Changing Agricultural Opportunities: The Role of Farming Systems Approaches

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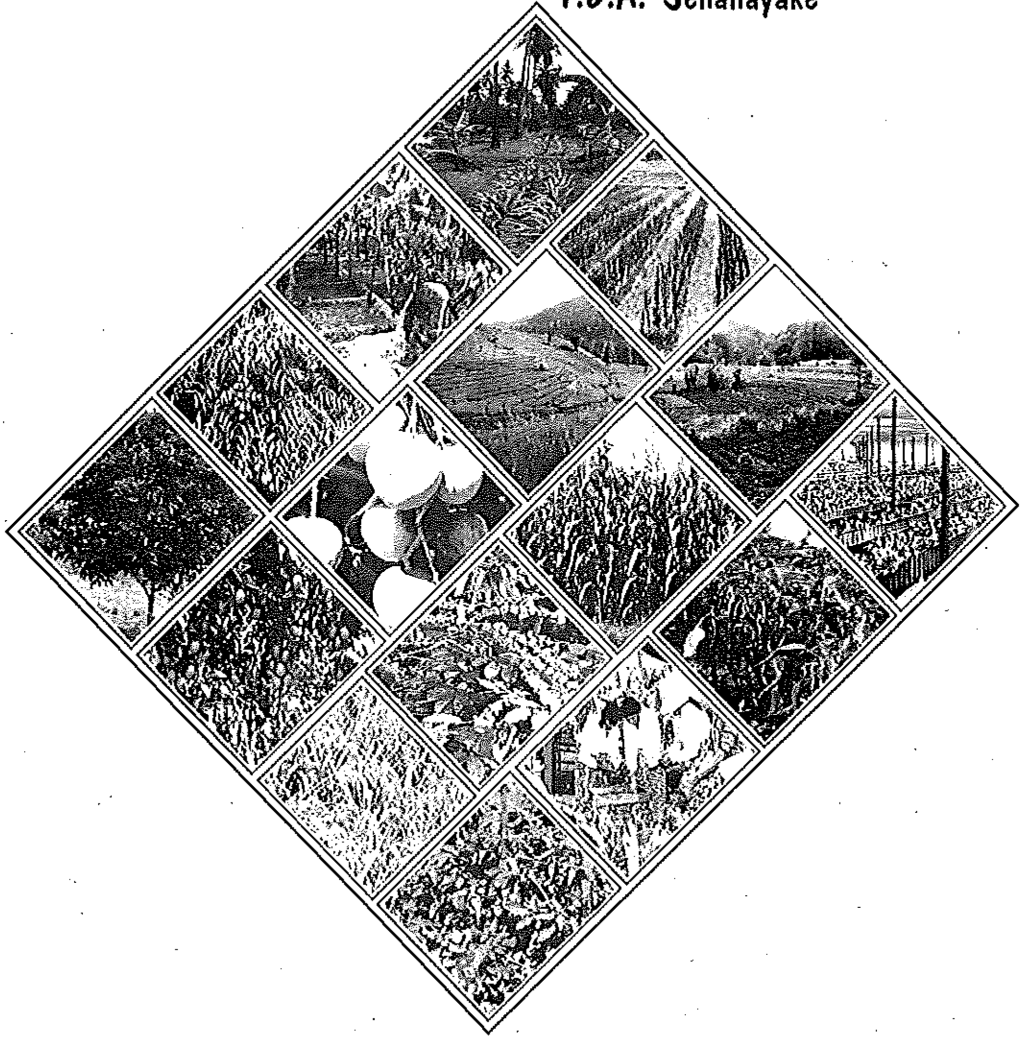

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Forum 2: Sustainability Indicators

Forum 3: *Gender Issues*

FORUM 2: SUSTAINABILITY INDICATORS FROM FARM TO WATERSHED - A SYNTHESIS OF ISSUES

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Introduction

Sustainability has become the "in" concept with donors and development planners. The level of interest is amazing given the fact that researchers are still debating what the term really means and how best to measure it. Sustainability is a complex concept that is associated with many different parameters. Biologists commonly talk about sustainability in terms of recycling of energy and nutrients and ecological resilience. Social scientists associate sustainability with economic (resource use efficiency, stability, and productivity) and with the social and cultural issues (including quality of life, access to resources and equity in distribution of income) and policy setting.

For some, sustainability indicates a desired state, a goal to strive for, to others it is a process, the results of which can only be seen over time. The early efforts to define what was meant by sustainability succeeded only in demonstrating how complex the issue really is. A recent FAO report identified 48 different definitions but noted that few can be operationalized in the field (FAO, 1996). Even though no single definition is ever likely to emerge, there does appear to be a general feeling that at least with respect to agriculture when we use the term sustainability we are referring to a production system that is capable of meeting or exceeding the basic food and fiber needs of a population without causing irreversible damage or degradation to the environment and the natural resource base.

Within the context of agroecosystems analysis, Conway (1987) sees sustainability as the ability of a system to maintain a given level of productivity over time, even when subjected to environmental stress and shock. He and others (Rambo and Sajise, 1985) see sustainability as one of several system properties (productivity, stability, diversity, equitability, solidarity, autonomy and adaptability). The key is the interaction and possible trade-off between the properties. The notion of properties is useful in monitoring the impact of change across different sectors and at different levels but ultimately, an operational definition of sustainability will depend on who wants to sustain what, why and how (SUAN, 1993).

In the context of development, the Bruntland Commission (World Commission on Environment and Development, 1987) defined sustainability as a development process which meets the needs of the present without compromising the ability of future generations to meet their own needs. The indication here is that sustainability is directly linked with how humans use or manage the natural resource base to meet present and future needs. In this sense, the concept of sustainability brings together the notions of economic growth (productivity), human needs (food and shelter) and environmental degradation (Elliot, 1994). The central implication of the Bruntland Commission study for research on agricultural sustainability is that infinite economic growth based on expansion of current use patterns of a finite natural resource base is not possible. This suggests that sustainability of agricultural production will involve some kind of transformation in how we manage our natural resources.

The complexity of agricultural systems and the complex nature of the sustainability concept requires sets of indicators that match different disciplinary (ecology, economics, sociology, history) perspective and span different spatial and temporal scales. Suitable indicators at the farm level may not be applicable at the watershed level and vice versa. Nutrient balances and imbalances, for example, are difficult to quantify at field and farm levels but are important catchment and watershed level indicators.

It is also important to recognize that it is not just the various disciplines that have specific ways of looking at sustainability. Different stakeholders also have varying ways of looking at sustainability. Perhaps a common set of at least qualitative indicators is needed to facilitate communication and consensus building among the different stakeholders and decision makers including, farmers, researchers and regional and national level planners.

An electronic conference on sustainability indicators (INFORUM 1993-1994) proposed the following scheme, suggesting that indicators needed to be identified for the socio-economic and bio-physical systems across multiple levels.

Global - Socio-economic system
National - socio-economic system
Community
Farm
Crop/Trees
Soils - bio-physical system
Landscape - bio-physical system
Watershed. - bio-physical system
Global - bio-physical system

(Hart, 1994)

Figure 1. Hierarchy and levels of sustainability indicators.

This approach makes a key distinction between the social and economic and bio-physical parameters. A more recent FAO-sponsored working session suggested that sustainability of agricultural practices should be considered within three categories - Ecological (including biological and physical features) Social/Cultural/Political and Economic. In order to predict the likely consequences of a particular resource management strategy, it is necessary to ascertain the short and long range impact across time and levels of social and ecological organization.

A case from the Philippines makes this point very clear. Based on an analysis of the changing levels of biomass recycling, we felt that individual farming systems in the project site were moving in a direction towards more sustainable and environmentally sound resource management practices. What our farm level indicators did not reveal was the fact that at a higher level, plans were being made that would result in the whole area being converted to an industrial park. This conversion actually took place in a period of less than two years. Farmer priorities quickly changed from resource management to maximizing financial compensation they would receive from the landowner. Can we say that a system is really sustainable when forces at one level are negating positive actions at another level? Clearly when we look at sustainability in a broader context than field level production or on-farm efficiency, we will need to address a variety of issues that are beyond the capability of conventional farming systems research.

While it is difficult to agree on reliable indicators of sustainability, we have many indicators of <u>unsustainable</u> natural resources management such as soil loss/erosion, reduced forest/plant cover, loss of biodiversity, salinization and acidification of soils, groundwater and surface water pollution, and perhaps global warming. We need indicators of sustainable natural resource management that are simple and easy to measure, low cost, accurate, and relevant. The indicators should have meaning and value for the various resource users (farmers, researchers and decision-makers). Without going further in terms of introduction, we would like to refer back to the five issues that the symposium organizers hope that this group will be able to address, namely:

- Trade-off and linking different disciplinary perspectives - ecology, soils (land degradation), economic, sociological (equity) and agronomic (production)
- Complementarity and conflict between farmer indicators and those of the scientists and policy makers
- Systematic definition of different indicators for different users
- Tools and techniques for monitoring indicators at different system levels
- Farmers utilization of indicators of degradation in national resources in family and community decision-making

With these in mind, we will briefly attempt to highlight what I believe are the key points made by the different papers related to the theme of sustainability indicators.

The paper by **S.S. Magat** (the Philippine coconut study) deals exclusively with one indicator - which also happens to be the most often applied indicator - namely productivity, defined in terms of physical yield (biomass converted into copra using the nut to copra conversion index). The methodology is based on standard procedures and can be considered only one indictor for sustainable yield of a single crop. This is clearly a researcher defined indicator that may not have the same meaning for stakeholders (small farmers, large scale producers, traders and commercial consumes of copra).

Broadening the scope somewhat, a second contribution from the Philippines, the paper by **A.C. Rola and E.P. Tagarino,** suggests the need to look at measures of sustainability across multiple sectors. The authors identify two basic components of agricultural sustainability:

- land and other agricultural resources
- population

Agricultural growth is monitored and quantified through measures such as: yield per unit area; income per unit area; proportion of inorganic fertilizer cost to total cost of production; proportion of pesticide cost to total cost per unit area; proportion of agricultural to forested areas (min. 30% should be forested); availability of food; cropping index (cropping intensity - i.e., no. of crops per year per unit area). Population parameters include common social indicators: birth rate, death rate, net migration rate, and age at first marriage.

The authors further suggest that local government programs to promote agricultural sustainability should emphasize women's productivity and delay of first marriage; sanitation and nutrition; family planning and birth control; as well as (re)forestation of watersheds (+30%); reduced soil erosion and minimize pest resistance through promotion of various initiatives. Measuring sustainability will require established indicators plus a temporal dataset. People at the local government level must be trained in the identification of indicators and the generation, maintenance and analysis of temporal datasets. The case study from Northern Thailand by **S. Praneetvatakul and W. Doppler** argue for a farming and regional approach involving data collection at the farm, village, regional and environmental levels. The authors suggest that an indication of unsustainable utilization of the natural resources base is a decrease in fuelwood supply within rural communities while consumption/demand increases. Indicators of the severity of the problem are: the cost of alternative fuel sources that households are willing to shoulder; the amount of time/labor spent on fuelwood collection; and aggregate wood consumption versus actual wood supply.

In the study by **P. K. Joshi, S. P. Wani, V. K.Chopde and J. Foster** from India on farmers' perceptions of land degradation, the authors suggest that understanding farmers' perceptions of this process is crucial in the planning of measures to reverse land degradation. Based on an RRA assessment, the paper suggests a number of indicators of land degradation including top soil erosion; soil nutrient loss; soil salinity; water logging; and yields that can only be maintained over time through increasing applications of inorganic fertilizers - as observed by farmers.

This paper emphasizes the fact that different stakeholders perceive a particular problem differently and have different ways of (verbally) expressing a particular phenomenon - in this case land degradation. It is not clear from the paper though as to which indicators/measures were farmer derived and which were researcher defined. The authors note that awareness is necessary but insufficient in itself to generate significant efforts on the part of farmers to control soil erosion or to expend much effort to rehabilitate severely degraded lands.

The paper from Nigeria by **R. A. Omolehin, A.O. Ogunbile, J.O. Olukosi and S. A. Ogunwale** describes a system of mix cropping that appears to offer higher yields and profitability than the traditional system of sole cropping. The author's report that in addition to increased yields, that mixed cropping of improved millet and cowpea allows fuller use of light, nutrients and water, and tends to reduce the negative effects of erosion. They also suggest that this system reduces the risk of crop failures from pests and disease and provides a greater variety of foods for household consumption. While not directly focused on sustainability, the study does suggest a range of factors - production, income, soil fertility and soil loss - that would need to be measured over time to determine the potential sustainability of this management system.

The paper from Pakistan by **M. H. Panhwar and F. Panhwar** on sustainable methods for fruit crop production provides a wealth of information and suggestions for maximizing the use of agricultural wastes and by-products to increase and sustain the production of horticultural fruit crops. Much of the methodology appears to build on the assumption that recycling of organic material is a major component in environmentally sound agricultural production systems. The work suggests a number of biophysical indicators of sustainable agriculture systems.

The last paper, by **Xavier Simon Fernandez,** discusses some of the constraints to sustainable rural development from an agroecological perspective. He notes that in designing sustainable agroecosystems, it is impossible to separate the agrarian from the socio-economic and ecological components of the system. In fact, he suggests that the major constraints are likely to be social and political, rather than technical in nature. Given the fact that agriculture is dependent on natural resources and ecological processes as well as human technical developments, the author argues that it is unconscionable to support changes in the agrarian sector without considering similar changes in the interrelated aspects of the larger social system. Given the complexity and inter-relatedness of such system, it's argued that the design of sustainable technologies must emerge from integrated research that addressed the natural and socioeconomic influences on production systems. He argues that a key indicator of sustainability is the degree to which rural production systems are in harmony (rather than in conflict) with the natural ecological processes.

In summary, it seems that the papers in this forum reinforce the notion that sustainability must be measured across sectors and at different levels. Four of the papers focused on the relationship between agricultural productivity and environmental degradation. One emphasized the difference between farmer and research perspectives and another paper emphasized the relationship between agriculture and population growth. Hopefully, these brief comments and the specific case studies reported in the papers will provide the basis for a stimulating discussion of what sustainability can or should mean in the context of farming systems research and how we can monitor and measure it.

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