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Economic and Environmental Perspectives on Sustainable Agriculture Developments

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Economic and Environmental Perspectives on Sustainable Agricultural Developments[1]

by

Clem Tisdell[2]

September 1995

[1] Notes prepared for a lecture given in July 1995 in the Centre for Integrated Resource Management, The University of Queensland in the course 'Agri-Industries Development and Environmental Management'.

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Research for ACIAR project 40, *Economic impact and rural adjustments to nature conservation (biodiversity) programmes: A case study of Xishuangbanna Dai Autonomous Prefecture, Yunnan, China* is sponsored by the Australian Centre for International Agricultural Research (ACIAR), GPO Box 1571, Canberra, *ACT,* 2601, Australia. The following is a brief outline of the Project

Rural nature reserves can have negative as well as positive spillovers to the local region and policies need to be implemented to maximise the net economic benefits obtained locally. Thus an 'open' approach to the management and development of nature conservation (biodiversity) programmes is needed. The purpose of this study is to concentrate on these economic interconnections for Xishuangbanna National Nature Reserve and their implications for its management, and for rural economic development in the Xishuangbanna Dai Prefecture but with some comparative analysis for other parts of Yunnan

The Project will involve the following:

1. A relevant review relating to China and developing countries generally.
2. Cost-benefit evaluation of protection of the Reserve and/or assessment by other social evaluation techniques.
3. An examination of the growth and characteristics of tourism in and nearby the Reserve and economic opportunities generated by this will be examined.
4. The economics of pest control involving the Reserve will be considered. This involves the problem of pests straying from and into the Reserve, e.g., elephants.
5. The possibilities for limited commercial or subsistence use of the Reserve will be researched.
6. Financing the management of the Reserve will be examined. This will involve considering current sources of finance and patterns of outlays, by management of the Reserve, economic methods for increasing income from the Reserve and financial problems and issues such as degree of dependence on central funding.
7. Pressure to use the resources of the Reserve comes from nearby populations, and from villagers settled in the Reserve. Ways of coping with this problem will be considered.
8. The political economy of decision-making affecting the Reserve will be outlined.

Commissioned Organization: University of Queensland

Collaborator: Southwest Forestry College, Kunming, Yunnan, China

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Economic and Environmental Perspectives on Sustainable Agricultural Development

1. Introduction: Economic Activity and the Natural Environment

Economic Sustainability requires are of the natural environment

There is a great deal of concern today to ensure that economic development, including agricultural development, is sustainable. It is being increasingly emphasized that this sustainability requires care to be taken of the natural environment. This is because the natural environment is both the source of important resources that support economic activity and an avenue or sink for disposal of wastes from economic activity.

Soil and water are for example, important natural resources used in agricultural production. However, other natural resources used in agriculture include the raw materials from which many fertilisers are produced, fossil fuels and so on. In addition, wild cultars and relatives of cultivated plants and domesticated livestock provide a genetic reservoir that may be very useful in sustaining agricultural production.

If attention is not paid to the sustainability of economic production, future generations may be impoverished and even present generations may experience a future drop in their incomes. For example, this result clearly follows when land management or its use results in a rapid rate of soil erosion and loss of the valuable topsoil.

Connections between economic systems and the natural environment

The main connections between the economic system and the natural environment can be illustrated by Figure 1. The economic system (including the agricultural economic sector) may fail to sustain itself because (1) it produces wastes and pollutants which cannot be readily absorbed by the natural environment so reducing the quality or availability of natural resources or (2) because the economic system irreversibly depletes natural resources.

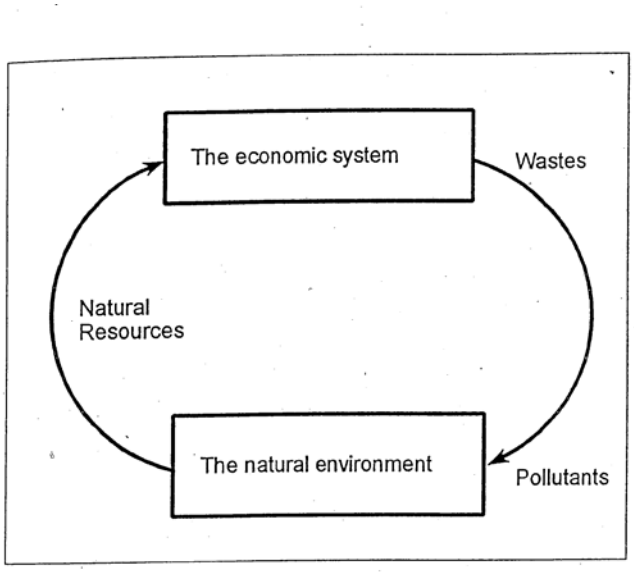

Figure 1 The sustainability of the economic system depends heavily on the conservation of the natural environment.

Whether or not wastes or pollutants from economic activity are a threat to the integrity of the natural environment depends upon their volume and the type of pollutants produced. Within limits, the natural environment can assimilate some pollutants or wastes. The problem today is that many of these limits have been surpassed and that some substances are being produced which even in small quantities have serious environmental impacts such as some of the ozone-depleting substances. Depletion of the ozone layer leads to an increase in UV-B radiation which in turn increases the incidence of a number of cancers and can also reduce plant growth. Another well-known effect that could reduce future production, including agricultural production, is the greenhouse effect. These are global environmental effects, but localised pollution problems can also be important for agriculture, e.g., the release of toxic substances from factories, which contaminate irrigation water or cause air-borne pollution of (crops.

Offsetting natural resource depletion and emissions of pollution

In general enhanced economic activity leads to increased natural resource depletion. This is clear in the case of non-renewable resources such as minerals. However, it can also happen for renewable resources such as natural forests. Many types of natural resource depletion are irreversible e.g., the extinction of a wild species. Pollution also can permanently damage natural resources or reduce their useability. Such factors tend to reduce the productivity of

economic systems.

The main factor that can offset this reduction is technological progress. As a rule, it enables more economic output to be achieved with fewer resources. It has been a major factor in enabling economic production to increase despite resource depletion and increased pollution. However, the extent of continuing technological progress is uncertain.

For a time, investment in man-made capital may also offset the impacts of resource depletion. But the production of man-made capital involves the conversion of natural resource stocks into .such capital. This further depletes natural resources and all man-made capital has a limited life. So man-made capital accumulation is unlikely to be a suitable long-term offset to natural resource depletion.

Strong and weak sustainability

Those economists concerned that natural resource depletion and deterioration could limit future economic growth or undermine economic production can be divided into two broad groups (see Pearce, 1993):

1. Those who believe that any further depletion or deterioration in the natural environment is likely to have disastrous consequences for the sustainability of economic production. This group believes that strong conservation measures are needed to sustain economic production. They do not favour using the environment as a source for production of more man-made capital. If some use of the environment occurs, they favour the use of offset policies to counteract it (see Tisdell 1993, Ch. 8). For example, if an electricity station is built and uses coal, the company may be required to plant trees to absorb the extra carbon produced. Some Dutch electricity generating companies have planted forests in Brazil to act as sinks for carbon dioxide to offset their release of carbon dioxide by burning fossil fuels.

2. A second group of economists who are also concerned about natural resource depletion and deterioration do not recommend such strong conservation measures. They support weaker conditions as a means to increasing sustainability of economic production. For example, a reduction in natural environmental resources would be allowable if this was used to provide resources for research which resulted in technological progress. Nevertheless, even this group believes that caution is needed

in making such trade-offs.

2. The Precautionary Principle

Most of those favouring policies for sustainable development stress the importance of a precautionary principle. This involves planning which anticipates future possible environmental consequences. It is a matter of looking before one leaps.

This approach is considered important in relation to the environment because many environmental changes are irreversible or can only be reversed at a great cost. Furthermore caution is required because the environmental impacts of many of mankind's activities (particularly new economic activities) are uncertain. Again, there may be little or no forewarning of an environmental collapse or by the time the collapse becomes apparent, it may be impossible to take countervailing action which will avert the disaster.

3. Sustainable Agricultural (and other) Techniques or Systems of Land Management

There has been a great deal of interest in the sustainability of agricultural (and other) techniques of economic production. Whether or not a technique is likely to be sustainably used appears to depend on three factors:

1. The biophysical sustainability of its use.
2. Its economic viability.
3. Its social acceptability.

A really sustainable agricultural technique would be one that is economically viable, socially acceptable and biophysically sustainable. In Figure 2, if A represents the set of available economically viable techniques, B and C is the set of socially acceptable techniques and C is the set of biophysically sustainable techniques, only those in the overlapping set (dotted) would be fully sustainable. In practice we cannot be sure that such sets will overlap. However, it is possible that they may be made to do so as a result of extra research and development. Many agricultural research bodies (including international research bodies such as those belonging to CAGIAR) have now included sustainability of agricultural techniques

in their research agenda.

This discussion can be further extended by considering what would be required for economic viability, social acceptability and for biophysical sustainability.

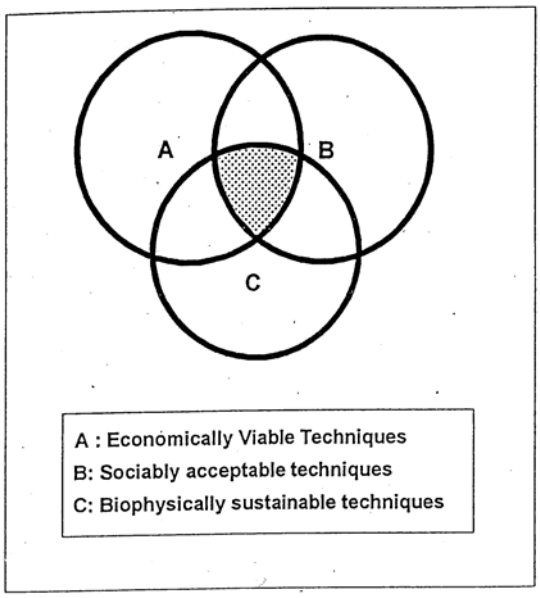

Figure 2 : Basic requirements for the sustainability of agricultural techniques

Gordon Conway (1985, 1987) or example in considering the evaluation of agricultural systems appears (1) to measure economic viability by level of returns or yields taking account of the degree of instability of these (2) social acceptability by the impact of these techniques on the distribution of income and (3) biophysical sustainability by the ability of yields to recover to former levels after being subjected to an environmental shock.

Conway considers that on the whole traditional agricultural techniques are more sustainable and have a better income distributional or equity consequence than modern agricultural techniques. On the other hand, they give a lower level of returns than modem techniques but their returns may be more stable.

Basically Conway defines sustainability in biophysical terms, that is the ability of yields to return to former levels after experiencing an ecological shock. For the cases illustrated in Figure 3, (3a) is a sustainable case and (3b) illustrates an unsustainable case.

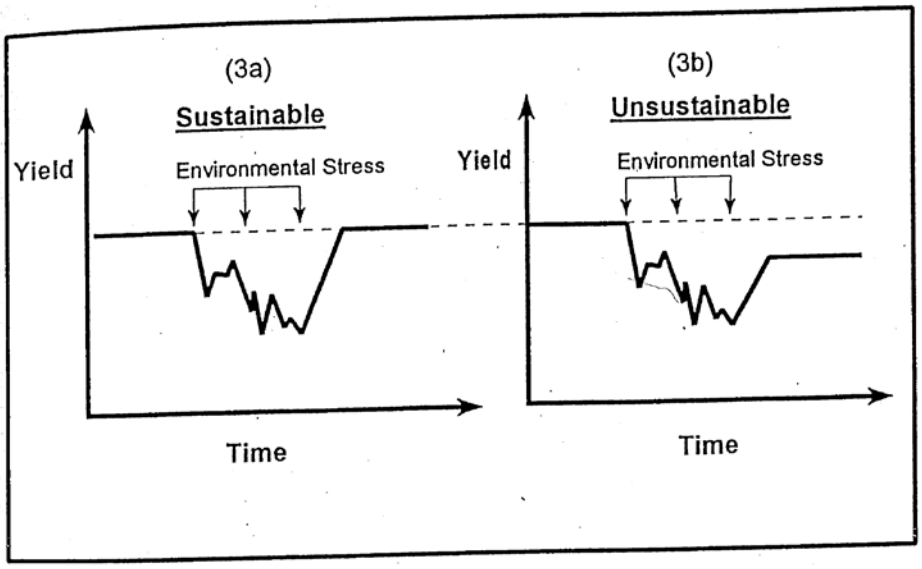

Figure 3 Sustainable and unsustainable agricultural systems according to Conway (1985, 1987)

Views have also been expressed about what may be required for social sustainability and for economic sustainability, but I shall not discuss these here. Some writers for example, have suggested that 'community' or communal cohesion must be retained for social sustainability to be achieved.

4. Normative and Positive Attitudes to Sustainability - What is versus what ought to be

We can consider whether something is sustainable such as income or yields from a crop using a particular technique. This is a positive approach to sustainability. Another approach is to consider whether it is desirable for some particular thing to be sustained. This is a normative approach.

It cannot be over stressed that sustainability is of little value in itself and rather meaningless unless we specify sustainability of what. Indeed, there are some situations which it would be undesirable to sustain, e.g., poverty.

Very often a clear distinction is not made between what it is desirable to sustain and what can be sustained. One needs to look critically at discussion from this point of view. For example, those recommending strong condition for sustainability may do so because (1) they have

ecocentric values or (2) believe that given current conditions any further reduction of natural environmental stocks will threaten the economic well-being of future generations or (3) because they hold both viewpoints.

5. Economics and Sustainability of Production

Economic activity will only be sustained by the private sector as long as it is profitable. Unfortunately, private economic decisions do not ensure long-term sustainability of environmental resources or production.

Private economic greed can threaten sustainability

Desire to make large short-term profits may motivate individuals to destroy natural resources such as forests, drive species to extinction and the mine the land. This could also occur because people are desperately poor but in this case their power to transform the natural environment is rather limited because they lack capital. This may occur even when private rights to property are fully secured in land and natural resources. This is not to say that market economic systems do not support conservation of natural resources in some case. They do as long as this is privately profitable.

Inappropriate property rights threaten sustainability

In many cases, *lack of property rights* is a disaster from a conservation or sustainability point of view. This is so for *open-access* resources, that is a resource which all are free to exploit. In the past, fishing stocks were brought to extinction or close to extinction by open-access e.g., consider the stock of whales.

Private economic viability versus social economic benefit

Private economic profitability of the use of a technique or agricultural system is necessary in most economies if the use of the technique is to be sustained. However, this does not mean that the technique is socially desirable or that its social economic return is positive. The private costs of using a technique may be less than its social cost because some of the costs are passed onto others without compensation. For example, the clearing of land for agriculture may increase water run-off and increase flooding and erosion downstream imposing costs on other farmers. The flow of streams may also become more erratic and so

impose additional costs on others.

Similar problems may occur in shared water bodies. Wastes may be disposed of in such bodies by economic agents and impose costs on others. The uncontrolled withdrawal of water from such bodies for irrigation can result in water shortages and a crash in agricultural production dependent on such irrigation.

Private and social returns from projects or economic activity need not coincide. This will be the case when significant environmental spillovers or externalities arise from private economic activity. Thus three possibilities exist:

1. Projects that are privately economically viable but give a *negative* social economic return.
2. Projects that are privately economically viable and also give a *positive* social economic return.
3. Projects that are not privately economically viable but which give a *positive* social return. These three possibilities are illustrated in Figure 4.

Group 1 is unacceptable from a social point of view and are likely to threaten the sustainability of production. Measures should be taken to prevent economic entities, e.g., farmers, engaging in these activities. Group (2) appears socially desirable and are likely to be adopted. Projects in group (3) are socially beneficial but will not be undertaken by private business. It would be desirable as far as group (3) is concerned to adopt policies to make these projects privately economically viable (for example, they might be subsidised by the government) or to have these projects undertaken by the government.

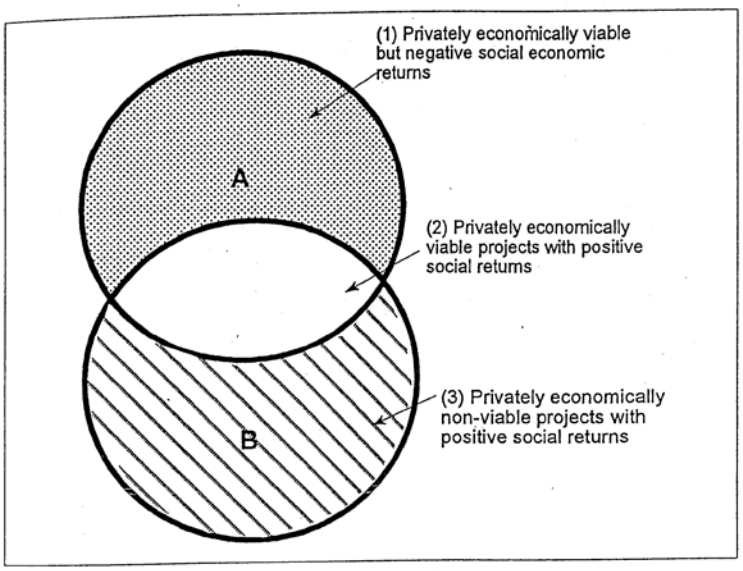

Figure 4 Due to environmental spillovers or externalities, private and social benefits from economic projects may differ. The above diagram indicates three alternative possibilities.

6. Complexities

It is not possible in one lecture to introduce you to all the complexities involved in considering polices for and approaches to sustainable agricultural development and sustainable development generally.

However, as far as sustainable development is concerned, there are two important general aspects to consider. These are:

1. Obtaining the appropriate *balance* between different economic activities and,
2. Ensuring that the *scale* or aggregate level of economic activity is kept within bounds likely to be reasonably harmonious with the maintenance of economic activity, given the dependence of economic activity on conservation of natural resource. (See Figure 1).

Both aspects are important for economic sustainability. Even if we get the balance between economic activities 'right', production may prove to be unsustainable because of the increasingly massive scale on which natural environmental resources are being utilised The increasing scale is due to rising world populations and the desire for ever increasing levels of

per capita income.

Sustainability of use of agricultural techniques in a dynamic context

The world is subject to continual change. Consequently techniques of production (agricultural techniques) which seem to be sustainable in a stationary setting or one of little change may not be viable in a changing world. For example, shifting or swidden agriculture may be very sustainable at low levels of population density, but becomes unsustainable as population densities increase and the length of the cultivation cycle becomes shorter. This has happened in a number of parts of the world where shifting agriculture is practised. In such circumstances, it is important to search for alternative agricultural techniques which may prove to be more sustainable in the changing circumstances. This illustrates the importance from a policy point of view, of making the best sustainability- adjustment when particular trends are apparent and cannot be counteracted.

7. Case Studies Involving the Economics of Natural Resource Management

For case studies involving the following subjects:

(a) the sustainability of conservation farming projects, and,
(b) environmental economics and sustainable aquaculture,

(see Tisdel11995a, b).

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