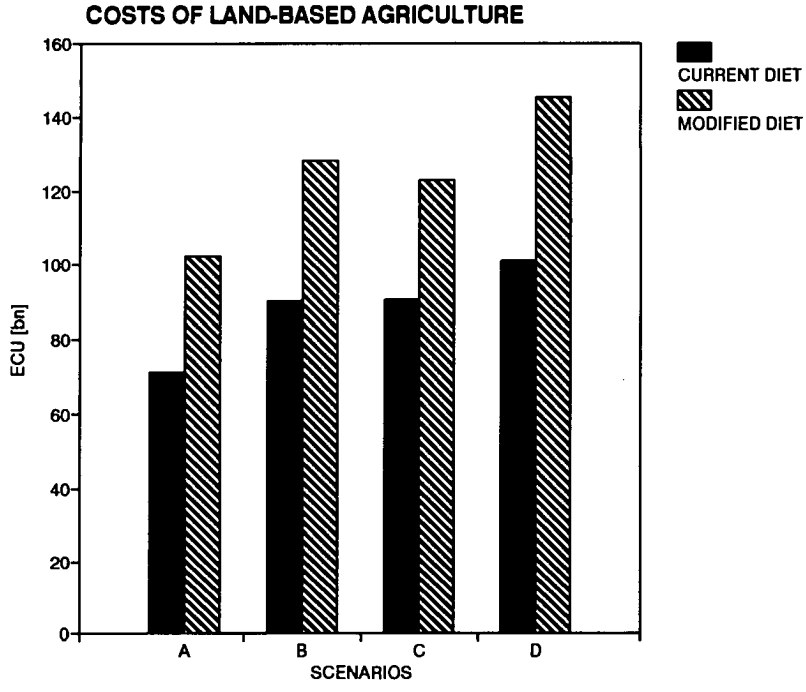
The figures per hectare vary less markedly. The differences between the scenarios are shown in Figure 5.8. In B_+ the approximately 150 million kg a.i. is distributed in such a way as to produce an average input of 2.1 kg a.i. per hectare, not much different from the value in scenario A. In the case of the present diet a reversal even occurs: in scenario A_0 the input of crop protection agents per hectare (1.7 kg a.i. per ha) is higher than in scenario B_0 (1.3 kg a.i. per ha). Scenarios C and D are much lower.

The input of crop protection agents per hectare is based on an analysis of the total area and not just on those land use forms where crop protection is applied. This provides a somewhat distorted picture since the use of crop protection agents is widespread in arable farming and for permanent crops but very limited in extensive grassland farming or cereal cultivation.

5.3.3.4 *Costs*

The differences in costs between the scenarios vary by as much as a factor of two. These differences are shown in Figure 5.9. Not surprisingly the lowest costs are found in scenario A. A second striking observation concerns the difference in costs between the diet variants. The difference in demand for agricultural products is directly reflected in a rise in costs. Thirdly a distinction needs to be drawn between scenarios A and C on the one hand and B and D on the other. Scenarios A and C work with free imports of agricultural products, meaning that the costs of domestically produced agricultural products are by definition lower than in scenarios B and D, which needs to be taken into account in interpreting the results.

Figure 5.9 **Differences in costs of land-based agriculture between the four scenarios**



Source: WRR.

A comparison of the diets indicates that upon a change in diet across the board the costs rise by roughly 30-40 per cent. A comparison between the scenarios is somewhat more complicated since various aspects change simultaneously.

The costs of environment-friendly agriculture may be deduced from a comparison between the costs in scenarios A and C. In the case of both the present and a modified diet the difference in costs between these scenarios amounts to roughly 20 billion ECU. In a certain sense this is the price that has to be paid for conducting agriculture in a way that complies to the fullest extent possible with the two environmental objectives in the GOAL model.

The difference in costs between scenarios B and D is more difficult to explain. This difference amounts to around 10 billion ECU given the present diet and some 15 billion ECU given a modified diet. As against a more balanced distribution of employment in relation to the *present* level of employment in scenario B there is a lower use of nitrogen (total of 0.7 mill. tonnes N; average of 8 kg N per ha) in scenario D. Here the choice is therefore between the maximum distribution of employment or a relatively low environmental impact at higher costs in relation to scenario A of some 20 to 40 billion ECU.

If instead of total costs we examine the costs subdivided over arable farming, livestock farming and irrigation, substantial shifts are evident (see Tables 5.2 and 5.3). The costs of irrigation, in particular, vary markedly. The restrictions in scenarios C and D mean that irrigation is used on a wide scale, resulting in a sharp increase in costs. Further analysis of the results clearly reveals that irrigation costs account for the major differences in inter-regional costs. The remaining costs of conducting agriculture are more or less the same in every region. Only when other restrictions are imposed on production do the comparatively more expensive forms of irrigated agriculture become active in the model. The restrictions imposed on the goal variables with respect to the

use of nitrogen and input of crop protection agents in scenarios C and D mean that irrigated agriculture is in fact practised in these scenarios.

5.3.4 Scenario outcomes for the Netherlands

In the present situation some two million hectares of cultivated land are in use in the Netherlands. This area becomes dramatically reduced in a number of the scenarios.

In scenario A, where cost-efficiency is a prime consideration, livestock farming takes place in the Netherlands; the conditions for the cultivation of roughage in the Netherlands are favourable. In variant A_0 half the present cultivated area is used for roughage cultivation and in variant A_+ the entire cultivated area. No arable farming takes place in the Netherlands in scenario A. Nor is forestry cost-effective on former agricultural land. Beef-farming with a low cattle density takes place on part of the roughage area in both variants A_0 and A_+.

Similarly agriculture is confined to livestock farming in the Netherlands in scenario B. In both variant B_0 and B_+ over half the present cultivated area is used for this purpose. In comparison with scenario A the land use for dairy farming in scenario B is lower and hence also the production from this activity. Dairy farming is a labour-intensive industry and is therefore of particular relevance for the objective in scenario B of maintaining as much employment as possible in land-based agriculture throughout the Community. The displacement of labour-intensive dairy farming from the Netherlands to other regions can contribute to this objective at European level.

Subject to environmental restrictions, the highest possible land productivity is pursued in scenario C in order to release as much land as possible for nature development. With the exception of potato-growing, higher yields can be obtained in regions outside the Netherlands for all the crops examined. Since potatoes are grown in rotation with other crops, such cultivation requires less land on balance in regions outside the Netherlands. In scenario C agricultural or forestry activities therefore take place in the Netherlands only in order to preserve a minimum level of employment. In variant C_0 a minimum area is allocated to this end for dairy farming, while the remaining employment is generated from forestry on former agricultural land. In variant C_+ forestry is the sole source of employment. Because forestry is not particularly labour-intensive, substantial areas are required in order to retain a minimum of employment.

In scenario D, in which environment objectives predominate, the use of nitrogen and input of crop protection agents is minimised. The scope for reducing the use of nitrogen, in particular, is more limited in the Netherlands than elsewhere, for which reason agricultural production is kept as low as possible in scenario D. As in scenario C, agricultural and forestry activities take place in order to maintain a minimum of employment in the present land-based agriculture. In variant D_0 this employment arises from both the land-use-oriented form of cereal cultivation (with a low input of fertilisers and pesticides) and from forestry on former agricultural lands. In variant D_+ employment derives completely from forestry.

Table 5.4 Calculated land use in the Netherlands in the scenarios (in mill. ha)

	A_0	A_+	B_0	B_+	C_0	C_+	D_0	D_+
dairy farming	0.6	1.6	0.7	1.1	-	-	-	-
beef-farming	0.5	0.4	1.1	0.3	-	-	-	-
cereal cultivation	-	-	-	-	-	-	0.3	-
forestry	-	-	-	-	0.9	1.1	0.3	1.1
total	1.1	2.0	1.8	1.4	0.9	1.1	0.6	1.1

Source: WRR.

It is evident that the pursuit of combinations of objectives at Community level cannot always be combined with large-scale agriculture in the Netherlands, or at least not land-based agriculture. Livestock farming takes place on a large scale in the Netherlands in scenarios A and B. In scenarios C and D agricultural and forestry activities take place only in order to maintain a minimum level of employment. In so far as these are less labour-intensive activities, the amount of land use can still be considerable.

5.4 Sensitivity analysis

From the scenarios it has emerged that the production can be distributed over the regions of the Community in various ways. This depends on the restrictions imposed on the goal variables, which in turn determine the optimal regional allocation of agriculture and forestry. The question next arises whether a small adjustment in the technical restrictions imposed on the agricultural system in the EC-12 brings about a major change in the regional allocation of land use. This has been examined in a sensitivity analysis [1].

Goal restrictions have been imposed on the scenarios on costs, the use of nitrogen and the input of crop protection agents. A reduction of less than 10 per cent in the cost level of at least one arable farming technique means that arable farming is distributed to each region, with the exception of those on the southern periphery of the Community. If this cost reduction is applied to the cultivation of roughage, the latter is then even produced in every region of the Community. The allocation in relation to the minimisation of costs therefore turns out to be highly sensitive.

The regional allocation is less sensitive to a minimisation in the use of nitrogen. The latter has to be reduced by 20 to 50 per cent in order to assign arable farming to regions not so far used for that purpose. A lower reduction is insufficient to reduce the total use of nitrogen. The use of nitrogen moreover turns out to be highly sensitive to the prevailing soil type in a region.

The regional allocation is by no means robust in relation to the use of crop protection agents. The latter use exhibits little if any regional variation for a given agricultural technique.

The analysis reveals that the model is particularly sensitive to shifts in costs. Small shifts in the technical coefficients can bring about major changes. Since the costs are to a significant extent determined by non-natural factors, on which government policy can exert some effect (e.g. the infrastructure), it is therefore possible to exert a marked effect on the regional allocation of agriculture.

[1] D. Scheele, *Formulation and characteristics of GOAL*; Working Documents no. W64; The Hague, WRR, 1992.

5.5 Conclusions

We have emphasised several times that the scenarios should not be regarded as forecasts. Instead, on the basis of agro-technical data, they set out the technical scope for and obstacles towards realising a number of political views concerning the way in which European agriculture should evolve. Obstacles of a political or institutional nature have not been incorporated into the model.

Policy preferences are reflected in the scenarios in the form of the restrictions imposed on the goal variables in line with the respective political philosophies. For this reason it can be determined on the basis of the outcomes whether and to what extent certain potential developments can be influenced by government policy, and whether and to what extent the goal variables are mutually compatible. The result is therefore to spell out the theoretical policy options.

Scenario A is based on allocating priority to the lowest costs of agricultural production without further restrictions, scenario B to the highest possible regional employment, scenario C to the greatest possible area for the natural environment and scenario D to strict environmental requirements. While the outcomes of these scenarios indicate striking potentials, such as less land use and lower agricultural employment, the differences between the scenarios are also significant.

The values of the goal variables vary considerably in relation to the restrictions imposed. The lowest and highest values for land use differ by a factor of 3.5; for costs, employment, nitrogen use (total and per ha) the figure is around 2; crop protection per hectare differs by a factor of 4 and crop protection in total terms by a factor of 7.

These differences between the highest and lowest values indicate that there is scope for policy – a scope that varies widely for the various goal variables, other things remaining equal.

This means that the political philosophies are sufficiently distinct and independent from one another to enable conclusions to be drawn with respect to the compatibility of policy goals. A trade-off of objectives may be analysed in relation to costs (as a goal variable that is ultimately minimised in all scenarios). The lowest costs are obtained in scenario A. If a lower limit is set for regional employment the costs rise by some 20 billion ECU. Part of these costs may be attributed to the higher demand (arising from self-sufficiency in B as against free imports in A) and part to the maintenance of regional employment.

Comparison of scenarios with a similar level of demand (A and C compared with B and D) results in even more conclusions: the difference in costs between A and C (20 bn ECU) may be interpreted as the price for environment-friendly agriculture. There are also other benefits, such as higher employment (300,000 MPUs) and a lower input of pesticides (down by 40 mill. kg a.i.). Other 'costs' are a smaller area in C (20 mill. ha).

The above comparisons have been made by examining the scenarios given the present diet; in the case of a modified diet the same conclusions apply, although at a higher average cost level.

The difference in costs between the regions is primarily attributable to the labour required for irrigation. There is sufficient water available for irrigated agriculture in virtually every region but in certain cases the costs are prohibitive.

The possibilities outlined by the model for satisfying the demand for agricultural products by means of further productivity improvements on a smaller land area can be achieved in various regional configurations. Although the differences are comparatively small at macro level (see the ranges of the goal variables), there are substantial differences in the regional distribution of activities.

The differences between the scenarios reveal that self-sufficiency results in a higher demand for internally produced agricultural products. In the case of a number of linked goal variables self-sufficiency is therefore to be preferred to free imports. It may also be seen that a modification of the diet in favour of a higher level of (animal) protein results in a considerable increase in primary agricultural production on account of the grain-meat conversion factor. Once again, therefore, goal variables that are associated with the scale of total production prove sensitive to changes in the assumptions.

From the analysis of forestry it may be concluded that traditional forestry does not provide a solution to the 'area problem' of agriculture. If new forests are planted in suitable locations, high yields can be obtained. A small area will, however, be sufficient in these circumstances to meet the total demand for timber and timber products within the EC, although it is possible that forestry for energy purposes could in certain circumstances make use of surplus agricultural land. There is sufficient land available for this activity, but its commercial viability is questionable. It also needs to be borne in mind that although this kind of forestry would take up a good deal of land, it would generate very little employment.

Spatial quantification of the model scenarios

6

6.1 Agriculture and other land use activities

The GOAL model is solely confined to an analysis of agriculture and forestry, and does not therefore take into account a number of other land use functions in the rural areas of Europe. A number of alternative activities are therefore dealt with in this chapter. Successively, the chapter deals with:

1. wishes with respect to non-agricultural forms of land use;
2. a representation of those wishes so as to permit a comparison to be drawn with the land use patterns in the scenarios;
3. possible incompatibility of these wishes with the scenarios;
4. the question as to which regions would remain largely unused if both the requirements of the scenarios and supplementary wishes were satisfied.

Wishes with respect to non-agricultural forms of land use include such matters as land for construction purposes, the development of industrial sites, roads and other infrastructural projects, irrigation canals, the expansion of glass-house horticulture and large-scale recreational facilities. In addition the fact that some rural areas are still in a natural or semi-natural state creates a demand for land for nature conservation areas. Furthermore, historical forms of land use may have generated characteristic landscapes (such as the construction of terraces for olive-groves or vineyards), to which value is attached. More land may then be required for the expansion of crops and small-scale recreational facilities while maintaining the original character of the region in question.

In order to obtain a clear impression of the land use consequences of the scenarios, a more detailed analysis is provided below of those wishes that may be expected to generate a substantial demand for land in the future. Urban development does not feature as part of this yardstick. Currently, the urbanised area in the EC-12 covers some 10 per cent of the total land area [1]. Historical figures indicate, however, that the urban area is growing by just 0.1 per cent a year. In the case of the Netherlands the urban area grew by 0.135 per cent a year between 1979 and 1985 [2]. For West Germany the 'Raumordnungsbericht' indicates a figure of 0.15 per cent a year, while suggesting that the increase will gradually taper off [3].

Recreation can in due course take up a significant area of additional land. Under present EC policy, recreation is put forward as a possible alternative to the decline in agriculture in a number of regions. For the purposes of this report, research has been conducted into trends in tourism and recreation in the European Community [4], in which respect the future tourist potential of the

[1] H.D. Clout, *A rural policy for the EEC*; London, Methuen EEC Series, 1984, p. 3. Clout provides a figure of 7.8 per cent for the urbanised land area in the EC-10. His material dates from 1981.

[2] J. Luyt, *De dynamiek van het grondgebruik. Een literatuurstudie* (The dynamics of land use. A survey of literature – in Dutch); Research report no. 43, The Hague, Institute of Agricultural Economics, 1988, p. 23.

[3] Bundesminister für Raumordnung, Bauwesen und Städtebau, *Raumordnungsbericht 1986*; Bonner Schriftenreihe Raumordnung, Drucksache 10/6027, Bonn – Bad Godesberg, 1986.

[4] Nederland Research Institute for Recreation and Tourism, *Trends in Tourism and Recreation in the European Community. Outline Report*; Working Documents no. W60, The Hague, WRR, 1991.

regions has been outlined on the basis of such indicators as landscape quality [5], climate and cultural and historical features [6]. The only way in which it proved possible to quantify this was in terms of the number of registered overnight stays. The relationship this has with land use, however, is unclear. The study concluded that Portugal and Greece had the greatest potential for attracting more tourists, but it did not prove possible to assign that potential interest to particular areas. In addition, it is evident that the area required for recreational purposes will not be particularly extensive. No major conflict with other forms of land appears necessary.

Of the activities with a land use requirement mentioned at the start of this section, this therefore leaves nature conservation and development. Considerable emphasis is already given to these aspects in the present rural policy of the EC. The land use claims for nature protection form an express part of many plans for adapting the agricultural structure. In line with the EC's Habitat Directive, protected wildlife areas in the EC are expected to grow from the present level of around 3 per cent to roughly 10 per cent in 10 years time. An expansion of protected wildlife areas of this order will certainly have consequences for the agricultural area.

An attempt has been made in the following sections to spell out the wishes with respect to nature conservation in such a way as to permit a comparison to be made with the patterns of land use resulting from the scenarios. The working method whereby nature conservation wishes have been incorporated in the scenarios is discussed in section 6.3.

In order to identify potential land use conflicts in the longer term between agriculture and nature conservation, those areas which it is desired to set aside for nature conservation, and the location of those areas, have first been analysed. The formulation of this 'package of wishes' must of course be based on the underlying principle that the areas set aside for nature conservation do in fact lead to the (sustained) conservation of areas worth protecting.

In addition the analysis examines the extent to which alternative forms of land use such as nature conservation can compensate for the withdrawal of agricultural lands from production. This is done by comparing the maximum areas potentially qualifying for nature conservation with the required agricultural area in the GOAL model scenarios. The result shows the regions in which large tracts of land remain unused.

In this respect the approach towards rural development problems is critically important. Should all the activities that are lost be compensated for to preserve the social structure of the region or is one prepared to accept that certain regions will become 'redundant' in social terms? The answer to this question plays an important part in interpreting the results and is discussed in more detail in section 6.4.3.

6.2 Nature conservation and land use

Nature conservation and development have traditionally been a matter for national regulation within the EC. Each country has its own laws and regulations and its own definitions of nature reserves, regional parks and national parks. International agreements based on the notion that the nature of ecological

[5] laborated in the form of a description of coastal areas and the value of the hinterland, mountain areas with their potential for winter sports and active recreation, inland waterways with water sports potential, and diversity in rural areas.

[6] Namely towns with cultural and historical features and high-quality services, widely distributed features in the rural areas and mass-tourism attractions.

relationships and the associated threats cross national frontiers and that nature conservation should therefore be the subject of international cooperation is of recent origin [7]. In recent years the EC member states have entered into commitments with respect to habitats for fauna and flora. These commitments are covered by the conventions of Ramsar, Bern and Bonn, as well as a number of European Commission Directives, of which the Habitat Directive is the most recent. In December 1991 the European environmental ministers entered into a highly concrete commitment by setting up a new environmental fund, LIFE. The LIFE funds (400 mill. ECU) are designed to channel funds from the northern to the southern EC countries, where they can be used to preserve valuable areas [8].

Whereas nature conservation had for many decades been a matter of private initiative, in the 1970s it became the object of government responsibility in virtually all EC countries. Since then the methods and aims of protection have become more diversified. Protection no longer just means conservation (i.e. the separation of functions); management is also tackled in various ways, with efforts to combine agriculture, forestry, recreation, nature and the landscape (i.e. the interweaving of functions).
The background to this is that traditional methods of protection have not always proved effective. In many cases separate nature reserves will be too small or lack interconnection. The fauna and flora in the reserves can consequently become impoverished, a process sometimes known as the 'island effect'. Many plant and animal species need to be distributed over a wide area for long-term survival. If animal species are to survive and adapt to changing circumstances, a genetic exchange will be required with neighbouring populations of the same species. All ecosystems are characterised by a dynamic equilibrium. If the reserves are too small any disruptions to that balance will be incapable of being absorbed and intensive control measures will be required in order to preserve certain species.

In recent years therefore policy has become more actively interventionist. The aim has been to safeguard nuclear areas and to supplement these with new conservation areas, thus creating a network of protected areas consisting of nuclear areas and corridors. By means of a system of nuclear areas (including areas that are now already protected) and by expanding nature reserves and/or developing new ones in various places, it becomes possible to maintain a wide diversity of fauna and flora with a minimal use of land.

The development of new nature reserves and corridors does however take time and the results are uncertain. It will not always be sufficient to designate an area as a nature reserve and to carry out certain preparatory activities. The result of all these efforts will also depend on environmental factors over which there is no control. The Stork Plan, which is intended to turn the river forelands of the Rhine in Gelderland and Utrecht into a protected habitat, provides an example. Although the plan is designed to provide uninterrupted stretches of water and land to which all kinds of waterfowl will be attracted, the quality of the water in the Rhine will have a decisive bearing on the ultimate biological community [9]. This is a factor that cannot be controlled in a nature development

[7] M. Creemer, *Natuurbeheer in Europa. Een inventarisatie van doelstellingen, methoden en kosten van inrichting en beheer in beschermde gebieden in de landen van de EG* (Nature conservation in Europe. An inventory of aims, methods and costs of arrangement and management of protected areas in the memberstates of the European Community – in Dutch); report on a period of practical training, The Hague, 1990.

[8] 'Akkoord over Europees milieu- en natuurfonds LIFE' (Agreement on European environment- and naturefunds LIFE – in Dutch), in: *ROM Ruimtelijke ordening en milieubeheer*, Jan-Feb 1992, Vol. 10, no. 1-2, p. 47.

[9] *Ooievaar, de toekomst van het rivierengebied ('Stork', the future of the riverbasin – in Dutch)*, by D. de Bruin, D. Hamhuis, L. van Nieuwenhuijze et al.; Arnhem, Gelderse Milieufederatie, 1987.

project of this kind. Furthermore, the protected area will be operating subject to certain constraints in the form of inner-dyke safety and unrestricted navigation on the Rhine. The acquisition and development of land for nature conservation purposes also tends to be costly. The various aspects of a nature conservation project therefore need to be tackled as efficiently as possible.

As far as the EC is concerned, it is fair to say that the natural environment has suffered most from human intervention in the densely populated regions in the north of the Community. On the other hand, nature conservation is often well regulated in these areas. While the natural environment is actively managed in the protected areas, the situation differs elsewhere. The high degree of mechanisation and large scale of agricultural activities represent a severe threat to individual plant and animal species in the cultivated area. Large-scale efficient arable farming provides virtually no room for wildflowers, hedges and the associated fauna. Mechanised grassland management is at variance with the maintenance of meadow bird populations. Greater nature conservation in the northern regions must therefore largely take the form of expanding the protected areas and the adaptation of farming practices so as to provide room for ecological features.

In the relatively sparsely populated southern regions of the Community and in Ireland nature conservation often exists on paper only. On the other hand, precisely on account of the comparatively low population density in these regions, there are still comparatively large areas of natural environment. As a first step, the efficiency of nature protection in these regions can be increased by improved legislation and regulations and practical arrangements in the form of nature management plans. There is a particular need for greater knowledge concerning the scope for restoring ecological features within nature conservation areas, on the basis of which operational and effective management plans can be drawn up. But here too the natural environment needs to be enlarged in order to ensure its preservation in the longer term. Although the more labour-intensive and small-scale forms of agriculture do in principle afford greater scope for ecological features within the agricultural area, the trend towards the type of farming systems encountered in the northern regions constitutes a threat to the accompanying natural environment [10].

6.3 Network of protected areas in the EC

For the purposes of this report an analysis has been made of the form that the network of protected areas might take at the level of the EC-12 as the 'backbone' of nature [11]. This is no more than a tentative outline that is designed to indicate the existing possibilities and certainly does not amount to a land plan.

This has been done in two steps. On the basis of the principles outlined above, a number of categories of areas of ecological value have first been distinguished. A classification has then been made into nuclear areas, expansion areas and development areas, thus building up a network of protected areas.

6.3.1 Component elements

The following categories of areas have been identified as the component elements in a network of protected areas:

[10] OECD, *Agricultural and environmental policies, opportunities for integration*; Paris, 1989.

[11] N.T. Bischoff and R.H.G. Jongman, *Development of rural areas in Europe, the claim for nature*; WRR, forthcoming.

already protected areas

- Already protected areas include nature reserves, conservation areas and national parks as recognised by the International Union for the Conservation of Nature (IUCN) and notified to CORINE (the EC project in which the condition of natural areas is recorded in digitalised form).

  Agriculture and forestry are only permitted within these protected areas as a form of landscape management, e.g. traditional land use such as the extensive management of grasslands. Recreation is permitted if it does not cut across the primary objective of nature conservation. This means that the public will have only limited access.

- Areas protected from the viewpoint of natural beauty. This concerns the preservation of characteristic features of the landscape. A good example consists of the Areas of Outstanding Natural Beauty in the UK. Nature reserves often form part of these areas. In general the public has access to such areas and there are rules for land use, building regulations (such as the use of local materials) and environmental restrictions.

- Internationally protected areas. In general these are natural areas that have been designated in bilateral and multilateral agreements on account of the international importance of the ecological value of those areas and because that heritage can only be preserved through international cooperation.

  Examples of such areas include wetlands (generally coastal zones) providing sanctuary, breeding areas and foraging zones for birds. Because this report relates to *land use* in the EC, wetlands in coastal areas have been left out of account.

nature extension areas

These must satisfy a number of criteria, namely:
- the diversity within a biogeographic region must be maximised by the development of the expansion area;
- account must be taken of the scarcity value [12];
- the designated areas must be on a sufficient scale to permit a stable situation, i.e. to bring about or maintain the maximum feasible ecological features;
- the location must be such that corridors are created when existing areas are expanded.

nature development areas

These are areas that do not at present enjoy protection and where the existing ecological features have not been clearly identified, but which, given the quality of the soil and climatic conditions could support significant natural vegetation in the future.

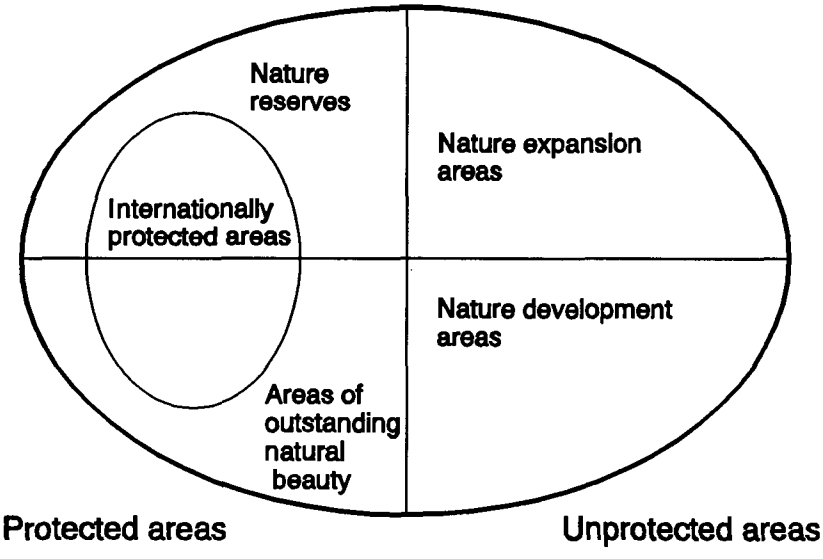
On the basis of this approach the areas that would desirably be set aside for nature conservation have been identified and shown on a map.

[12] The scarcity value of a component element relates both to the scarcity of the unique abiotic conditions (*e.g. serpentine rock formations*) and scarcity resulting from the fact that the majority has been destroyed (e.g riverside forests). Scarcity value is assessed both within the biogeographical regions themselves and for the EC as a whole.

6.3.2 Specification

In terms of the various component elements specified in 6.3.1, a network of protected areas in the EC-12 has been converted into operational terms for the purposes of this report. Figure 6.1 indicates how the various elements fit in with one another. Existing areas may be singled out, which can serve as nuclear areas. In addition existing areas can be expanded and new areas formed. Together these will make up the TEMS ('Tentative Ecological Main Structure'), which sets out to standardise the wishes and objectify them as far as possible (see Fig. 6.2). For a more detailed description of the method adopted see the study by Bischoff and Jongman [13].

Figure 6.1 Component elements of a network of protected areas



Source: Agricultural University Wageningen, Physical Planning Department.

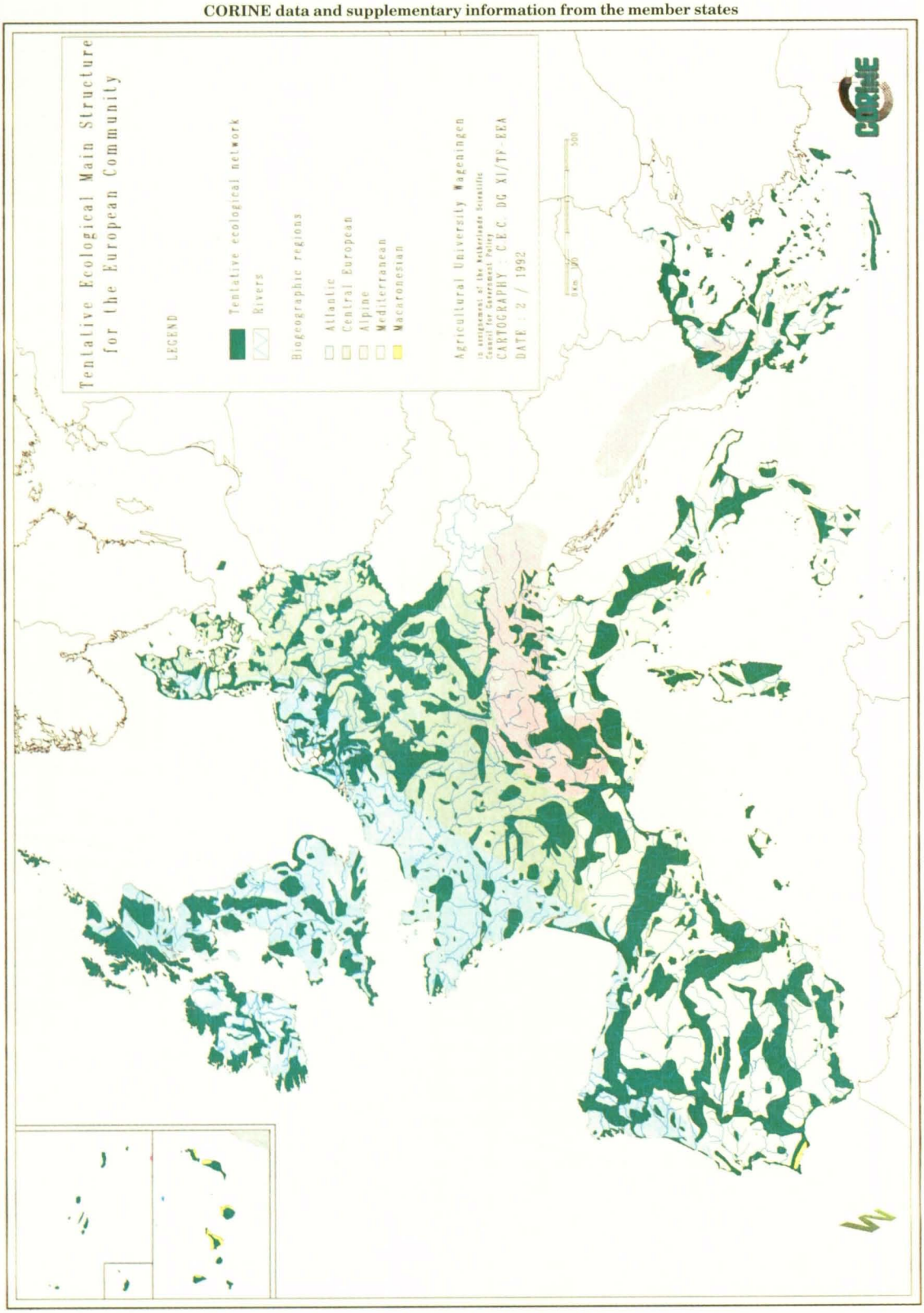
TEMS has been constructed on the basis of data gathered as part of the CORINE project [14], One of the problems of this material is the disparate nature of the data, arising from the different definitions used in the various countries in relation to nature and nature conservation.

A second problem is the fact that the delimitation of the field in the CORINE data is not known. In the case of each 'site' included in this database only the coordinates of a single point and the surface area of the region are given. With the aid of existing cartographical material, such as the map of natural vegetation in Europe and the European soil map, an effort has been made to localise these areas as best as possible. A third problem is formed by gaps in the basic material. CORINE contains virtually no data on Germany and the UK, for example. This means that a different working method has to be adopted in each country in a number of cases.
The knowledge gathered this way has been assessed in a consultation round against the knowledge of experts in various EC member states. The working method that has been adopted means that although the map has been put together with care, improvement would certainly be possible if better

[13] N.T. Bischoff and R.H.G. Jongman, op. cit.

[14] Commission of the European Communities, *CORINE Biotopes Manual, Methodology. A method to identify and describe consistently sites of major importance for nature conservation*; Luxembourg, Office for Official Publications of the European Communities, 1991.

Figure 6.2 **Tentative Ecological Main Structure (TEMS) in the EC on the basis of CORINE data and supplementary information from the member states**



Source: Wageningen Agricultural University, Physical Planning Department.

databases become available in the future. In the meantime the results obtained with this study have already been used in drawing up EECONET, a possible policy blueprint of the European ecological network [15].

The location of the TEMS is evident from the map shown in Figure 6.2, but the distribution of the ecological areas over the various member states is less evident. For this reason the share of the total area taken up by TEMS is shown for each member state in Table 6.1, together with the proportion of the total area currently consisting of conservation areas or areas of protected landscape. The proportion of these areas enjoying internationally protected status is also shown.

Table 6.1 **Share of total land area required per country for TEMS and share of total land area of present nature reserves and areas of outstanding natural beauty (in % of the total area)**

		Present protected area		
	TEMS	Nature	Landscape	Internat.
West-Germany	38	1.4	25.8	0.1
France	28	1.2	2.8	0
Italy	34	1.8	5.5	1.2
Netherlands	44	5.9	7.5	1.9
Belgium	45	1.3	10.4	10.8
Luxembourg	62	14.6	13.8	0
United Kingdom	43	3.5	18.3	1.2
Ireland	43	0.4	0.3	1.7
Denmark	31	4.5	10.2	12.9
Greece	45	0.7	0.3	0.9
Spain	36	0.2	3.7	1.3
Portugal	32	2.0	3.3	1.2
Average EC-12	36	1.4	7.6	1.2

Source: Wageningen Agricultural University, Physical Planning Department.

On average the TEMS takes up 36 per cent of the total area of the EC. This is markedly different from the current situation; most countries protect somewhere between virtually 0 and 6 per cent of their land area as *nature conservation areas*. Only in Luxembourg is the figure higher, at nearly 15 per cent. In addition most countries have higher percentages of *protected landscape*, the front-runners being the UK and Germany with 18 per cent and 26 per cent respectively. Most other countries lag considerably behind. Of these protected areas no more than a small part is *internationally protected*. Only in Belgium and Denmark do such areas form more than 10 per cent of the total area.

In order to move from the present situation to what is envisaged in TEMS, a substantial area would need to be added in the form of nature expansion and development areas. The land-area share of the nature expansion areas ranges between 10 and 50 per cent per region. If to this is added the nature development areas this results in the aforementioned spatial requirement of an average 36 per cent for the EC as a whole.

6.4 Comparison of TEMS with the four scenarios

What room do the scenarios leave for the realisation of TEMS? This may be examined in terms of conflicts with TEMS or other striking developments.

[15] *Towards a European Ecological Network EECONET*, ed. by G. Bennett; Arnhem, Institute for European Environmental Policy, 1991.

Conflicts can first emerge when it is established whether nature reserves and agricultural cultivation are competing for the same land. The amount of land required for agriculture and forestry as established in Chapter 4 is ranged against the spatial demands of nature, thus revealing incompatibilities.

The following calculations are based on the assumption that the present forest cover and the area taken up by rough grazings could be effectively combined with TEMS. On the other hand, the network of protected areas cannot in principle be combined with arable farming and forestry as formulated in GOAL, i.e. with a strict production objective.

Spatial conflicts do not just arise if the land area assigned to arable farming plus that assigned to commercial forestry and that to nature exceed the total area of the region. Even where the sum total lags well behind the total available area there are reasons for a more detailed analysis.

The approach adopted has two limitations. In the first place it is confined to a numerical conflict: is the acreage of the region in question sufficient to cope with the various competing demands for land use? The approach does not take into account the possibility of rival claims to the same areas for nature conservation and agricultural production. Allowance needs therefore to be made in the results for a possible underestimation of the problems. The actual shortage in a region can be higher than we have established.

Secondly, the fact that the land area required for urban use (i.e. the built environment and infrastructure, etc.) has been left out of account can also mean that the potential deficit is underestimated in a particular region.

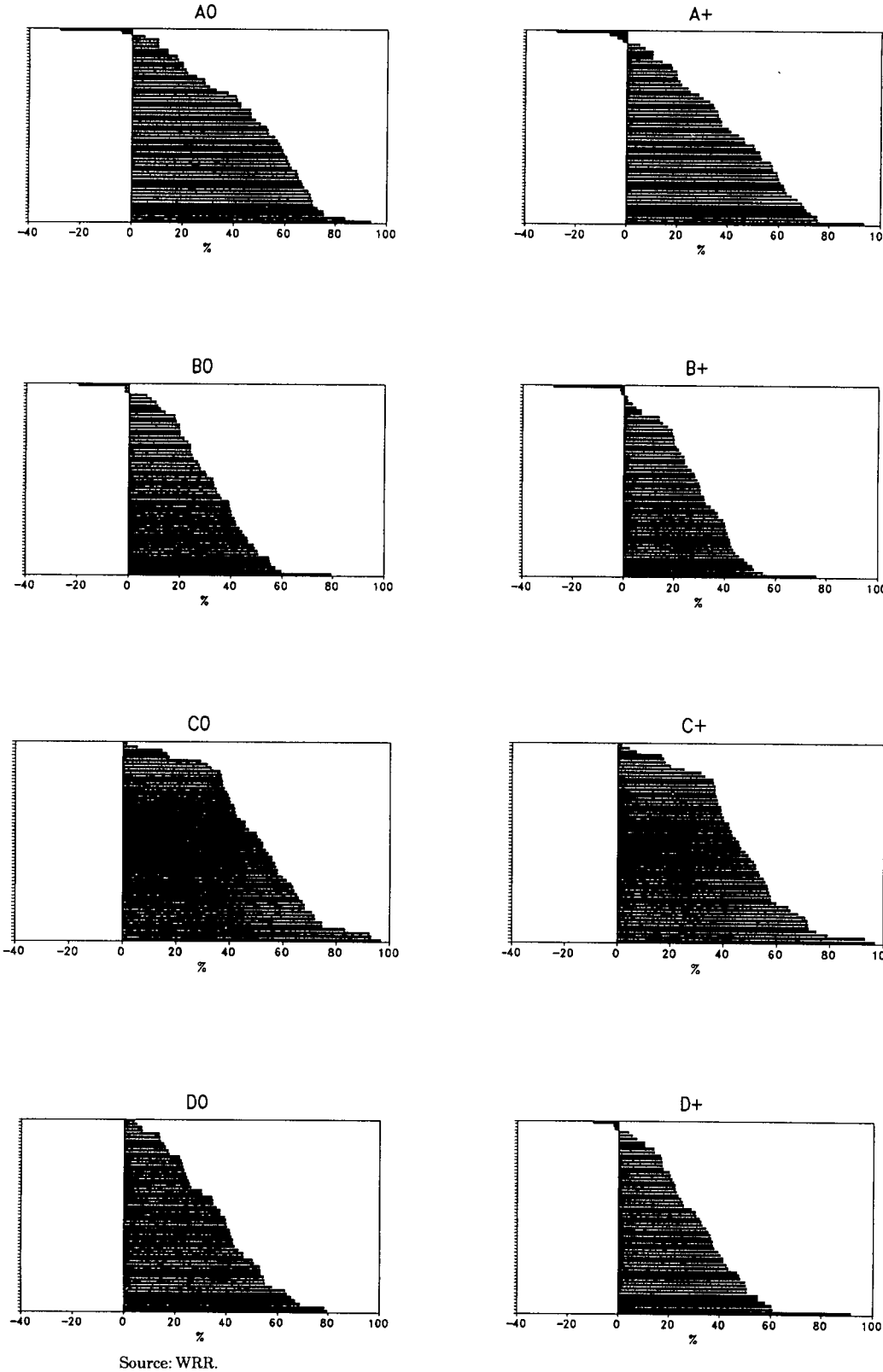
6.4.1 Resulting land use allocation

On the basis of the four political philosophies (A, B, C, D,) and the two dietary patterns (present = 0 and modified = +) discussed in Chapter 4, it has been established whether there is sufficient land available in the various NUTS-1 regions for the agricultural area calculated in the scenario combined with the desired area of nature provided for under TEMS. In many regions there proved to be far more land available than that required for satisfying the claims for both kinds of land use.

The dramatic reduction in the cultivated area in the scenarios ensures that the land use claims for nature reserves can be readily met in most regions. In most cases, a substantial area even remains 'left over'. The scale and distribution of this surplus varies from scenario to scenario, as shown in Figure 6.3.

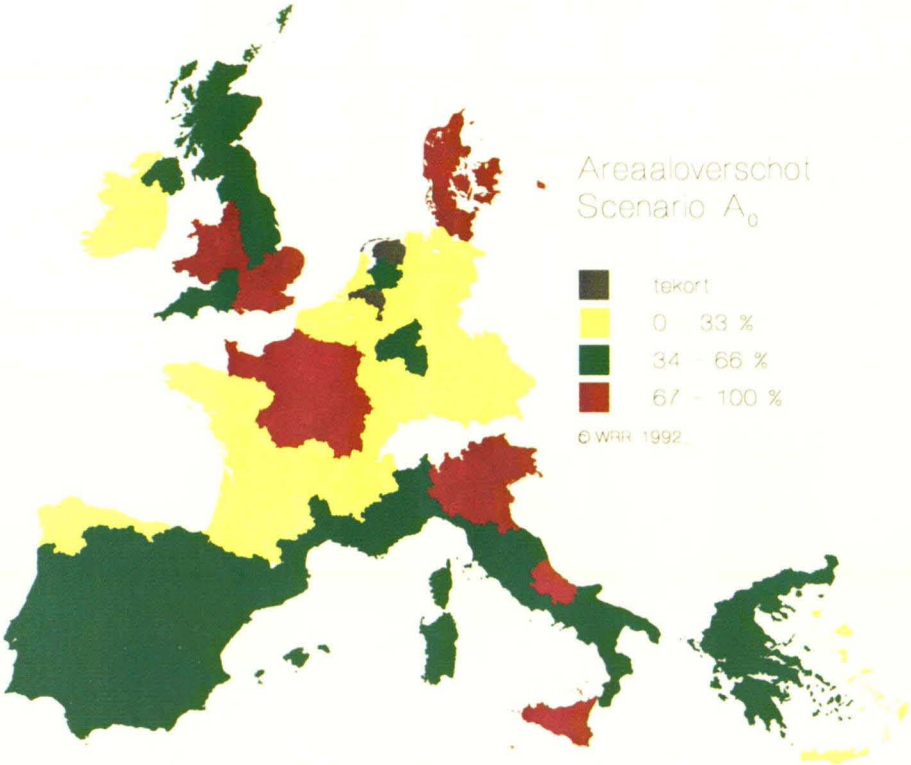
The sequence of the regions in Figure 6.3 varies considerably from scenario to scenario. The eight figures indicate that in all scenarios the deficits are insignificant compared with the surpluses. Scenario A_+ exhibits the greatest spread between the regions, namely a deficit of 28 per cent in the Zuid-Nederland region on the one hand and a surplus of 94 per cent in the British North West region at the other extreme. In three of the eight scenarios (B_0, B_+, and C_0) there are no regions with deficits. Although the diagram enables a comparison to be made between the deficits and surpluses in the various scenarios, it does not indicate how this would work out in terms of geographical distribution. Figures 6.4 to 6.7 therefore indicate how the deficits and the surpluses are distributed over the regions in each scenario. For ease of reference four categories have been employed, namely regions with a deficit and regions with a surplus of up to 33, 66 and 100 per cent.

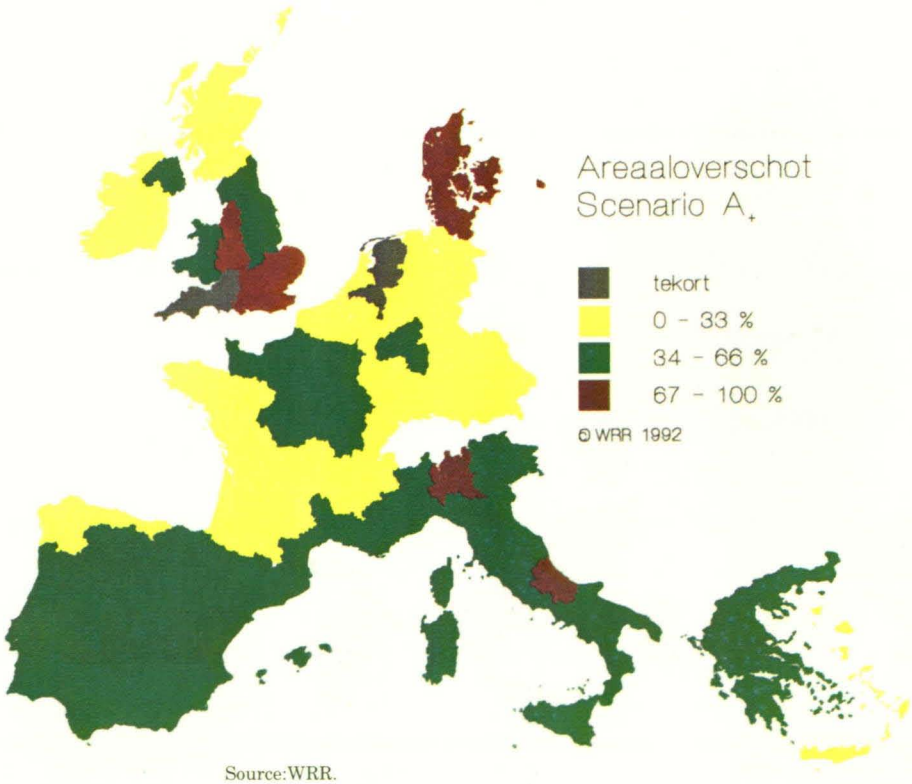
Figure 6.3 **Percentage of surplus or deficit land area in all regions upon realisation of the Tentative Ecological Main Structure.**



Source: WRR.

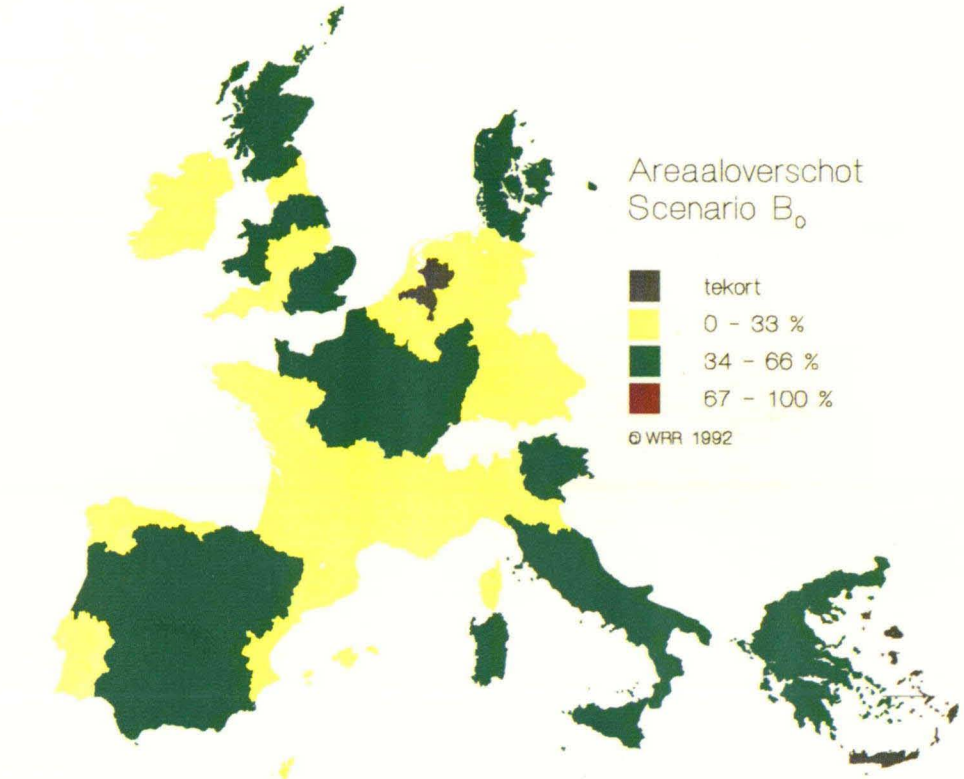
Figure 6.4 **Distribution of the surplus land area ('areaaloverschot') over the various NUTS-1 regions in scenario A_0 (current diet) and scenario A_+ (modified diet) ('tekort' means deficit)**

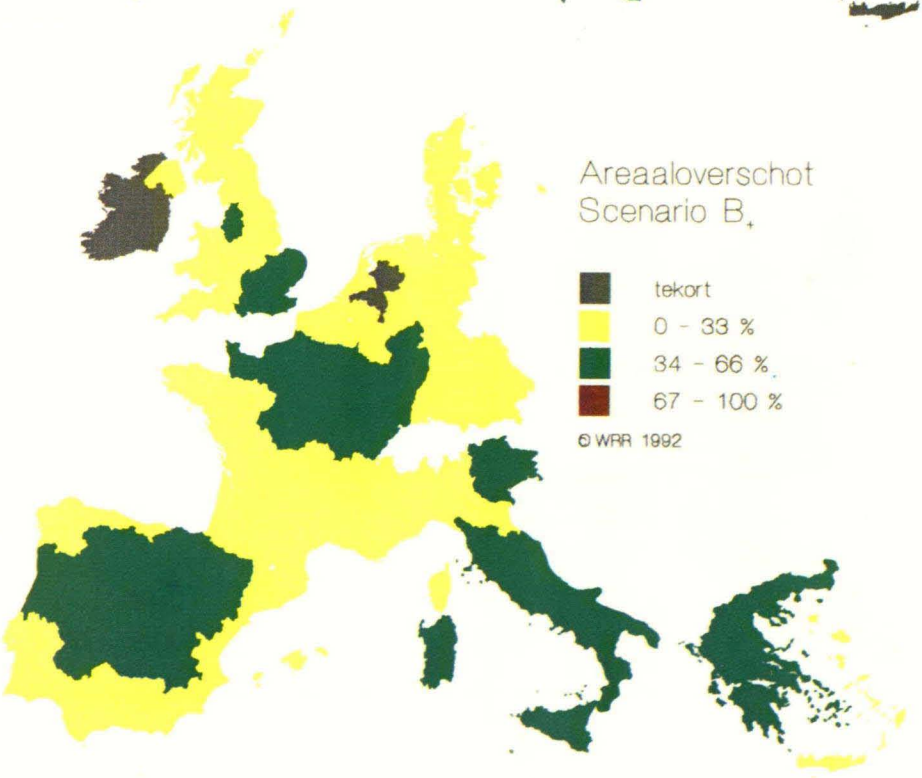




Source: WRR.

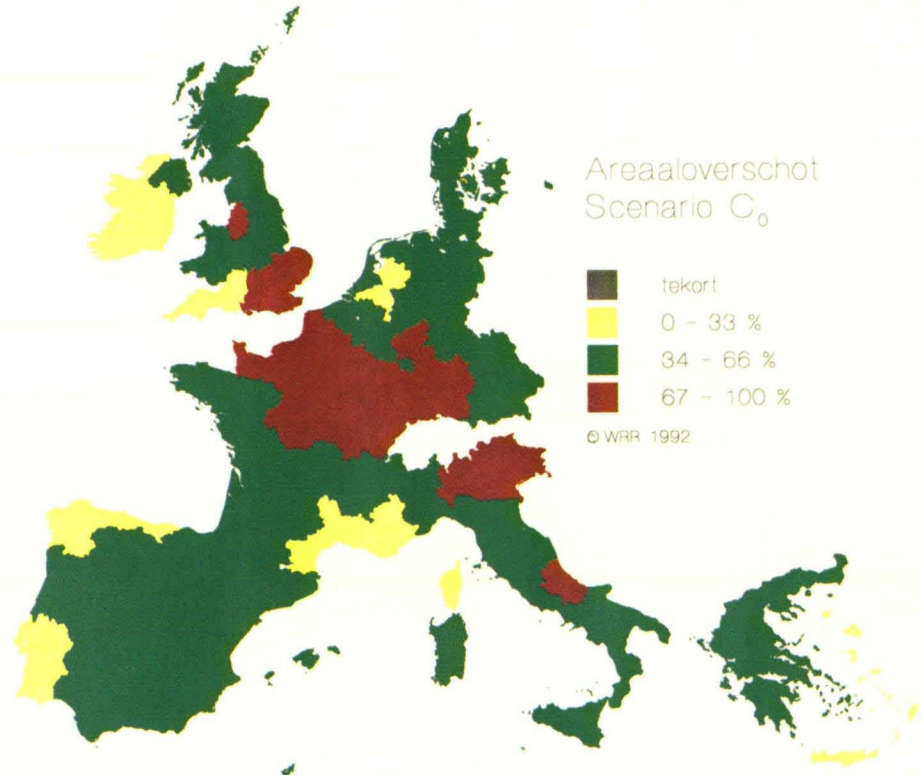
Figure 6.5 **Distribution of the surplus land area ('areaaloverschot') over the various NUTS-1 regions in scenario B_0 (current diet) and scenario B_+ (modified diet) ('tekort' means deficit)**

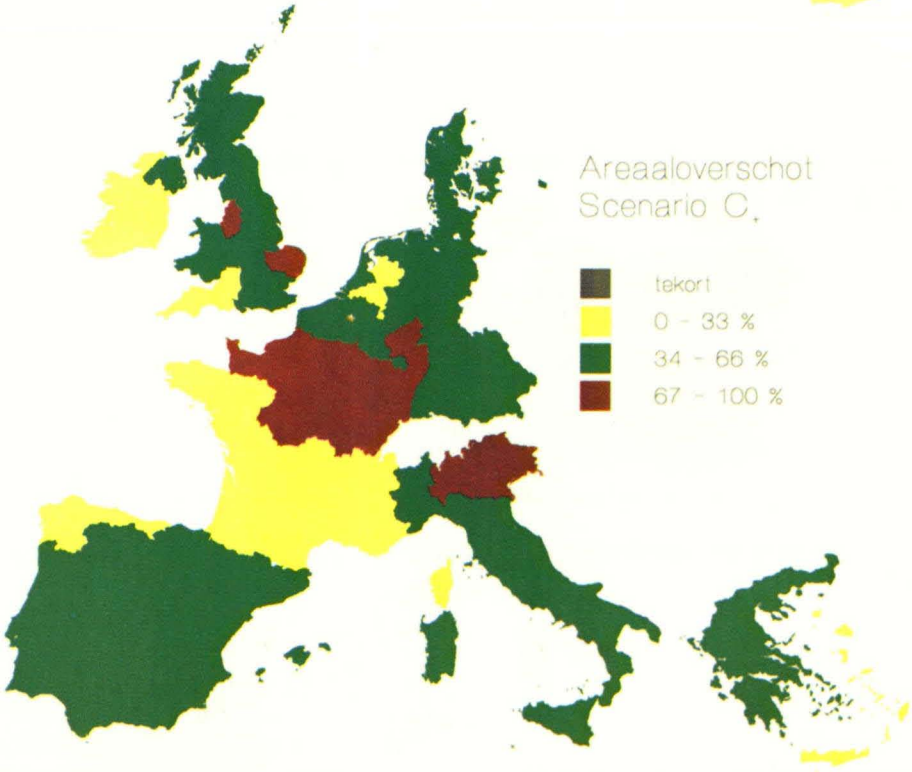




Source: WRR.

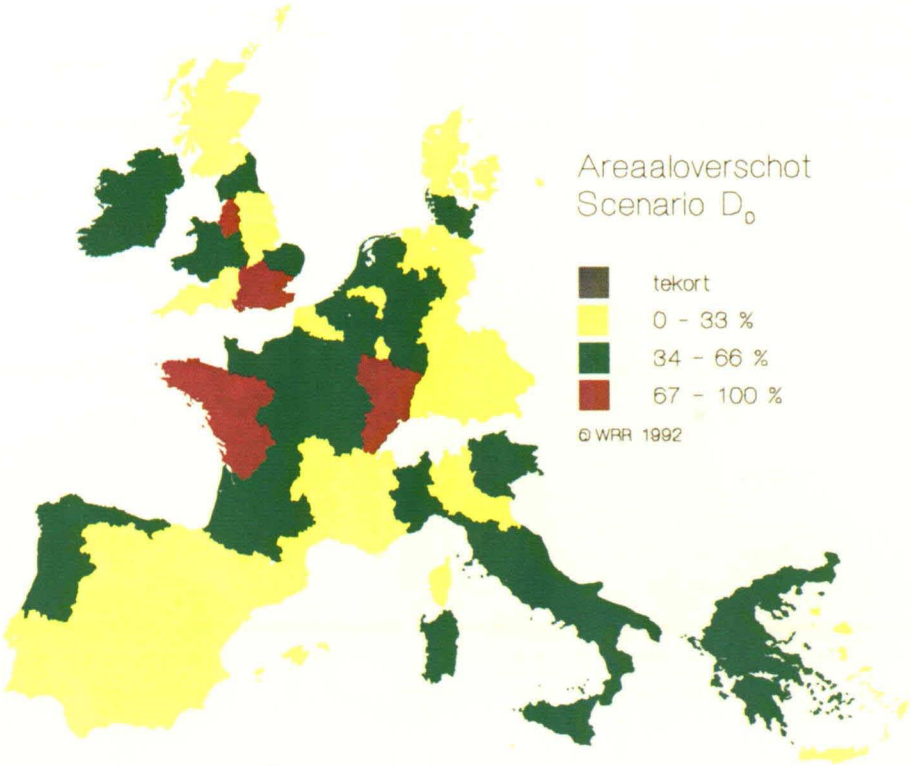
Figure 6.6 **Distribution of the surplus land area ('areaaloverschot') over the various NUTS-1 regions in scenario C_0 (current diet) and scenario C_+ (modified diet) ('tekort' means deficit)**

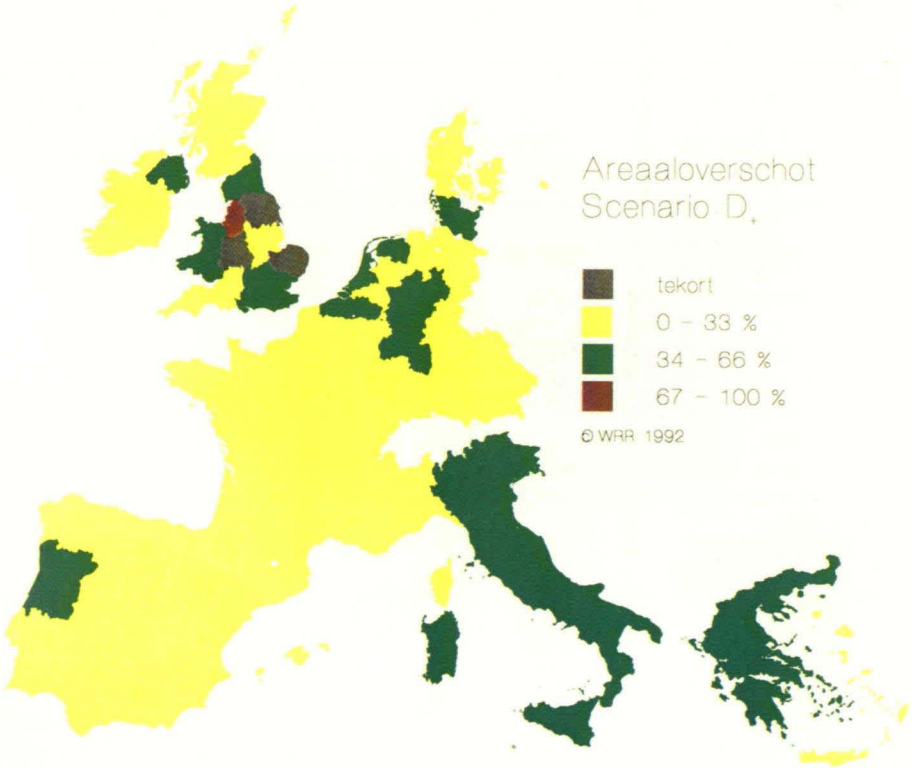




Source: WRR.

Figure 6.7 **Distribution of the surplus land area ('areaaloverschot') over the various NUTS-1 regions in scenario D_0 (current diet) and scenario D_+ (modified diet) ('tekort' means deficit)**





Source: WRR

Only the Netherlands, England, Ireland and the Greek Islands have deficits in any of the scenarios. The regions in the Netherlands – especially Zuid, followed by Oost and Noord – suffer from a deficit in most of the scenarios (resp. 4, 3 and 3 times). This means that deficits could possibly arise in these regions if TEMS were to be introduced on an integral basis.

The largest surpluses generally occur in the central area of the EC. The south-west UK regions appear in the highest category in four scenarios and in the middle category in a further two. A number of North Italian regions appear in three of the eight scenarios in the category with the largest surpluses and in the middle category in the other five scenarios. In a somewhat less extreme way the same applies to France, Germany and Denmark, which are all in the highest category in three scenarios and respectively 4, 3 and 2 times in the middle category.

In contrast to what one might expect, the Mediterranean countries are generally in the middle surplus category and occasionally even in that with the smallest surpluses. This would appear due to the potential for agriculture linked with the large areas required for TEMS.

6.4.2 Regions with a land deficit under the allocation of land use

An examination of the regions in which there is insufficient land available for meeting the requirements for nature shows that the picture varies from scenario to scenario. Deficits do not always occur in the same regions, although a certain amount of overlap is unmistakable.

As previously noted, however, it is not really sufficient just to establish a numerical deficit in hectares. From the underlying structure of the TEMS it is possible to establish the specific requirements imposed by an area in terms of nature and nature development. In a number of cases the desired nature conservation will not be compatible with other forms of land use. This applies for example to the maintenance of primeval forest and other primary nature. On the other hand other ecological features *can* be simultaneously combined with land use for other purposes. In the case of certain forms of fauna and flora – for example the vegetation that naturally accompanies certain forms of agriculture – some form of agricultural use is even essential. A more detailed analysis of the regions with a shortage of land can throw further light on this matter.

The varying deficits in certain regions in the various scenarios are shown in Table 6.2.

As noted earlier, it has been assumed in calculating these shortages that the present area of forest and rough grazings forms part of the TEMS. The number of 'deficit regions' consequently remains limited. The scale of the deficit per region is also reasonably limited. The regions that emerge worst are Zuid-Nederland, Yorkshire-Humberside and South-West, with deficits of 13, 10 and 7 per cent respectively.

Closer analysis, however, puts these deficits in a somewhat different light. In a number of regions agriculture consists to some extent of extensive grasslands. In contrast to rough grazings – i.e. highly extensive grasslands with no other agricultural use apart from livestock grazing – extensive pasture is managed, although on a more extensive basis than other production and environment-oriented techniques. A comparatively large amount of land is therefore used for comparatively limited production. Depending on the ecological resources that a network of protected areas is designed to protect, the inclusion of extensive pasture in TEMS is more or less admissible.

Table 6.2 Deficits of land in the various scenarios per NUTS-1 region

SCENARIO	REGION	AGRICULTURE (x1000 ha)	(%)	TEMS (x1000 ha)	(%)	CURRENT FOREST	(%)	SHORTAGE (x1000 ha)	(%)
A_0	ZUID-NL	493	70	406	58	0.034	5	−200	−28.0
·	NOORD-NL	575	67	316	37	0.037	4	−30	−3.5
A_+	ZUID-NL	493	55	406	58	0.034	5	−200	−28.0
·	SOUTH-WEST	293	54	1271	53	0.171	7	−170	−7.1
·	NOORD-NL	575	67	316	37	0.037	4	−30	−3.5
·	OOST-NL	562	56	461	46	0.132	13	−20	−2.0
B_0	ZUID-NL	493	55	406	58	0.034	5	−140	−20.0
·	OOST-NL	562	56	461	46	0.132	13	−20	−2.0
·	NISIA	297	58	1340	83	0.649	40	−30	−1.9
B_+	ZUID-NL	493	70	406	58	0.034	5	−20	−28.4
·	OOST-NL	562	56	461	46	0.132	13	−20	−2.0
·	IRELND	4044	58	3002	43	0.327	5	−80	−1.1
D_+	YORKSH-HUM	1079	70	607	40	0.061	4	−150	−9.8
·	EAST-ANGL	972	78	304	24	0.073	6	−20	−1.6
·	WEST-MIDL	949	73	370	29	0.073	6	−20	−1.5

Source: WRR

Under scenario A_0 in the Zuid-Nederland region, for example, the realisation of the TEMS would involve a deficit of 200,000 hectares. The model calculations for this scenario indicate that there would be 314,000 hectares of extensive pasture in this region. This would support 455,000 cows at an average density of roughly one and a half cows per hectare. At this level of density it is perfectly possible to maintain or introduce meadow birds [16]. From the viewpoint of protecting meadow birds there is therefore in fact no shortage of land for realising the TEMS.

Genuine problems in realising the desired land use for nature conservation and agriculture do arise in scenario A_+ in Noord-Nederland and South-West. In the Noord-Nederland region the deficit of land in A+ is 30,000 hectares; the density of cattle on the highly productive pasture lands (4.8 cows per ha) leaves too little room for meadow birds.

In the South-West region there is a deficit of 170,000 hectares. Of the total area 54 per cent is suitable for cereal cultivation. The model indicates the combination of wheat and field beans in a 5:1 rotation to be the most lucrative. Nature conservation requirements indicate that 53 per cent of the land area should form part of TEMS. A comparison of the map showing the suitability of land for cereal production (Fig. 4.4) with that for the TEMS (Fig. 6.2) indicates that the competition for space is concentrated on the southern periphery of the region.

If the structure of the TEMS in these regions is examined more closely a number of other qualifications emerge. In the pleistocene lowlands of northwest Europe virtually the entire catchment areas of the lowland streams have been included in the TEMS. Particularly for Zuid-, Oost-, and Noord-Nederland this represents a major claim on land use since the systems of streams and brooks have been included in their entirety. In contrast to the network of protected areas in the Nature Policy Plan this also includes the land area of the corridors [17].

[16] *Factoren die de dichtheid van weidevogels bepalen* (Factors influencing the abandance of meadow birds – in Dutch); by C.J.M. Musters, F. Parmentier, A.J. Poppelaars et al., Leiden, Environmental Biology/Centre for Environmental Sciences, 1986.

[17] *Natuurbeleidsplan* (Nature Policy Plan); Parliamentary Proceedings, Lower House, 1989-1990 session, 21 149, nos. 2-3.

As noted earlier, the CORINE database contains virtually no information on Germany and the UK. For this reason information has been gathered at regional and national level for the UK regions, supplemented by information supplied by experts. This approach is less refined than that for the other countries and may therefore lead to an overestimation of the TEMS area. For the South-West region, for example, the soil is suited not just for agriculture but also to hornbeam woods, which are capable of supporting a large number of animal species. On the basis of this criterion a substantial proportion of this region has been included in the TEMS. The region also contains a significant corridor between the two national parks of Dartmoor and Exmoor, so that the share of the TEMS in this region rises to 53 per cent. The Yorkshire-Humberside region has a comparatively large number of nature reserves linked within the TEMS by corridors, resulting in an above-average land-area share for the TEMS of 40 per cent.

6.4.3 Regions with a substantial area of unused land

At the other end of the scale the model calculations produce a series of regions with a large unused area, even when large areas are set aside for wildlife and countryside in addition to agriculture. It was noted earlier that such a surplus of agricultural land is nothing new. Earlier in the development of agriculture periods of expansion alternated with others of contraction. Large areas were deserted in the process, leading to the decay of agricultural communities. Some of these areas were taken into use again in later periods when the demand for agricultural products began to exceed the production.

The availability of the surplus land may be viewed in various ways. In American literature the view is encountered that land which was once developed for agricultural use but now makes no more than a marginal contribution to total production should be withdrawn from use under set-aside schemes. That element of the population dependent on the agricultural output of the area in question will in due course disappear of its own accord [18]. It can also be argued that the problem of surplus land should be entirely left to market forces [19].

Within the EC, however, there is a widely held view that these surplus areas should continue to be used in some way or other since the decline in economic activity in the region in question would otherwise form a major threat to social and economic stability. This view therefore involves identifying alternative uses for the surplus area.

Apart from the size of the area no longer being used it is important in terms of a possible policy response to know where these surpluses are located. Contrary to expectations the results of the calculations indicate that the surpluses are likely to occur not in the areas around the Mediterranean but in the central areas of the EC. This applies especially to scenario C0. (This scenario of course has the largest surpluses as the agricultural area has been minimised so as to release the maximum amount of land for nature reserves.) The geographical distribution of the surplus land in the various scenarios is shown in Figures 6.4-6.7. From the maps it may be seen that large surpluses occur especially in the UK regions of East Anglia and South-East, the French regions of Ile-de-France, Nord-Pas-de-Calais, Bassin-Parisien and Est, the German regions of Rheinland-Pfalz, Baden-Württemberg and Saarland and the Italian regions of Nord-Este and Emilia-Romagna. The figures for the surpluses for the highest category (i.e. over 66 per cent of the area unused) are shown in Table 6.3.

[18] *Rural Economic Development in the 1980s, Prospects for the Future*, by D.L. Brown, J.N. Reid, H. Bluestone et al. (eds.); Rural Development Research Report No. 69, Washington D.C., U.S. Department of Agriculture, 1988.

[19] A. Swinbank, 'A surplus of farm land?'; in: Land Use Policy, January 1992, Volume 9 number 1, p. 3.

Table 6.3 **Regions with more than 66 per cent of unused land in any one scenario linked up into the number of scenarios in which this occurs**

	SCENARIOS							
	A_0	A_+	B_0	B_+	C_0	C_+	D_0	D_+
(6x)								
NORTH-WEST	94	94	.	.	93	93	79	91
(4x)								
ILEDEFRNCE	.	.	79	76	97	97	.	.
LOMBARDIA	73	73	.	.	72	72	.	.
EAST-ANGL	75	75	.	.	75	75	.	.
SOUTH-EAST	75	75	.	.	75	.	69	.
(3x)								
BASSIN-PAR	84	.	.	.	83	83	.	.
EST	.	.	.	.	67	68	67	.
NORD-EST	71	.	.	.	71	72	.	.
ABRUZ-MOLI	69	69	.	.	68	.	.	.
(2x)								
SCHLEWIG-H	70	70	.	.	.	.	.	.
RHEIN-PFLZ	.	.	.	.	71	71	.	.
WEST-MIDL	71	71	.	.	.	.	.	.
DANMARK	67	67	.	.	.	.	.	.
(1x)								
BADEN-WURT	.	.	.	.	67	.	.	.
NORD-PDCAL	.	.	.	.	93	.	.	.
OUEST		.	.	.	.	.	.	78
EMILIA-ROM	67	.	.	.	.	.	.	.
SICILIA	70	.	.	.	.	.	.	.
MADRID	.	.	.	.	.	72	.	.

Source: WRR

The causes of these surpluses vary from region to region. In most cases agriculture accounts for only a very small proportion of the total land area – generally between 0 and 5 per cent. Exceptions are Ile-de-France (20% in the B scenarios) and North-West (15% in scenario C_+). On the other hand the TEMS accounts for approximately 30 per cent of land use in most regions, with downward exceptions of North-West (6%), Ile-de-France (3%) and Nord-Pas-de-Calais (6%). These exceptions are caused by the lack of protected areas in those regions and also because there are no grounds for designating potential nature areas. In the case of France the TEMS is concentrated especially on the southern regions.

The combination of a low agricultural area and/or limited area for TEMS causes the surplus but otherwise there is no clear pattern.

6.5 Conclusions

The most clear-cut conclusion to emerge from this chapter is that nature conservation and agriculture need not compete in terms of land use. The comparison of the scenarios with possible wishes with respect to nature conservation and development indicates that the TEMS could be realised in all cases. Within the parameters imposed on the GOAL model, sufficient land is available to achieve fairly ambitious goals in relation to the natural environment.

Secondly it is notable that in a number of regions a substantial or even increased share of the present cultivated area remains as 'surplus' even after a considerable proportion of the land area has been set aside for nature conservation. The assumptions in the various scenarios have a clearly discernible effect in this respect. As might be expected, the largest surplus in the largest

number of regions occurs in scenario C. In scenario A, too, there are numerous regions with a large area of unused land. This is much less the case in B and D. Both the restriction on regional employment and on emissions per hectare results in these scenarios in the distribution of agricultural activities over every region. In addition, the TEMS share is, with a few exceptions, of the same order of magnitude.

A third notable result is the fact that the regions with the largest unused area are located not in the traditional problem areas around the Mediterranean but in the more prosperous central areas of the EC. This may well create possibilities for alternative uses for the land made available, as these regions also support non-agricultural activities.

To sum up, the realisation of the TEMS may be regarded as technically feasible. In the case of land that is no longer required for agricultural production this would in part create a meaningful alternative. The financing – i.e. acquisition, development and management costs – could however constitute a major problem if the TEMS were in fact to be implemented. Although there is more land in the EC than required for agricultural production, there is, as noted earlier, a macro-micro problem; in macro terms there is a surplus but the individual farmer (micro) will generally stand to benefit commercially by expanding the size of his farm. This means that the land market remains under pressure, especially in those areas where farms are small and there are few opportunities for alternative activities. This is accentuated by the fact that all sorts of regulations (e.g. rights to use fertiliser and dairy-farming rights) are linked to the land, thereby keeping the price of land artificially high. While this effect will not apply with equal force in all places, in those areas that it does the realisation of the TEMS can become expensive [20].

Finally it should be noted that under the methodology adopted for the purposes of this report, agriculture and nature conservation are diametrically opposed to one another, in that agriculture and areas of protected countryside are mutually exclusive activities. In practice, however, many ecological features exist outside protected areas by virtue of agriculture. To some extent this notion of integration is reflected in the underlying assumption that agriculture is conducted rationally and efficiently, thus minimising the load on the environment from the wastage of fertilisers and pesticides, etcetera. This report, however, has not made any allowance for the fact that the ecological features in agricultural areas depend in part on farming methods. It is not, therefore, possible to make any statements about the possible consequences for the natural environment of changes in farming methods.

[20] For the expectations with respect to the Netherlands see: Commissie Financiering Natuurbeleid, *Naar een sluitende groenfinanciering* (Towards a balanced financing of nature – in Dutch); The Hague, 1992.

Afterword

Surveys of the future help identify threats and opportunities. In doing so, they can provide a framework for the strategic choices that need to be made. This report provides such a framework. It indicates that there are clear opportunities for the rural areas in the EC, while at the same time identifying a number of threats. Possibly the biggest threat of all is the failure to make choices and to keep in place a policy by adapting its instruments without taking stock of what its goals are or should be. In this way, with a bit of patching here and there and some minor modifications, the great bastion of the CAP remains intact at ever increasing cost to the Community. By denying the structural nature of surplus of agricultural land and indeed compulsorily maintaining such land for agricultural purposes by means of temporary set-aside schemes, other possibilities with attractive features to them remain blocked. Particularly in the densely populated areas of Western Europe, land is a scarce commodity. The over-allocation of land to agriculture means that other forms of land use go begging.

Highly productive agriculture as currently practised in a number of areas is associated with severely adverse environmental effects. This need not be so. Nitrogen emissions and pesticide immissions can be reduced without adverse economic consequences. In all the scenarios developed for the purposes of this report, agriculture is highly productive but also environmentally safe and compatible with other forms of land use. The concept of integrated agriculture is compatible with each of the scenarios and fits in with widely differing distributions of land use, depending on the kind of future envisaged for rural areas.

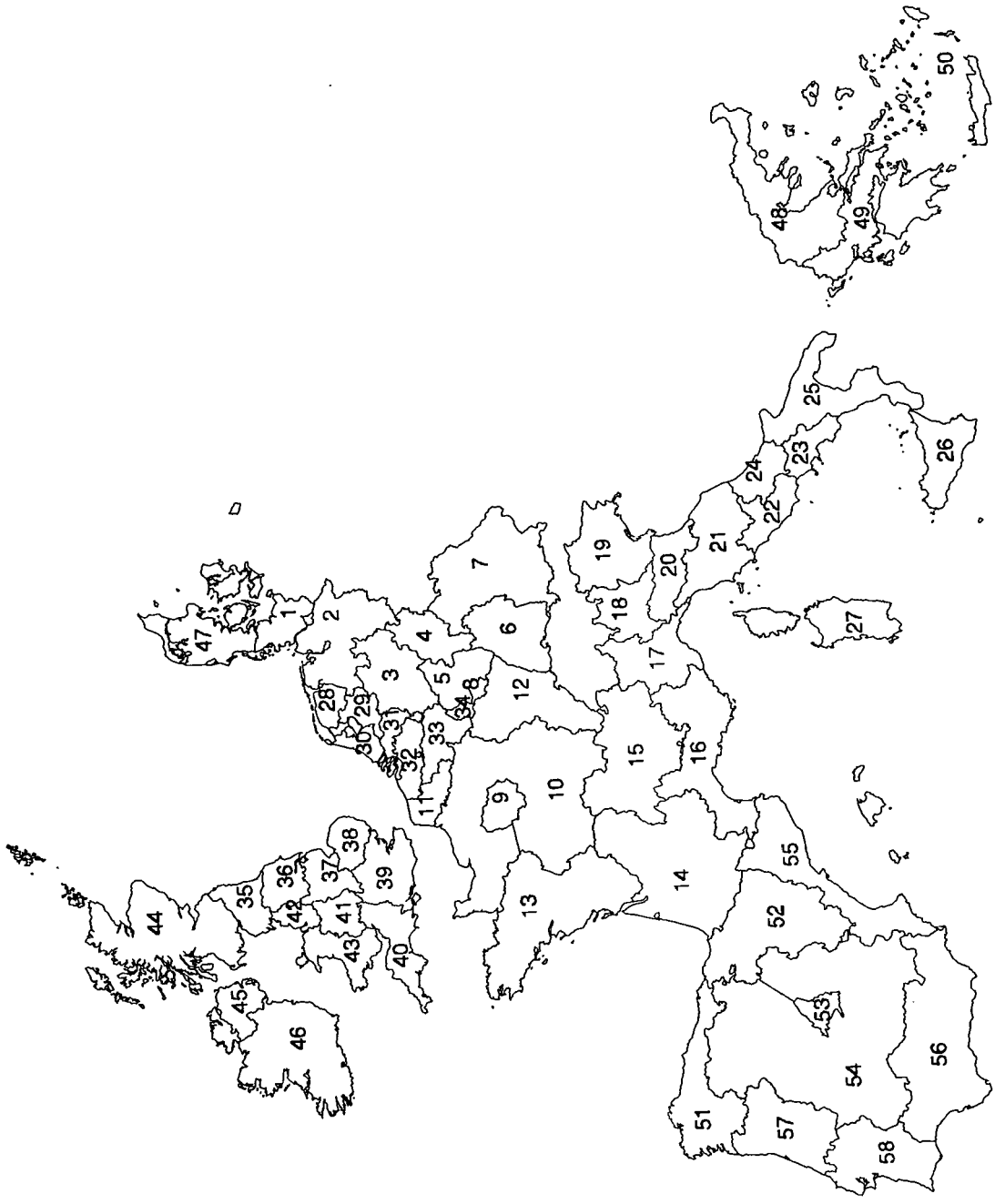
The realisation of various views concerning the future centres around land policy. The aim of bringing European agriculture more closely into line with market forces does not detract from the need for active governmental policies broadly determining which land should be reserved for which activities, and helping to promote developments in that direction. If government policy remains passive and scope is simply created for greater market forces, new structures will certainly evolve in many regions in due course, but this will be associated with the pauperisation and bankruptcy of elements of the rural community. Land-based agriculture would then undergo the purgation of (excessive) market discipline. The result need not even be optimal efficiency; the fact that short-term economic factors will always be the decisive consideration in such policies, rather than the physical characteristics of the area in question, means that marked impoverishment can also take place on agriculturally good soils. This is another reason in favour of an active government policy. The scenarios developed in this report provide a framework of evaluation for such policies.

But more is possible. Working from the firm foundation of the technical scenarios it is possible to look to a more distant future. The findings in this report at least provide a frame of reference for the future shape of agriculture as it might develop in the European Community under a two-fold model. The first element would consist of highly productive agriculture meeting the lion's share of the demand for food on a small area using the best technical means. Such agriculture would make use of the most advanced eco-technological principles and of maximum biological self-help (i.e. by means of persistent strains, the high uptake of plant nutrients, biological pest control, good crop rotations, crops designed to minimise mineral losses, and mixed farms on a larger scale than now). The area required for such agriculture would be limited, as would the employment. Alternatives will therefore need to be created, which can vary widely. In many cases a support framework for and the acceleration of natural wastage will be sufficient.

In addition highly extensive agriculture can be conducted on a large area aimed at landscape management and forms of agriculture that preserve or promote ecological and landscape features. These kinds of agriculture (e.g. fenlands and hill farming) require subsidies in order to defray the costs of the ecological features desired by society. Within this framework an extremely wide variety of niche production is possible, i.e. agriculture meeting the demand of specialised groups of consumers for products produced in a certain way. This provides scope for the eco-technologist to create conditions for alternative forms of agriculture and small-scale activity.
If matters were to evolve this direction, this would also release land for large European nature parks, for recreation, and for forests, only a small part of which was required to meet the demand for timber and which could make a contribution to energy supplies (by means of large areas with a 5-year rotation of for example poplars or multi-year miscanthus). While this would not give rise to a new Arcadia, it would mean a Europe in which agricultural land was much more interspersed with areas of natural countryside, regions set aside solely or partly for recreation, large-scale energy plantations and large tracts of wasteland, all this interwoven with 'back to nature activities' aimed at specific consumer markets.

So there are ideas enough, but their realisation does demand systematic and thorough investigation. If new prospects are to be created for rural areas, analysis of these kinds of ideas is therefore creative and meaningful. This is the quintessence of this report: there is, in more than one sense, ground for choices, as long as we do not stick over-tenaciously to the present arrangements. Prospects exist, provided we look to a horizon beyond the everyday world.

Appendix
NUTS-1
Regions of the European Community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NUTS-1 Regions of the European Community

Country	Abbrev.	Region	Abbreviation	No. on map
West-Germany	BRD	Schleswig-Holstein	SCHLEWIG-H	1
		Niedersachsen	NIEDERSACH	2
		Nordrhein-Westfalen	NORDRHN-WF	3
		Hessen	HESSEN	4
		Rheinland-Pfalz	RHEIN-PFLZ	5
		Baden-Württemberg	BADEN-WURT	6
		Bayern	BAYERN	7
		Saarland	SAARLAND	8
France	F	Ile-de-France	ILEDEFRNCE	9
		Bassin-Parisien	BASSIN-PAR	10
		Nord-Pas-de-Calais	NORD-PDCAL	11
		Est	EST	12
		Ouest	OUEST	13
		Sud-Ouest	SUD-OUEST	14
		Centre-Est	CENTRE-EST	15
		Mediterranee	MEDITERRAN	16
Italy	IT	Nord-Ovest	NORD-OVEST	17
		Lombardia	LOMBARDIA	18
		Nord-Est	NORD-EST	19
		Emilia-Romagna	EMILIA-ROM	20
		Centro	CENTRO-IT	21
		Lazio	LAZIO	22
		Campania	CAMPANIA	23
		Abruzzi-Molise	ABRUZ-MOLI	24
		Sud	SUD	25
		Sicilia	SICILIA	26
		Sardegna	SARDEGNA	27
Netherlands	NL	Noord-Nederland	NOORD-NL	28
		Oost-Nederland	OOST-NL	29
		West-Nederland	WEST-NL	30
		Zuid-Nederland	ZUID-NL	31
Belgium	B	Vlaams-Gewest	VLAAMSGWST	32
		Region-Wallonne	REG-WALLON	33
Luxembourg	L	Luxembourg	LUXEMBOURG	34
United Kingdom	UK	North	NORTH	35
		Yorkshire-and-Humberside	YORKSH-HUM	36
		East-Midlands	EAST-MIDL	37
		East-Anglia	EAST-ANGL	38
		South-East	SOUTH-EAST	39
		South-West	SOUTH-WEST	40
		West-Midlands	WEST-MIDL	41
		North-West	NORTH-WEST	42
		Wales	WALES	43
		Scotland	SCOTLAND	44
		Northern-Ireland	NRTH-IRLND	45
Ireland	IRL	Ireland	IRELND	46
Denmark	DK	Danmark	DANMARK	47

NUTS-1 Regions of the European Community

Country	Abbrev.	Region	Abbreviation	No. on map
Greece	GR	Voreia-Ellada	VOR-ELLADA	48
		Kentriki-Ellada	KENTR-ELLA	49
		Nisia	NISIA	50
Spain	SP	Noroeste	NOROESTE	51
		Noreste	NORESTE	52
		Madrid	MADRID	53
		Centro	CENTRO-ESP	54
		Este	ESTE	55
		Sur	SUR	56
Portugal	P	Norte-do-Continente	NORTE-CONT	57
		Sul-do-Continente	SUL-CONT	58

The Council has published the following Reports to the Government

First term of office

1 Europese Unie (European Union), 1974.

2 Structuur van de Nederlandse economie (Structure of the Netherlands Economy), 1974.

3 Energiebeleid op langere termijn (Long-term Energy Policy), 1974. Reports 1 to 3 are published in one volume.

4 Milieubeleid (Environmental Policy), 1974.

5 Bevolkingsprognoses (Population Forecasts), 1974.

6 De organisatie van het openbaar bestuur (The Organization of Publics Administration), 1975.

7 Buitenlandse invloeden op Nederland: Internationale migratie (Foreign Influence on the Netherlands: International Migration), 1976.

8 Buitenlandse invloeden op Nederland: Beschikbaarheid van wetenschappelijke en technische kennis (Foreign Influcence on the Netherlands: Availability of Scientfic and Technical Knowledge), 1976.

9 Commentaar op de Discussienota Sectorraden Wetenschapsbeleid (Comments on the discussion Paper on Sectoral Council of Science Policy), 1976.

10 Commentaar op de nota Contouren van een toekomstig onderwijsbestel (Comments on the White Paper on the Contours of the Future Eduacation System), 1976.

11 Overzicht externe adviesorganen van de centrale overheid (Survey of external Advisory Bodies of the Central Government), 1976.

12 Externe adviesorganen van de centrale overheid, beschrijving, ontwikkelingen, aanbevelingen (External Advisory Bodies of the Central Government: Description, Developments, Recommendations), 1977.

13 'Maken wij er werk van?' Verkenningen omtrent de verhouding tussen actieven en niet-actieven 'Do we make Work our Business?' An Exploratory Study of the Relations between Economically Active and Inactive Persons), 1977.

14 Overzicht interne adviesorganen van de centrale overheid (Survey of Internal Advisory Bodies of the Central Government), 1977.

15 De komende vijfentwintig jaar, een toekomstverkenning voor Nederland (The Next Twenty-Five Years: a Survey of Future Developments in the Netherlands), 1977.

16 Over sociale ongelijkheid, een beleidsgerichte probleemverkenning (On Social Inequality: a Police-oriented Study), 1977.

Second term of office

17 Etnische minderheden – A. Rapport aan de regering; B. Naar een algemeen etnisch minderhedenbeleid? (Ethnic minorities – A. Report to the Government; B. Towards on Overall Ethnic Minorities Policy?), 1979.

18 Plaats en toekomst van de Nederlandse industrie (Industry in the Netherlands: its Place and Future), 1980.

19 Beleidsgerichte toekomstverkenning: deel 1. Een poging tot uitlokking (A Policy-oriented Survey of the Future: Part 1. An Attempt to Challenge), 1980.

20 Democratie en geweld – Probleemanalyse naar aanleiding van de gebeurtenissen in Amsterdam op 30 april 1980 (Democracy and Violence – an Analysis of Problems in Connection with the Events in Amsterdam on April 30, 1980), 1980.

21 Vernieuwing in het arbeidsbestel (Prospects for Reforming the Labour System), 1981.

22 Herwaardering van welzijnsbeleid (A Reappraisal of Welfare Policy), 1982.

23 Onder invloed van Duitsland. Een onderzoek naar gevoeligheid en kwetsbaarheid in de betrekkingen tussen Nederland en de Bondsrepubliek (The German Factor, A Survey of Sensitivity and Vulnerability in the Relationship between the Netherlands and the Federal Republic), 1982.

24 Samenhangend mediabeleid (A Coherent Media Policy), 1982.

Third term of office

25 Beleidsgerichte toekomstverkenning: deel 2; Een verruiming van perspectief (A Policy-oriented Survey of the Future: Part 2: Towards a Broader Perspective), 1983.

26 Waarborgen voor zekerheid; een nieuw stelsel van sociale zekerheid in hoofdlijnen (Safeguarding Social Security), 1985.

27 Basisvorming in het onderwijs (Basic Eduaction), 1986.

28 De onvoltooide Europese integratie (The Unfinished European Integration), 1986.

29 Ruimte voor groei (Scope for Growth), 1987.

30 Op maat van het midden- en kleinbedrijf (Tailoring Policy to the Needs of the Small and Medium-sized Business), 1987.

31 Cultuur zonder grenzen (Culture and Diplomacy), 1987.

32 De financiering van de Europese Gemeenschap (Financing the European Community), 1987

33 Activerend arbeidsmarktbeleid (An Active Labour Market Policy), 1987.

34 Overheid en toekomstonderzoek (Government and Future Research), 1988.

Fourth term of office

35 Rechtshandhaving (Law Enforcement), 1989.

36 Allochtonenbeleid (Immigrant Policy), 1989.

37 Van de stad en de rand (Institutions and Cities; the Dutch Experience), 1990.

38 Een werkend perspectief (Work in perspective), 1990.

39 Technologie en overheid (Technology and Policy), 1991.

40 De onderwijsverzorging in de toekomst (Educational support in the future), 1991.

41 Milieubeleid; strategie, instrumenten en handhaafbaarheid (Environmental Policy: Strategy, Instruments and Enforcement), 1992.

42 Grond voor keuzen; vier perspectieven voor de landelijke gebieden in de Europese Gemeenschap (Ground for Choices), 1992.

Reports nos. 13, 15, 17, 18, 28, 31, 32 and 42 have been translated into English; English summaries are available of Reports nos. 16, 18, 19, 20, 25, 26, 27, 29, 30, 33, 34, 37, 38 and 41; Report no 23 has been translated into German. Of Report no. 42 a German and a Spanish Summary is available, as well as a full French translation.

The Council has published the following Preliminary and background studies (in Dutch)

First term of office

V 1 W.A.W. van Walstijn, Kansen op onderwijs; een literatuurstudie over ongelijkheid in het Nederlandse onderwijs (Educational Opportunities: a Literature Study of Inequality in the Netherlands Educational System) (1975)

V 2 I.J. Schoonenboom en H.M. In 't Veld-Langeveld, De emancipatie van de vrouw (Women's Emancipation) (1976)

V 3 G.R. Muster, Van dubbeltjes en kwartjes, een literatuurstudie over ongelijkheid in de Nederlandse inkomstenverdeling (Dimes and Quarters: a Literature Study on Inequality in the Distribution of Income in the Netherlands) (1976)

V 4 J.A.M. van Weezel a.o., De verdeling en de waardering van arbeid (The Distribution and Appreciation of Work) (1976)

V 5 A.Ch.M. Rijnen a.o., Adviseren aan de overheid (Advising the Government) (1977)

V 6 Verslag Eerste Raadsperiode 1972-1977 (Report on the First Term of Office) (1972-1977)*

Second term of office

V 7 J.J.C. Voorhoeve, Internationale Macht en Interne Autonomie International Power and Internal Autonomy) (1978)

V 8 W.M. de Jong, Techniek en wetenschap als basis voor industriële innovatie – Verslag van een reeks van interviews (Technology and Science as a base for Industrial Innovation) (1978)

V 9 R. Gerritse, Instituut voor Onderzoek van Oveheidsuitgaven: De publieke sector: ontwikkeling en waardevorming – Een vooronderzoek (The Public Sector: Development and Valuation) (1979)

V10 Vakgroep Planning en Beleid/Sociologisch Instituut Rijksuniversiteit Utrecht: Konsumptieverandering in maatschappelijk perspectief (Shifts in Consumption in a Social Perspective) (1979)

V11 R. Penninx, Naar een algemeen etnisch minderhedenbeleid? Opgenomen in rapport nr. 17 (Towards an Overall Ethnic Minorities Policy? Attached to Report nr. 17) (1979)

V12 De quartaire sector – Maatschappelijke behoeften en werkgelegenheid – Verslag van een werkconferentie (The Quarternary Sector: Societal Requirements and Employment Opportunities) (1979)

V13 W. Driehuis en P.J. van den Noord, Produktie, werkgelegenheid en sectorstructuur in Nederland 1960-1985 (Output, Employment and the Structure of Production in the Netherlands, 1960-1985) Modelstudie bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

V14 S.K. Kuipers, J. Muysken, D.J. van den Berg en A.H. van Zon, Sectorstructuur en economische groei: een eenvoudig groeimodel met zes sectoren van de Nederlandse economie in de periode na de tweede wereldoorlog (The structure of Production and Economic Growth: a Simple Six-Sector Growth Model of the Dutch Economy in the Post-War Period) Modelstudie bij het rapport Plants en toekomst van de Nederlandse industrie (1980)

V15 F. Muller, P.J.J. Lesuis en N.M. Boxhoorn, Een multisectormodel voor de Nederlandse economie in 23 bedrijfstakken (A Multi-Sector Model of the Dutch Economy Divided into 23 Branches of Industry).
F. Muller, Veranderingen in de sectorstructuur van de Nederlandse economie 1950-1990 (Shifts in the Structure of Production in the Dutch Economy 1950-1990). Modelstudie bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

V16 A.B.T.M. van Schaik, Arbeidsplaatsen, bezettingsgraad en werkgelegenheid in dertien bedrijfstakken (Jobs, Capacity, Utilization and Employment Opportunities in Thirteen Branches of Industry) Modelstudie bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

V17 A.J. Basoski, A. Budd, A. Kalff, L.B.M. Mennes, F. Racké en J.C. Ramaer, Exportbeleid en sectorstructuurbeleid (Export Policy and Structural Policies) Pre-adviezen bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

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V18 J.J. van Duijn, M.J. Eleman, C.A. de Feyter, C. Inja, H.W. de Jong, M.L. Mogendorff en P. VerLoren van Themaat, Sectorstructuurbeleid: mogelijkheden en beperkingen (Structural Policies: Prospects and Limitations) Pre-adviezen bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

V19 C.P.A. Bartels, Regio's aan het werk: ontwikkelingen in de ruimtelijke spreiding van economische activiteiten in Nederland (Putting Regions to Work: Trends in the Regional Distribution of Economic Activity in the Netherlands) Studie bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

V20 M.Th. Brouwer, W. Driehuis, K.A. Koekoek, J. Kol, L.B.M. Mennes, P.J. van den Noord, D. Sinke, K. Vijlbrief en J.C. van Ours, Raming van de finale bestedingen en enkele andere grootheden in Nederland in 1985 (Estimate of the Final Expenditure and some other Data in the Netherlands in 1985) Technische nota's bij het rapport Plaats en toekomst van de Nederlandse industrie (1980)

V21 J.A.H. Bron, Arbeidsaanbod-projecties 1980-2000 Projections of the Labour Supply 1980-2000) (1980)

V22 A. Faludi, R.J. in 't Veld, I.Th.M. Snellen en P. Thoenes, Benaderingen van planning; vier preadviezen over beleidsvorming in het openbaar bestuur (Approaches to Planning) (1980)

V23 Beleid en toekomst (Government Policy and the Future), report of a symposium on the report Beleidsgerichte toekomstverkenning deel I (Policy-Oriented Survey of the Future, Part I) (1981)

V24 L.J. van den Bosch, G. van Enckevort, Ria Jaarsma, D.B.P. Kallen, P.N. Karstanje, K.B. Koster, Educatie en welzijn (Education and Welfare) (1981)

V25 J.C. van Ours, D. Hamersma, G. Hupkes, P.H. Admiraal, Consumptiebeleid voor de werkgelegenheid (Consumption Policy for Employment) Background reports to the report Vernieuwingen in het Arbeidsbestel (Prospects for Reforming the Labour System) (1982)

V26 J.C. van Ours, C. Molenaar, J..A.M. Heijke, De wisselwerking tussen schaarsteverhoudingen en beloningsstructuur (The interaction between Relative Scarcities and the Remuneration Structure) Background reports tot the report Vernieuwingen in het Arbeidsbestel (Prospects for Reforming the Labour System) (1982)

V27 A.A. van Duijn, W.H.C. Kerkhoff, L.U. de Sitter, Ch.j. de Wolff, F. Sturmans, Kwaliteit van de arbeid (The Quality of Work) Background reports to the report Vernieuwingen in het Arbeidsbestel (Prospects for Reforming the Labour System) (1982)

V28 J.G. Lambooy, P.C.M. Huigsloot en R.E. van de Landgraaf, Greep op de stad? Een institutionele visie op stedelijke ontwikkeling en de beïnvloedbaarheid daarvan (Getting Cities under Control? An Institutional Approach to Urban Development and its Controllability) (1982)

V29 J.C. Hess, F. Wielenga, Duitsland in de Nederlandse pers – altijd een probleem? Drie dagbladen over de Bondsrepubliek 1969-1980 (Germany in the Dutch Press: Always a Problem? Reporting by three newspapers on West Germany, 1969-1980) (1982)

V30 C.W.A.M. van Paridon, E.K. Greup, A. Ketting, De handelsbetrekkingen tussen Nederland en de Bondsrepubliek Duitsland (The Trading Relationship between the Netherlands and the Federal Republic of Germany) (1982)

V31 W.A. Smit, G.W.M. Tiemessen, R. Geerts: Ahaus, Lingen en Kalker; Duitse nucleaire installaties en de gevolgen voor Nederland (Ahaus, Lingen and Kalkar: German Nuclear Facilities and their Implications for the Netherlands) (1983)

V32 J.H. von Eije: Geldstromen en inkomstenverdeling in de verzorgingsstaat (Money Flows and the Distribution of Income in the Welfare State) (1982)

V33 Verslag Tweede Raadsperiode 1978-1982 (zie V6) (Report on the Second Term of Office 1978-1982)*

V34 P. den Hoed, W.G.M. Salet en H. van der Sluijs: Planning als onderneming (Planning as a Form of Action) (1983)

* Also available in English

V35 H.F. Munneke e.a.: Organen en rechtspersonen rondom de centrale overheid (Administative Bodies on the Periphery of Central Government); two volumes (1983)

V36 M.C. Brands, H.J.G. Beunders, H.H. Selier: Denkend aan Duitsland; een essay over moderne Duitse geschiedenis en enige hoofdstukken over de Nederlands-Duitse betrekkingen in de jaren zeventig (Thinking about Germany; An Essay on Modern German History, with some Chapters on Dutch-German Relations in the Seventies) (1983)

V37 L.G. Gerrichhauzen: Woningcorporaties; Een beleidsanalyse (Housing Corporations: A Policy Analysis) (1983)

V38 J. Kassies, Notities over een heroriëntatie van het kunstbeleid (Notes on a Reorientation of Policy on the Arts) (1983)

V39 Leo Jansen, Sociocratische tendenties in West-Europa (Sociocratic trends in Western Europe) (1983)

The Council commissioned a number of experts to carry out preliminary studies for the report 'A Coherent Media Policy'. The following studies were published in a separate series entitled 'Media Policy Background and Preliminary Studies' (in Dutch):

M 1 J.M. de Meij: Overheid en uitingsvrijheid (The Government and Freedom of Speech) (1982)

M 2 E.H. Hollander: Kleinschalige massacommunicatie; locale omroepvormen in West-Europa (Small-scale Mass Communications: Local Broadcasting Forms in Western Europe) (1982)

M 3 L.J. Heinsman/Nederlandse Omroep Stichting: De kulturele betekennis van de instroom van buitenlandse televisieprogramma's in Nederland – Een literatuurstudie (The Cultural Significance of the Inflow of Foreign Television Programmes in the Netherlands – A Survey of the Literature) (1982)

M 4 L.P.H. Schoonderwoerd, W.P. Knulst/Sociaal en Cultureel Planbureau: Mediagebruik bij verruiming van het aanbod (Media Use and a Wider Media Range) (1982)

M 5 N. Boerma, J.J. van Cuilenburg, E. Diemer, J.J. Oostenbrink, J. van Putten: De omroep: wet en beleid; een juridisch-politicologische evaluatie van de Omroepwet (Broadcasting – Legislation and Government Policy: A Legal and Political Evaluation of the Broadcasting Act) (1982)

M 6 Intomart B.V.: Etherpiraten in Nederland (Radio Pirates in the Netherlands) (1982)

M 7 P.J. Kalff/Instituut voor Grafische Techniek TNO: Nieuwe technieken voor productie en distributie van dagbladen en tijdschriften (New Techniques for the Production and Distribution of Newspapers and Magazines) (1982)

M 8 J.J. van Cuilenburg, D. McQuail: Media en pluriformiteit; een beoordeling van de stand van zaken (The Media and Diversity: An Assessment of the State of Affairs) (1982)

M 9 K.J. Alsem, M.A. Boorman, G.J. van Helden, J.C. Hoekstra, P.S.H. Leeflang, H.H.M. Visser: De aanbodsstructuur van de periodiek verschijnende pers in Nederland (The Supply Structure of Regular Press Publications in the Netherlands) (1982)

M10 W.P. Knulst/Sociaal en Cultureel Planbureau: Mediabeleid en cultuurbeleid; Een studie over de samenhang tussen de twee beleidsvelden (Media Policy and Cultural Policy: A Study of the Interrelationship between the two Fields of Policy) (1982)

M11 A.P. Bolle: Het gebruik van glasvezelkabel in lokale telecommunicatienetten (The Use of Fibre Optic Cable in Local Telecommmunications Networks) (1982)

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