The greenhouse effect and primary productivity in European agro-ecosystems

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Climate change and agricultural policy making

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The change in world food production, due to a considerable greenhouse effect, is not a major issue. Water use efficiency in most field crops will increase and the possibilities for crop growth in temperate zones will increase, but these effects will not cause a dramatic change in the world's potential for food production. There may be a change of locations where primary production has most perspectives. This change in perspectives in various areas may cause regional problems, but will hardly affect the world's potential for food production.

Policy makers at various aggregation levels should be familiar with potential changes in regional possibilities and adapt their instruments. On a world scale, food and feed production may not be a problem, but for various continents and political blocks that may be different. For the European Community, for example food self-sufficiency is more than achieved during the last decades and surplus production creates difficulties on the world market. Even without a greenhouse effect, the potentials for agricultural production in the EC exceed the needs for food products and the increase in agricultural productivity per unit area will continue in the next decades. This increase is due to the large gap between potential and actual agricultural production in most agricultural areas of Europe, and to the fact that the efficiency in terms of inputs per unit of output still increases at higher production levels (de Wit et al., 1987). Thus, the increasing over-production in the EC is a major problem for policy makers at the supranational level and as a consequence also for policy makers at the regional level. The increase in agricultural productivity is not the same in various areas of Europe and this may create further divergence of regional economics in Europe. Regional and structural funds are increasingly called upon to mitigate the undesirable socio-economic and environmental effects of the common EC market in agricultural products. However, little or nothing is known about the cost-effectiveness of investments for agricultural development in the various peripherous regions. The need to apply the limited resources from the funds as effectively as possible, requires a more thorough assessment of the different alternatives for the use of resources.

Therefore in 1989 the Netherlands Scientific Council for Government Policy (WRR) started a project on the possible developments of the rural areas in Europe. The general objective of this project is: 'To provide information on the interactions between a number of more or less self-contained technical development processes in agriculture, and objectives from other angles of view such as social economy, environmental protection and nature conservation and the consequences of these interactions for rural areas in Europe'.

This objective is approached in several stages. First a qualitative and quantitative analysis of the long-term agricultural potential of the EC is carried out. Using simulation models, the agricultural production potential of the various European regions is assessed based on soil

properties and climatological conditions. When the latter change, the results of these simulations may change. Second, these calculated potentials are used to allocate agricultural production considering different policy goals. For this purpose an optimization model (GOAL: General Optimal Allocation of Land use) is developed that incorporates quantified agro-technical, socio-economic and environmental goals (Veeneklaas, 1990). The model is used to calculate the optimum allocation of categories of land use given the technical possibilities within the agricultural sector and the defined preferences for the incorporated goals. Finally, the analysis is completed with the definition a preliminary set of regulatory provisions that are considered necessary to attain the outlined scenarios.

Hence, the study will result in a number of scenarios for a Common Agricultural Policy aiming at solving the problems arising from increasing productivity, market saturation, uneven distribution of production within Europe and increasing concern for the environment and the landscape. At this moment, the land evaluation is completed. The optimization model is defined and the first test runs with the model are completed. An inventory and evaluation of the EC funding and regulations for regional development is also completed. The study can provide information on land use in the EC-12 assuming that the EC aims at food-self-sufficiency. It is also possible to determine expected food production when the EC operates on a liberalized world market. This type of information is needed for a long-term policy choice for the EC.

Climate change as a result of increased greenhouse gases in the atmosphere are not considered yet, but are relatively simple to introduce. The simulation models that generate the potential yield must be run again using modified climate data.

Of course the project does not aim at worldwide scenarios for food supply, but the role of the EC in world food supply can be investigated. The interrelations with other important producing nations (U.S.A., Canada, Australia) and the changes for developing countries can be described within the different scenarios.

The methodology developed and used in this study is not only appropriate for studies where the policy consequences of the greenhouse effect are studied, but has wider applicability. For large scale studies into world food supply this approach may prove to be an important building block.

References

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