

FUNDAMENTAL STRATEGIES FOR SUSTAINABLE AGRICULTURE

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ABSTRACT

We are living together on Planet Earth, which means that we have limited space available for our needs, and limited resources not only of oil and coal, but also of air, water and soil. Up until now, our economic activities have been carried out on the assumption that the Earth is limitless. However, the reverse is the case.

'Our Common Future', published in 1987, claimed that sustainable development is a common need for us all, and that the integration of ecology and the economy is necessary. The Economic White Paper of the Economic Planning Agency of the Government of Japan for 1990 also emphasized environmental issues, not in terms of immediate economic benefits but for future generations. For sustainable development, we need a new paradigm of economic activity, in which ecology or pedology is linked with the economy.

INTRODUCTION

Why are we so concerned with the concept of sustainability? It is a simple question but, I think, one with a profound meaning. Every day, we carry out routine economic activities. On what principle are these based? There are diverse opinions about this, but one thing they all have in common is that no theory from any School of Economics recognizes the fact that "the Earth is a limited sphere" (Kajii 1988). I was greatly impressed by the statement of Professor Kajii, at that time new to me, that there is no principle of economics which incorporates the concept of the limited sphere and resources of the Earth.

"Planet Earth" is quite a common term nowadays. "Limits to Growth", claimed by the Club of Rome, is another widely used phrase. When we first saw pictures of the beautiful Planet Earth taken from satellites and through remote sensing technology, it gave people's minds more of a global perspective, and they felt a renewed love for the whole planet. At the same time, we clearly recognized that the Earth has only a limited sphere for all human beings, and all the other living creatures which maintain the whole ecological system, including the soil.

It is important for those of us working in the fields of pedology and agronomy to recognize the significance of accepting that natural resources of air, soil and water are limited (Hamada 1991). Even in the arena of agriculture, we have environmental problems caused by present agricultural practices, such as non-point source water pollution (Crosswhite and Sandretto 1991). We must reconsider our present way of life, which is basically constructed on the concept that we have unlimited space.

HOW SHOULD WE VIEW THE EARTH AND HUMAN ACTIVITY?

The term "sustainable" has become quite common since the publication of '*Our Common Future*' by the World Commission on Environment and Development (WCED). In 1987, on 27th of April, at the Queen Elizabeth Hall in London, the Prime Minister of Norway, Mrs. Brundtland, who is also the Chairman of the World Commission of Environment and Development, released this report (Starke 1990). She said:

"Securing our common future will require new energy and openness, fresh insights, and an ability to look beyond the nar-

row bounds of national frontiers and separate scientific disciplines. The young are better at such vision than we, who are too often constrained by the traditions of a former, more fragmented world. We must tap their energy, their openness, their ability to see the interdependence of issues...”

She suggests that we must adopt a new paradigm based on a completely new value system.

“Our generation has too often been willing to use the resources of the future to meet our own short-term goals. It is a debt we can never repay. If we fail to change our ways, these young men and women will suffer more than we, and they and their children will be denied their fundamental right to a healthy, productive, life-enhancing environment.”

Her speech made it clear that we are consuming resources which must be transferred to the next generation. We must recognize that, because resources are limited, we need a sustainable way of life. Interestingly enough, the Economic White Paper issued by the Economic Planning Agency of the Government of Japan in 1990 was based on the same idea.

Japan’s Economic White Paper of 1990 looked at the environmental problems caused by human activity.

- As with the destruction of the ozone layer, and the greenhouse effect due to the increase in the carbon dioxide content in the atmosphere, the issue has become borderless. Influence and effects of our activities go beyond national territories.
- Even environmental concerns must come to be considered as a resource problem, since an unpolluted natural environment and air are also limited resources.
- It has become a “stock” problem rather than a “flow” problem. From the type of pollution which caused only a daily “flow” hazard, we have advanced to the type of pollution which can hardly be recognized on a daily basis but continues to accumulate as a “stock”.
- Distribution of the negative inventory continues down the generations. Even if there is not a very great hazard for the present generation, for the next generation it can become a real problem.
- The ‘north and south’ issue is involved.

Countries in the northern hemisphere are consuming far more resources and creating much more pollution than those in the southern hemisphere. It is unjust that countries to the south must suffer from the adverse effects without receiving any of the benefits, and are even expected to pay for the excesses of the north by e.g.. conserving forest rather than exploiting it.

- The concept of “sustainable development” or “sustainable growth” is becoming very important in people’s minds. If we recognize the fact that the earth has limited resources, we must pursue sustainability in every aspect of our economic activity. If we destroy our environment, we shall eventually destroy the foundation of our sustainable life.
- We cannot yet estimate qualitatively the danger of the environmental problems we are creating.

RECOMMENDATIONS MADE BY THE WORLD COMMISSION ON THE ENVIRONMENT AND DEVELOPMENT

In using the term “sustainable”, it is inevitable to refer to “Our Common Future”, commonly known as the Brundtland Report. Starke (1990) has given us a neat summary of the main points of the Report.

Revive growth: This is particularly important in developing countries, since poverty is a major source of environmental degradation. Industrialized countries can and must contribute to reviving world economic growth.

Change the quality of growth: Growth must be of a new kind, where sustainability, equity, social justice and security are embedded as major social goals. A safe, environmentally sound energy pathway is indispensable.

Conserve and enhance the resource base: Sustainability requires the conservation of environmental resources such as clean air, water, forests and soils.

Ensure a sustainable level of population: Population policies should be integrated with other programs of education, health care, and improving the livelihood base of the poor.

Reorient technology and manage risks: The orientation of technological development in all countries must change, and give more importance to environmental factors. In developing countries, the

technological innovation capacity needs to be greatly enhanced.

Integrate the environment and economics in decision-making: Sustainability requires taking wider responsibility for the impact of policy decisions. Policy decision makers must focus on the sources of environmental damage, rather than the symptoms.

Reform international economic relations: Fundamental improvements in international trade and finance are necessary, to help developing countries.

Strengthen international co-operation: High priority must be given to environmental monitoring, assessment, research and development and resource management in all fields of international development. New dimensions of multilateralism are essential for sustainable human progress.

One of the points which the Brundtland Report emphasizes is a strong concern for developing countries. It is also oriented towards the proper management of resources, not only of oil and coal but also of air, water and soil. The environment itself is considered as our main resource. The Report also emphasizes the necessity for decision makers to make decisions based more on environmental concerns.

The proposal to integrate the environment and economics means that we must change our present concepts of growth and economic activity. The monetary value system on which our major economic activities are now based should not be our major concern in the future. We shall have to pay more attention to the non-monetary values of clean air and water and healthy soil, which are not properly taken into account at present. Only by doing this can we integrate economy and ecology for our common future, and transfer the natural inventory which we inherited to the next generation.

We who work in the field of soil science are in a position to play a positive role in explaining what the value of soil is, and not just in monetary terms. We have only just begun to consider this, but a basic concept is the idea of conserving "Prime Land". This term first appeared in the "European Soil Charter" of 1972, issued by the European Council of the European Community. Buringh (1982) also pointed out that the loss of our prime arable land is more important than any other problem, including desertification, salinization or erosion of soil.

PEDOLOGY—THE PROCESS OF RECOGNIZING THE NATURE OF SOIL

Pedology is a branch of science which studies soil in an attempt to understand what it is, and the processes which form it. To do this, we must try to apply a holistic approach, while of course also using the same modern analytical procedures and methods used in chemistry, physics or biology.

A representative holistic approach can be explained by considering "Factors in Soil Formation". I think this term is commonly used by soil scientists, but we unconsciously accept the soil-forming factors of climate, soil microorganisms, relief, the parent material, time, and recently, human activity, without noticing that discussion of soil forming factors is necessarily based on a holistic way of thinking. It is a process of recognizing and understanding soil as a natural body with a very long history.

If we look back at the history of field sciences such as ecology and pedology, we can see that the two have quite a lot in common. Both fields of science began to take their present form at the beginning of the 20th century, at a time when the holistic approach was gaining ground, as represented in Smuts' book *Holism and Evolution*.

This book was reprinted in 1973, when environmental concern became an important movement all over the world. It is true that holism has sometimes had an unfortunate effect on scientific interpretation in the past. However, we must remember the important fact that pedology has a holistic approach built into its framework, although the holistic approach alone can accomplish nothing.

A TENTATIVE KEY CONCEPT — "PEDOLOGICAL VALUE"

In a previous section, it was pointed out that we have been carrying out our activities as if the earth were limitless, a concept reflected in current economic theory. Since in fact the earth and its resources do have a limit, this is not a sound basis for future progress, which is why the need for a new paradigm is so widely felt (Brown 1991). There is even a proposal that a "green tax" should be levied, to promote a sustainable way of life.

According to *Our Common Future* (1987), it is necessary to integrate the environment with economics in decision making. The same concept has appeared in *Beyond Interdependence* (MacNeil *et al.* 1991), which had as its subtitle "*The Meshing*

of the World's Economy and the Earth's Ecology".

As in the case of the proposed green tax, this may be a way to secure clean air, water and soil resources for future generations who are otherwise likely to face a shortage of fundamental resources.

In order to restructure the concepts on which our economic activity is based, we must go beyond our present focus on monetary values. It is now time for us to incorporate non-monetary values in the skeletal structure of a new paradigm. The recent appearance of a new publication, the *Journal of Environmental Values*, may play an important role in promoting the concept of non-monetary values.

A project has recently been carried out by the Environmental Agency of the Government of Japan, under the leadership of Professor Okutomi. In this project, I had the task of evaluating soils, not in terms of their potential for agricultural production, but in terms of their conservation value (Hamada 1977). At that time, this evaluation simply consisted of giving soils in the sample area a rating based on the thickness of the layer of mature soil organic matter which made up their topsoil, and estimating the length of time required for this layer of organic matter to mature.

The concept of non-monetary values in pedology may lead us to one of "pedological value". I should like to use the term "pedological value" as a tentative key concept for linking pedology with a new concept of economics in human activity. It is not new for land use to be considered from an ethical viewpoint. Warkentin (1977), for example, referred to a statement by Leopold:

"It is inconceivable to me that an ethical relation to land can exist without love, respect and admiration for land, and a high regard for its value. By value, I of course mean something far broader than mere economic value; I mean value in the philosophical sense..."

A new paradigm which gives soil its proper value is likely to include the time factor in soil formation, and the eventual product after the elapse of time (Hamada 1988). Within a certain period, soil might be given a higher pedological value as time passes, and as the processes of organic matter formation and humification continue. This pedological value could be considered to increase with the elapse of time.

Humification studies on the organic matter in buried humic horizons may suggest one way in which soil can be evaluated. Another method would be to determine the pedological value based on the

elapse of time up to a limit of 10,000 years (Yoshida *et al.*). To examine the characteristics of organic matter, the Kumada method (now called the Nagoya method) was used. The results obtained indicated that for soil to reach its maximum level of humification with a relatively low molecular weight fraction of humic acid took about 4,000 years. With a relatively high molecular weight fraction of humic acid, this process took about 7,000 years.

If these facts become widely known, it will be obvious that we should respect soil for its age, and understand how the incorporation of organic matter has increased its capacity to sustain living creatures, including human beings.

CONCLUSION

As we realize that we are living on Planet Earth, a limited space, it becomes necessary for us to develop a new concept or paradigm which will enable the next generation of human beings, and those coming after them, to live in a sustainable way.

Emphasizing the concept of non-monetary values is becoming more important because it is increasingly obvious that our present world economy, based mainly on monetary values, cannot survive much longer. As far as pedology, is concerned, it is now an appropriate time to propose "pedological value" as a key concept for a fundamental strategy of land use, as part of a way of life.

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