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Pressure on Natural Resources — Implications for Research and Policy

Environmental concerns and problems of pressure on limited natural resources have been familiar to classical economists like John Stuart Mill or Malthus. However, forgotten during a long period of relatively undisturbed technical progress and economic development, they are relatively new to modern economists. Environmental problems pose principal theoretical issues, operational questions and problems of implementing an adequate environmental policy.

PRINCIPAL THEORETICAL ISSUES

Principal problems arise from the simultaneous consideration of ethical and economic principles and from the vague determination of the ecological equilibrium. Both problems are interdependent.

The ethical issue
The two following quotations from Rawls and Schweitzer characterise the two dimensions of the ethical issue involved in environmental problems:

If the world were fair, we would willingly enter it randomly

with respect to location at a given point in time, to time at a given location.[1]

I am life, which wants to live among life, which wants to live ... Hence ethic demands to pay the same reverence to all kinds of life which I pay to my own life.[2]

The ethical core of the environmental problem is the answer to the question: What is a fair distribution of limited natural resources (renewable or not) with respect to time at a given location and with respect to the division among the needs of the different kinds of life?

Need for a multidimensional objective function
Both quotations make clear, that what could be considered as fair is

determined by ethical rather than by economic principles. Consequently environmental policy has to consider ethical and economic principles simultaneously. In order to determine the objective function, one has to replace the one-dimensional approach of the classical cost–benefit analysis by the multidimensional approach of institutional economics,[3] since it is impossible to find a common denominator for the substitution of ethic demands and material welfare.

Value biased economics
The introduction of a multidimensional objective function is only a first step. It makes the problems evident, but it does not solve them, since rational behaviour under a multidimensional objective function requires the determination of priorities in some way or another.

At this point we enter the field of values which has caused so many discussions among economists. Certainly Popper's statement applies to environmental policy that one cannot take away value judgement from a social scientist without taking away his personality. I firmly believe, that there is not value-free economics in dealing with environmental problems.

Lack of a general accepted ethic
However, accepting a value biased approach (of course only if the values are made explicit) is only a precondition. It is necessary but not sufficient to determine the principles of finding an acceptable solution.

One of the remaining problems is the lack of a generally accepted ethic which includes future generations and nature in the responsibility of present mankind.

> Nature as subject of human responsibility is certainly a novelty with which ethic theory has to deal.[4]

Jonas who has identified the problem and who has investigated it thoroughly did not find a *general* solution:

> The concrete new obligations cannot be brought in a system because they just begin to appear in the reflection of the new facts of technological progress.[5]

. Let us see how far we can get if we use a more pragmatic approach and consider the different categories of resources described in Figure 1.

Non-renewable resources reduced by consumption
We are not even able to define the characteristics of a fair distribution in time for non-renewable resources which are reduced by consumption.

Economic models concerned with the problem follow mostly the attitude: 'Why should I care for wife and children? Let them beg if they are hungry.' They maximise the utility of the present users in taking into account technical progress or neglecting it. Most models which I know are typical textbook models of little if any operational value.
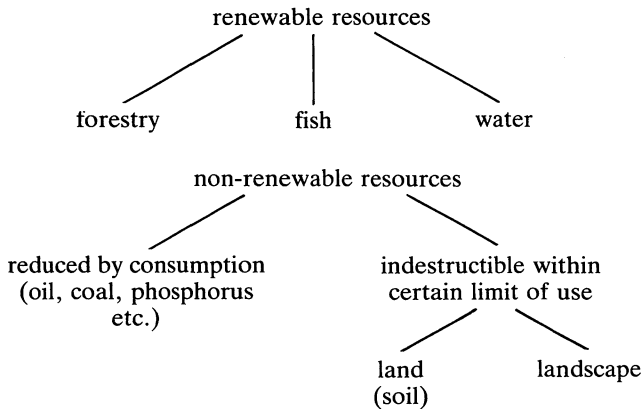
FIGURE 1   *Classification of natural resources*

Here is certainly an unresolved problem. However, I hesitate to say it is a problem for future research because it is hard to imagine that a satisfying operational solution exists.

Renewable resources and land   The ethical problem here is the problem of a fair distribution between human generations. The use of both – renewable resources and land – have in common that an upper limit for the intensity of their use exists. Observing that limit guarantees the stability of the system. Hence in both cases common sense limits the intensity of resource use. One must not cut off the branch one is sitting on. The use has to remain within the limits which preserve the long-term stability of the system.

Evidently this is a generally acceptable ethic (with the exception discussed below). Thus maintaining the stability of renewable resource and land use systems is not a problem of determining proper limits of use but a problem of defining and implementing a policy which makes people observe these limits. It will be briefly discussed in the next major section.

Ethical problems arise if the intensity of resource and land use required to satisfy the basic needs of the population, exceeds the limits which guarantee the long-term stability of the system. The exploitation of forests for the use of fuel wood[6] and the increasing intensity of land use endangering the continuous fertility of the land are typical examples which have been presented at the conference.

In these cases the 'skirt is closer than the coat' ethic will decide in favour of the existing generation. However, at the same time it demands a reduction of consumption to the lowest possible level, intensification of the search for substitutes and drastic measures which will prevent further increase of the basic needs.

Landscape   John Stuart Mill was the first economist who was concerned

over the possible demolition of the landscape by technical progress and economic development. He added an aesthetic component to the objective function of environmental economy.

> Nor is there much satisfaction in contemplating the world with nothing left to the spontaneous activity of nature, with every rood of land brought into cultivation which is capable of growing food for human beings, every flowery waste or natural pasture ploughed up, all quadrupeds or birds which are not domesticated for man's use exterminated as his rivals for food, every hedgerow or superfluous tree routed out, and scarcely a place left where a wild shrub or flower could grow without being eradicated as a weed in the name of improved agriculture. If the earth must lose that great portion of its pleasantness which it owes to things that the unlimited increase of wealth and population would extirpate from it, for the mere purpose of enabling it to support a larger, but not a better or a happier population, I sincerely hope, for the sake of posterity, that they will be content to be stationary, long before necessity compels them to it.[7]

His warnings passed unnoticed as one can see if one drives through the most fertile plains in almost any part of the world. Even now the maintenance of the beauty of the landscape and the diversity of natural life is a subject which economists hesitate to approach. To my great surprise it was mentioned only in the discussion groups of this conference and one subsequent poster session.[8] In the section *Forces Shaping the Future* and even in the reaction to *Pressure on Natural Resources* the subject was completely ignored. Nevertheless, I am convinced that the problem of determining an optimal or at least an appropriate use of the landscape will become a major research area, especially of regional and interregional economics. In particular the poster session 7, 'Crise des agricultures paysannes', which has emphasised the problems of mountain farmers in the EC and in Switzerland has confirmed my conviction. It cannot be the answer of the affluent industrial societies to their structural and environmental problems in the agricultural sector, that they obey like slaves the law of comparative cost advantages promoting an increase of agricultural production in the already over-exploited horror landscapes of John Stuart Mill, while agriculture is displaced in the marginal regions where it plays an important role in maintaining the equilibrium of the existing ecological system.

The difficulty of observing adequately the appropriate intensity of the use of the landscape arises from the fact that the ecological equilibrium is not clearly defined. Ecological principles call for the stability of existing systems, generally including the demand that human use of the open landscape is kept within the limits which guarantee the maintenance of the local maximum diversity of natural life.

However, stable ecological systems can be also maintained at a low level of diversity of natural life. The horror landscape of John Stuart Mill in which every bush and tree and most of the wildlife is displaced by

agricultural production can be found all over the world, mainly in the most fertile plains. Nothing indicates that the stability of these poor eco-systems is endangered as long as adequate cultivation methods assure the fertility of the land, avoiding soil erosion and destruction of the basic fertility and keeping the use of fertilizer and pesticides within certain limits.

Apparently the appropriate intensity of the use of the landscape is to be found within a (possibly wide) range of which at the one end the intensity of use allows for maintaining the maximum diversity of natural life, while the other end is determined by the stability of land fertility even at a low diversity of natural life. Economic requirements, ethical demands and aesthetic considerations will determine the adequate intensity of use in a given case, depending among others on population density and income per caput and food production.

We had two examples in the plenary session on natural resources:

the case of Java, presented by Birowo and Prabowo[9],
the case of the United States, presented by Farrel and Capalbo.[10]

There is little doubt that the adequate intensity of the use of the landscape is different in both cases, taking into consideration ecological and economic objectives simultaneously. In densely populated Java observing the ecological equilibrium at the lowest possible level of diversification seems unavoidable. Erosion control and appropriate irrigation management are major measures of environmental policy. They guarantee at least a temporary stability of the production system though on a poor ecological level. In the long run there is no solution to the environmental problems of the densely populated developing countries of the tropical world without a drastic decline of the growth of the agricultural population.

Seeing agriculture creeping up the hills of what once has been tropical rain forest one can hardly imagine that the environmental stability can be maintained another 25 to 30 years, when the population will have doubled again. Daniel Bromley[11] has added to the title of his paper the question: 'Is conflict inevitable?'. I am afraid, in many regions the answer is 'No'. Bromley sees the increase in the pressure on natural resources caused by population growth exaggerated by mistaken policy measures and by mechanised production of export crops.

Seeing the disaster coming I ask myself whether we can remain satisfied with the hope that 'agriculture is a flexible and resilient industry when it approaches a limit to growth'.[12] Is it not our job to illustrate drastically the way into the disaster if prevailing trends continue? This kind of economic analysis has been discredited as 'doomsday economics' since the Club of Rome model. However, doomsday economics is not necessarily 'measurement without data' for which the Club of Rome model was criticised. Based on well identified trends within realistic time horizons it is possible to highlight existing dangerous characteristics and

enlarge them to a scale so that they become visible to everybody. Carefully used, this is one of the most important tools economists have to influence future developments in critical situations.

The low level of the ecological diversity accepted in Java is certainly not acceptable in developed countries. In many industrialised countries of the Western world the problem is not how to satisfy the basic needs of a dense population under a minimum of ecological stability but how to contain production in order to find and maintain an equilibrium of supply and demand. Two basic alternatives exist from a pure logical point of view, given the present and probably lasting trend of surplus production: either release land and labour from the agricultural sector or use the surplus of factor potential to improve the ecological performance of agricultural production. Once this choice has been made it is possible to design the framework of a rational policy.

OPERATIONAL PROBLEMS

Operational problems of environmental research and environmental policy have been described by Farrell and Capalbo,[13] by Kramer[14] and in case studies presented in contributed papers and poster sessions. We distinguish the following categories of cases in order to give a survey.

Possibilities of producing energy in the agricultural sector
The prospect of producing energy from alcohol (ethanol) has given wings to the hopes of agricultural politicians and farmers in the Western industrial countries. Alcohol means a new, almost infinite market for the agricultural sector, releasing the pressure on structural change which results from technical progress and limited markets. The main concern is that the production is not or at least not yet profitable with the possible exception of producing ethanol from sugar cane. Sugar cane has a clear comparative advantage with respect to the production of ethanol. Rask[15] has therefore proposed to increase the production of ethanol from sugar cane in Brazil and exchange it for corn from the United States. The profitability of the production of ethanol even from sugar cane seems to be a critical problem if one takes social costs into consideration. Da Rocha Ferreira and Tourinho[16] found that the Brazilian Alcohol Programme has induced substantial increases in the prices for food, thus causing an increase in the social costs which are neglected in most calculations. The opportunity costs of the production of alcohol might increase especially if increasing prices of energy cause an increase in food prices. The conclusion is: More research is necessary before one can recommend to start or increase the production of alcohol.
Economic research has to take into account:
   the social costs and the effects on income distribution,
   environmental aspects, considering not only that ethanol is 'clean alcohol' but also that its production might have negative environmental effects,

the relation between food prices and the prices of energy.

There was a second proposal for the production of energy in poster session 14. Martin[17] and Mayeux and Martin[18] from the IRHO [Institut de Recherches pour les Huiles et Oléagineux] propose to use non-edible vegetable oil as a local source of energy for small farms. They give the best chances to semi-perennial oil crops like castor beans and Jatropha curcas, which can be used as hedges protecting the land from wind erosion and also providing fuel wood. Their proposal has the charm of small-scale production directly addressed to small farmers in semi-arid areas with a limited production potential for food. I believe that further economic investigation would be worthwhile.

The use of renewable resources within stable limits
The determination of the optimal use of renewable resources is no longer a research problem if it ever was one. The problem is the implementation of a proper policy given the problem of externalities.

In many cases in the densely populated developing countries the use of renewable resources has passed the limits of long-run stability under the pressure of basic needs. The degradation of forests is one of the best-known examples showing that densely populated developing countries are about to make the same mistakes which industrial countries, especially around the Mediterranean, made a few hundred years ago.

Srivastava[19], presenting India as an example, shows that there is no hope of adapting the use of fuel wood to the existing limits of the stability of forests which have already been surpassed in many parts of the country. The developing disaster can be prevented only if one succeeds in establishing new limits of stability in which the basic needs of the population for fuel can be met.

Logically there exist two kinds of measures:
– measures to decrease the basic need for fuel wood;
– measures to increase the production potential of fuel wood without exceeding the limits of stability.

Since by definition it is impossible to decrease the basic needs of a given population, the demand for fuel wood can be decreased only by the supply of substitutes. Srivastava shows that the increase of the use of substitutes is not only a technical but also an economic and social problem. Fuel wood is cheap for farmers considering that the opportunity costs of labour for gathering it are zero or close to zero while the substitutes require either investment and social co-operation (biogas) or at least investment (solar cookers, etc).

Here is a field for economic and social research, besides technical research, needed to improve the quality of substitutes. The economic and social conditions under which rural households are likely to accept substitutes need clarification. The improvement of the integration of livestock in the farm is part of the problem to make use of energy from biogas.

The better integration of livestock into the farming systems is also a requirement to meet Ackello-Ogutu's[20] demand for a 'new approach to fertilizer use and food production in the developing countries'. The problem is known to economists. However, I doubt whether sufficient attention has been given to it so far.

Agriculture and environmental quality
The relations between agriculture and environmental quality are as complex as the field of environmental quality itself.
Three major problems are involved:
– soil erosion;
– ground water pollution;
– the diversity of the landscape.
The conference has concentrated most of its attention on problems of soil erosion, following the research of recent years. The almost exclusive concentration on land erosion is not justified in my opinion, but it is explicable for several reasons:
– land erosion is an irreversible and the most visible damage which can occur in a landscape;
– farmers are aware that there is a relation between land erosion and the stability of yields;[21]
– serious disasters have occurred in the recent history of industrial countries like the USA and the USSR and ecologists continue to warn that similar disasters might happen again, particularly in developing countries.[22]
These are reasons enough to conclude that economic research on soil erosion will remain an important research problem. Economic research in this field is still at its beginning and might gain importance but the other two fields should also attract the attention of economists, especially the problem of ground water pollution, which has not been discussed at this conference.
The basic structure of the operational problem is similar in all the three fields. The following subproblems have to be solved:
1. Measurement of environmental quality.
2. Determination of the 'environmental production function'.
3. Determination of the costs of measures.
4. Quantifying an optimal or at least satisfying policy.
5. Implementation of the chosen policy.

Measurement of environmental quality
The measurement of environmental quality requires:

(a) Criteria for environmental quality – Environmental quality can be measured:
– *with respect to land erosion* by absolute or relative losses of soil in a given period,
– with respect to water *pollution* by the content of nitrogen or other waste,

– with respect to the *diversity of the landscape* operational objectives are difficult to determine. One of the basic objectives is to guarantee survival of the possible maximum of species in a given region. However, whether the percentage of the actually living in relation to the possible maximum of species could be used as a criterion to measure environmental quality needs clarification.

(b) Transformation of ethic demands in operational measures – The transformation of the ethical consideration of the first section into operational objectives requires an answer to questions such as:
– Which time horizon has to be chosen for a tolerable or optimal solution with respect to soil erosion?
– Which is the level of ground water pollution which can·be tolerated?
– How many species should be given a chance to survive in a given regional unit?
Naturally the final answer to these questions has to be given by politicians. However, the job of scientists to ask clear questions and to insist on answers might become all the more important the more politicians prefer to 'agitate with a stick in the fog' because they are afraid of the consequences of a clear answer.

Determination of the 'environmental production function'
Determination of the environmental production function means determination of the relations between environmental quality and measures to influence it. Imperfect knowledge of these relations is one of the most important operational problems considering environmental questions from an economic point of view.[23]

The erosion model designed to compute average soil losses from water erosion is a good example of the kind of information needed for economic research. The 'Universal Soil Loss Equation' (USLE) provides an estimate of 'soil moved off the particular slope segment represented by the selected topographic factors'[24] under specified land use and management systems. It determines soil losses as dependent on: (a) the natural factors (kind of soil, length and inclination of slope precipitation); (b) the 'man-made' factors (use of the land, use and managing practices on agricultural land).

However, the specification of the function which determines soil losses is only a first step. Economic research requires a second step namely the determination of a function which explains the relationship between yields and soil fertility. The general form of these functions has been described by Lanzer and Mattuella[25] and demonstrates the complexity of the problem. The authors seem to have succeeded in specifying the coefficients of their model.

Research in other fields is less advanced. There is little hope that the coefficients for sophisticated economic models can be specified in the near future. Thus economists might find themselves confronted with the

need to base at least part of their conclusions on research models with a less sophisticated data basis.

Determination of the costs of measures
The determination of the costs of measures to improve environmental quality is one of the major occupations of present research in environmental economics. One has to distinguish between costs at the micro and macro level, considering the disequilibrium in the agricultural sector of many countries.

The costs at the micro level consist of direct costs and of opportunity costs. Representative farm models are needed for the determination of opportunity costs. These models have static or dynamic character depending on the subject. Research needs extension. It is in the stage of pilot studies in most countries if it has begun at all. The knowledge of size and regional structure of costs at the farm level is essential for the successful implementation of an environmental policy based on incentives (see below).

Knowing the costs at the macro level is needed to determine social costs of environmental policy. Farrell and Capalbo[26] have rightly emphasised the need for better knowledge of the trade-off between productivity gains and improvement of the environmental quality.

A sector is productively efficient if it is producing as much as possible of every good and service given the amount or resources used. The neglect of the environmental quality components from these measures is a serious mis-statement of the economic performance of the sector and thus total factor productivity is inadequate for assessing economic efficiency and the tradeoffs between environmental quality and economic growth.

They view the process as an adjustment on the input side. Define the production function of a sector as:

$$Y = F(v, x, \dot{x}, t)$$

which represents efficient combination of the conventional inputs v, and the environmental inputs x that can be used to produce output Y at time t. 'If the level or quality of the environmental inputs declines ($\dot{x} \neq 0$), output falls for any given amount of the other inputs because of the necessity to devote inputs to changing the stock of x rather than producing output.' This diminution in output constitutes an internal cost of adjustment. The apparent inverse relationship between environmental quality and increasing productivity leads to several implications concerning public policies to raise agricultural productivity. Obviously, it is not enough that such policies should simply encourage individual farmers to become more efficient. Equally important is ensuring a high rate of gross investment in both the capital stock and the environmental stock. The relation described above in principle is the basis for an intertemporal

model in which capital and environmental resource accumulation ties the different time periods to each other.

It seems doubtful if economists will succeed in the implementation of such a model in the near future considering the difficulties in determining technical coefficients at the present state of the arts. One must therefore ask whether less sophisticated measurements of the trade-offs would not be sufficient to justify the formulation of an environmental policy, especially in the western surplus countries which suffer rather than benefit from an accelerated growth of productivity.

Models for the determination of optimal strategies
Model building has become the playground for agricultural economists since Dantzig, Heady and others laid the basis for the rapid expansion of quantitative research which we have witnessed in the past 25 years. The principal capacity of the most advanced and complex models in production economics exceeds considerably the possibilities of specifying the corresponding coefficients taking into account the available data.

In environmental economics the playground is still waiting for cultivation. I am sure that it will attract the attention of model builders very soon. Maybe we will then face the same situation as in general production economics. Model builders will surpass data research and we will be confronted with general models for which we cannot specify the coefficients.

The general structure of the problem to be 'modelled' may be described as follows.
Given are:
1. The (dynamic) production function, which relates agricultural production of a given aggregate (farm, region or sector) to
   (a) traditional input factors land, labour, capital,
   (b) the environmental factors like quality of soil (depending on soil losses, the diversity of the landscape, etc).
2. The environmental function which relates environmental quality to factors or measures which influence it positively or negatively.
3. The quantity of fixed factors available.
4. The prices of products and inputs.
One wants to find a solution which maximises profit from production subject to the following restrictions:
(a) Minimum given requirements for environmental quality (reflecting the upper limits for intensity of land use).
(b) 'Technical' restrictions, which result from the needs of the production process.
(c) The usual restriction that negative values of variables are not permitted.
Environmental quality is an exogenous variable so far as the minimum requirements are concerned (restriction (a)). It is an endogenous variable so far as realisation above the minimum requirement is concerned (production function 1). In other words, environmental quality is

determined either by the minimum requirement formulated in restrictions or by economic reasons if it pays to raise environmental quality above the minimum level.

The character of models which corresponds to this structure should be dynamic because of the dynamic characters of the two major relations (1) and (2). The soil conservation models applying optimal control theory correspond to this requirement (see below).

The positive experience with these models, particularly in the USA, cannot be easily generalised,[27] for the following reasons.

Production and environmental quality with respect to soil losses are positively correlated, at least in the long run. Farmers are frequently aware of the positive correlation as Saliba, Esseks and Kraft have shown.[28] Hence one can use the one-dimensional objective function of profit maximisation with some justification, assuming the minimum quality by the restriction (a). This corresponds in principle to the familiar practices already used for some time in farm planning.

In other fields, like maintenance or restoration of the diversity of the landscape, there is a positive correlation between production and environmental quality e.g. with respect to plant production. However, negative effects resulting from input requirements of land and labour clearly exceed the positive effects. As a whole there is an inverse relation between environmental quality and productivity. Hence, the one-dimensional objective function does not make sense. Models must show the trade-off between production and environmental quality in order to show what incentives are necessary to implement a corresponding policy.

Economists will therefore have to look for a simplified view, which leaves dynamic relations in the black box. A more simplified version of the problem might be described as follows.
Given are:
1. The objectives for environmental quality.
2. The measures to achieve these objectives within an acceptable time horizon. They may include investments which require capital and land, annual inputs of labour and capital and restrictions imposed on producers which limit their freedom of decision.
3. The (static) production function, which relates agricultural production to 'traditional' inputs at given stages of environmental quality.
4. The quantity of 'fixed' factors.
5. The prices of products and inputs.

The task is to find a solution which maximises the annual profit from production subject to technical restrictions which result from the nature of the production process and the usual restriction that negative values of variables are not permitted.

The environmental quality to be realised is given by the objectives, which are exogenous variables or, more precisely, the measures to achieve these objectives are the true exogenous variables of the model since the relations between measures and environmental quality are not explicitly considered. This is certainly a fundamental weakness of the

approach, but it corresponds to the present state of the arts which frequently permits the determination of only one point on the environmental function at best. We will have to live with this state for a while, especially since many ecologists do not understand the concept of an environmental function and are not prepared to intensify research in this field.

The present state of the arts justifies the static character of the model though it is applied in a dynamic world. It remains to be seen whether these disadvantages can be compensated for, at least partly, by comparative statics and simulation without entering the zone of measurement without data.

POLICY IMPLEMENTATION

Environmental problems are part of the category of externalities resulting from the conflict between individual and common interests. The major instruments to solve them are known:

research, in order to solve the problem by technical progress e.g. by biotechnology, thus making it non-existent as a problem,

education, in order to 'internalise' the problems and its social solution,

economic incentives,

regulations.

Research is the hope of policy makers. If biotechnology will do the job, public policy can avoid undertaking the unpopular task of promoting environmental quality by regulation or spending money that is not available. However, research might take too long and it seems questionable whether it can do the job alone unless fundamental changes in behaviour take place.

Education and extension, whose role has been emphasised by Saliba,[29] Esseks and Kraft,[30] are effective only if the measures recommended by policy correspond with the economic interests of individual farmers. Hence policy only has the choice between regulation and economic incentives, if the relations between environmental quality and productivity are inverse, as is mostly the case, except where strong soil erosion occurs.

Environmental policy-makers, usually short of financial means, tend to favour regulation. However, one has to consider that the farm sector is hard to control with its diversified structure of decision-making.

Farmers all over the world know their economic interests very well and they pursue them stubbornly. Especially in the market societies of the industrial countries they have been trained for generations to organise their farms according to the principle of maximum individual advantage. Environmental measures which are in conflict with the economic interest of individual farmers have therefore hardly a chance to be successfully implemented. One has to 'pay the farmers to love the land' as the *Economist* wrote recently. The institutional and the economic framework of the individual farms have to be shaped in such a way that the economic

interests of the farmers coincide with the 'production of environmental quality' at the desired level. What is good for the country has to become good for the farmers not vice versa. Taxes and subsidies are the major instruments of such a policy.

Economic research finds here a challenging field of activities. The task is not only to design the characteristics of an environmental policy but to co-ordinate these policies with other objectives of policy, like farm income, structural change, employment and, last and explicitly least, productivity. I believe the loss in productivity caused by the stronger consideration of environmental requirements has been frequently over-emphasised in this conference. Especially in the industrial countries with agricultural surplus production, greater environmental quality should be given priority over the increase in productivity.

NOTES

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[12]Edwards, C., 'The role of natural resources in regional economic growth'. (See pp. 692).

[13]Farrell, K. R. and Capalbo, S. M., op. cit.

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[18]Mayeux, A. and Martin, G., 'Integration of a non-food oil plant into the agrarian system with a view to increase means of production without energy constraints' (Poster 149).

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[30]Esseks, J. D. and Kraft, St E., op. cit.