ISSN 1444-8890

ECONOMIC THEORY, APPLICATIONS AND ISSUES

Working Paper No. 11

Sustainability: Can it be Achieved?
Is Economics the Bottom Line?

by

Clem Tisdell

October 2001

THE UNIVERSITY OF QUEENSLAND

ISSN 1444-8890
ECONOMIC THEORY, APPLICATIONS AND ISSUES
(Working Paper)

Working Paper No.11

Sustainability: Can it be Achieved? Is Economics the Bottom Line?*

by

Clem Tisdell†

October 2001

* Draft of a contribution to M. Quaddus and A. Siddique (Eds.) (2002) *A Handbook of Sustainable Development Planning: Studies in Modeling and Decision Support*, Edward Elgar, Cheltenham, UK. An earlier version of this article appeared as Working Paper No.41 in the *Economics, Ecology and Environment* Series.

† Professor of Economics, The University of Queensland, Brisbane 4072 Australia.

WORKING PAPERS IN THE SERIES, *Economic Theory, Applications and Issues,* are published by the School of Economics, University of Queensland, 4072, Australia.

For more information write to Professor Clem Tisdell, School of Economics, University of Queensland, Brisbane 4072, Australia or email c.tisdell@economics.uq.edu.au

Sustainability:
Can it be Achieved? Is Economics the Bottom Line?

Clem Tisdell

1. Introduction

To many, it will seem obvious that economics must be the bottom line in determining whether sustainability will be achieved in practice. There can be little doubt that in our increasingly market-driven and globalising world, the bulk of individuals and groups act to promote their own economic interest. Economic self-interest is an extremely strong motivator of human actions. When economic self-interest clashes with (social) sustainability goals, these latter goals are unlikely to be met, and some government intervention may be desirable to bring private self-interest into line with the socially perceived interest. Intervention could, for example, take the form of taxes or charges on pollution emissions, or prohibitions on environmental damage backed up by penalties for non-compliance such as might apply to illegal tree-clearing.

But obvious formulation of problems are often deceptive. For example, the economic bottom line for business or individual may be different to that for a society. Questions may also be raised about the extent to which individuals act in their own selfish economic interest, narrowly conceived, and the extent to which they are influenced by moral dimensions (Etzioni, 1988, 1991; Tisdell, 1997). The basis of human action is quite complex.

However, before giving some further attention to this matter, the meaning, desirability and possibility of achieving sustainability is considered and an opinion is given as to whether the goal of sustainability is a useful guide to human action and public policy. Then attention turns to the sense(s) in which economics is the bottom line for sustainability, and how the economic

bottom line(s) is (are) related to social and environmental bottom lines. Then relationships between values and sustainability are explored before examining whether sustainability can be achieved and what are the consequences if it cannot be.

2. Sustainability: An Enigma or a Clearcut Guide to Policy? Weak and Strong Conditions for Sustainability

Many individuals think it is desirable that policies be devised to achieve sustainability. But this objective is meaningless unless one specifies what should be sustained. Is it development which should be sustained, is it biodiversity or something else? In order to have any policy relevance, one must specify what is to be sustained, what is the object of the sustainability.

Even then, one is not necessarily out of the woods because the object may not be stated in a precise or operational manner. For example, views differ about what constitutes development so different views can exist about what aspects of development should be sustained. Clearer definitions are possible but these definitions will not satisfy everybody. For example, some economists (e.g. Tietenberg, 1988, p.33) define sustainable development as development that ensures the income of future generations is not less than that of current generations. But this will not satisfy individuals who believe that development involves broader considerations. For example, if this aim of achieving non-declining incomes is met at the expense of personal freedom, reduced social cohesion or increasing personal stress and tension, many would not regard it as development at all. So one has to define terms carefully to avoid vagueness and misunderstanding. Some of the varied definitions are outlined in Tisdell (1993).

It has become fashionable to consider 'sustainability' as being desirable, in some general way. But sustainability of many things is undesirable. Few would want to sustain injustice, poverty

and involuntary unemployment. Sustainability in itself is not a virtue, although there are several things that do seem worth sustaining such as our relatively liberal society.

Having clearly defined the object to be sustained and having obtained agreement about this end, the next matter is to consider whether the purpose can be achieved and how can it be achieved. It is possible that what one wants to maintain cannot be sustained because of the operation of natural or social principles. For example, given the entropy principle, it may be impossible to sustain global economic growth in material production forever, even though by careful choices we may sustain it for longer than otherwise.

A further problem is that if sustainability of several attributes is desired, it may be impossible to achieve this simultaneously. Sustainability of one attribute may have to be forgone to achieve sustainability of another. For example, some loss in biodiversity may be needed to sustain incomes. Trade-off between sustainability objectives is often necessary.

A question that has exercised the mind of some economists is how do we achieve sustainable development in the relatively narrow economic sense of ensuring that the income of future generations is not less than that of present generations. Orthodox economists and neo-Malthusians give different answers to this question of how, but all agree that it depends on current generations leaving a suitable bequest for future generations. The difference of opinion is about what constitutes a suitable bequest.

Orthodox economists have generally seen the provision of man-made capital as the most suitable bequest for future generations. This capital is defined as the produced means of future production and consists of such items as factory machinery, tractors, dams, buildings, infrastructure and even education, although the material forms of capital until the 1950s tended to be stressed to the

relative neglect of human capital. Karl Marx fervently believed that capital accumulation was the key to improving economic welfare. He was strongly in favour of the accumulation of capital, a message not lost on Stalin and Mao Zedong, but Marx objected to the capitalist market system on moral grounds.

In stark contrast to orthodox economists, neo-Malthusians believe that continued capital accumulation while it might initially increase material welfare, is an unsustainable strategy because in the long term, it is likely to impoverish humans. There are several ways this can occur. One is from the pollution generated by the transformation of natural and environmental resources into material commodities, including capital. The second is by the depletion of non-renewable resources used in the transformation process so production suffers from shortages of natural resource inputs in the future. Third, natural and environmental resources may be damaged or diminished by the economic transformation process to such an extent that they can no longer complement economic production, or do so in a much reduced way. Therefore economic production or productivity falls. Neo-Malthusians argue that the sustainability of future economic production and welfare depends increasingly on stocks of natural resources and environmental factors being sustained. Consequently, according to neo-Malthusians, it is becoming more important for the welfare of future generations to conserve natural and environmental resources rather than further accumulate man-made capital. This is especially so because the accumulation of man-made capital transforms and depletes natural resources and this capital lasts for a relatively short period, often not for the whole life of one generation of humans but at most, usually for a few generations. While the relatively unrestrained conversion or transformation of natural resources to man-made capital may have been justified in the past, it is

becoming increasingly inappropriate due to the continuing depletion of natural and environmental stocks (cf. Tisdell, 1999a).

The view attributed above to orthodox or conventional economists is sometimes said to be one that involves the imposition of **weak conditions for sustainable development**. Their view is that sustainable development can be achieved by transforming more natural resources into man-made capital. No particular limit or restriction needs to be imposed on this substitution. Furthermore, many orthodox economists are of the view that further substitution of man-made capital for natural capital is necessary for achieving sustainable economic development.

The view attributed above to neo-Malthusians is sometimes said to be one that involves the imposition of **strong conditions for sustainable development**. Their view is that further transformation of natural resources into man-made capital may endanger the welfare of future generations. This is because natural/environmental capital is to an increasing extent an irreplaceable contributor to economic production and human welfare. Man-made capital is becoming less satisfactory as a substitute for it, and in some cases is incapable of substituting. This means that the existing natural/environmental stock is becoming more precious as a basis for sustaining economic production and human welfare. Therefore, if we wish to sustain the welfare of future generations, we should be wary about irreversibly depleting this stock. We may do more to assist future generations by conserving this stock rather than by converting it into man-made capital.

The contrasting views of economists recommending weak conditions for sustainable development (orthodox economists) and of those claiming that strong conditions must be

imposed (neo-Malthusians) in order to achieve sustainable development are summarised in Table 1.

Table 1 Economic Conditions for Achieving Sustainable Development

Weak Conditions (Orthodox Economists)	**Strong Conditions (Neo-Malthusians)**
• Accumulation of man-made capital is to be encouraged because it provides a suitable productive bequest for future generations. • One can be optimistic about future prospects given the promise of technological progress	• Natural and environmental resources need to be conserved as a suitable bequest to future generations. • Conversion of these resources to man-made capital or their use for consumption may diminish the welfare of future generations. • Caution is needed.

So it can be seen that 'orthodox' economists and neo-Malthusians believe that a different economic bottom line applies today from the point of view of achieving sustainable development. But because economic production, consumption and capital accumulation are the life-blood of the capitalist system, the orthodox position prevails rather than the neo-Malthusian. Furthermore, because the employment of labour in the capitalist system depends on the level of economic activity and capital accumulation, and the maintenance of employment usually requires continuing economic growth (to counteract technological or similar sources of unemployment), labour interests also normally reject the neo-Malthusian viewpoint (cf. Tisdell, 1999b, Ch.6). The usually short-sighted nature of politics adds to this lack of support for the neo-

Malthusian position. Despite this, the neo-Malthusian position, if not extremely interpreted, may well be correct.

3. What is Economics and is it the Bottom Line for Sustainability or Just One Consideration?

Views about what economics is vary somewhat. But basically economics arises from the fact that human desires exceed the means or resources available to satisfy these and consequently, relative scarcity exists. This relative scarcity calls for economising. Dealing with the problem of scarcity involves both private decision-making and social issues. The effectiveness with which societies meet the challenge of scarcity depends on the effectiveness with which individuals make their economic decisions, and the adequacy of the social mechanisms which govern the use of the limited resources available to society. The market mechanism is just on of these social mechanisms.

Economics is a social science. It is more concerned with the social implications of individual decisions and those of businesses than with improving those decisions themselves. Detailed studies of decision-making and administration of businesses tend today to be more the concern of the fields of management and commerce than economics.

Nevertheless, given an economic perspective, economists would argue that any sustainability policies are unlikely to be adopted unless they are in the self interest of individual consumers and businesses, assuming that implementation of such policies requires supportive action by these economic agents. Economics and finance frequently are the bottom line as far as individual economic agents are concerned. Unless the individual self-interest of economic agents are harnessed to implement sustainability objectives, these objectives are unlikely to be achieved.

Much depends on whether one believes that individuals are guided by narrow self-interest or wider dimensions. Most economics since Adam Smith (1776) has been developed on the assumption that businesses basically aim to maximise their own profit and consumers their utility or satisfaction. Thus from this point of view, if a sustainability objective is unprofitable for business, it will not be pursued. Although individual businessmen may agree that the objective is morally desirable, they may be unable to pursue it because doing so may threaten the survival of their business. In a highly competitive world, economic agents may have limited scope for pursuing virtuous ends. However, some economists have argued that in a competitive economic system, pursuit of self-interest will promote the collective good. This incidentally is not a view that I share – social intervention is required to ameliorate some of the worst features and failures of the market system.

Traditionally economists have argued that there are four ways to deal with economic scarcity:

1) increase economic efficiency of resource use;

2) ensure full employment (that is the absence of involuntary unemployment);

3) promote economic growth and

4) to the extent that the distribution of income and opportunity is considered to be inequitable, alter this to change the burden of scarcity as between individuals, so as to promote social justice.

Today's economic rationalists are particularly keen on objectives (1) and (3) but more muted in relation to considerations (2) and (4). But the blind pursuit of objectives (1) and (3) only can add

to social injustice. These objectives (summarised in Table 2) should be pursued as a whole package rather than individually, if social justice is to be promoted.

Table 2 Summary of Traditional Economic Methods for Reducing Economic Scarcity

- Increase economic efficiency of resource use;
- Ensure full employment (that is the absence of involuntary unemployment);
- Promote economic growth* and
- If the distribution of income or opportunity is inequitable, alter this to change the burden of scarcity as between individuals, in order to promote social justice.

* Neo-Malthusians argue that unless care is taken, economic growth can increase scarcity in the long term rather than reduce it.

Note that traditional objective (3) now worries neo-Malthusians. They argue that unless we are careful, the economic growth promoted by present generations is not sustainable. It may become unsustainable if it undermines the natural resource and environmental base on which the maintenance of economic activity depends. Thus today's economic growth could impoverish further generations. It may be incompatible with sustainable development.

Economic systems are embedded in social and natural systems and depend on these. Thus the sustainability of economic development (to the extent that it can be achieved) depends on a suitable degree of sustainability in social and biophysical systems. Government may be regarded as part of the social system and, as Adam Smith observed, law, order and good government are essential for economic progress. They are equally important for the achievement of sustainable economic development. So from this point of view, there are several bottom lines to be fulfilled to achieve sustainable development.

An additional consideration is that individuals might want to sustain attributes other than economic welfare. An enormous range of possibilities exist. Some may want to sustain particular cultures, others may wish to maintain biodiversity, or particular political systems and so on. But there may be no solutions which achieve all these aims simultaneously and intense social conflict may arise about their desirability. Not everyone is agreed that sustainability is good, or possible, and some of those who consider sustainability good cannot agree about what ought to be sustained. There is no escaping the centrality of values in social decision-making.

4. Values and Sustainability

One's approach to valuing sustainability depends on the values to which one subscribes. Economists are anthropocentric in their value systems. In terms of the meaning of 'anthropocentric' given in The Macquarie Dictionary, economists view and interpret "everything in terms of human experience and values". Economics assumes "man to be the final aim and end of the universe".

Furthermore, the English liberal tradition, which dominates modern economics, assumes that the wishes of all individuals (humankind only) should count and that the role of economics is to suggest ways in which these wishes can be most fully satisfied given the limited resources available to satisfy these wishes. It involves humanism insofar as human interests predominate and appears to be based on the ethical doctrine of humanitarianism, "the doctrine that man's obligations are concerned wholly with the welfare of the human race" (The Macquarie Dictionary, 1981, p.863).

It follows that modern economics only pays attention to the conservation of other species and to maintaining ecological systems and nature inasmuch as individual humans value this. There is no moral obligation independent of human wishes to conserve nature.

This does not mean that no account will be taken of nature by economists in conservation decisions. However, the only weight given to nature is bestowed on it by individual human wishes. Thus if enough individuals want whales to continue to exist and not be harvested, economists would take this into account as an economic value. But whales and other species have no rights independent of human wishes to exist.

Values influencing sustainability are to a large extent culturally determined and this is true in our society. It is also true for economic approaches, although proponents of economic valuation methods often fail to see how culturally influenced their techniques are.

For example, consider a common economic approach to determining whether a natural area or ecosystem should be protected or sustained. Economists might try to find out how much all individuals are willing to pay to conserve it. This is relatively democratic in that everyone counts. However, the playing field is usually not completely level because those who feel strongly in favour of its conservation may have little money and be able to pay little. Future generations are, furthermore, not directly represented. And not all individuals may be well-informed about the value of conserving an ecosystem. Money sums are the arbiter in this situation involving willingness to pay.

This anthropocentric approach, however, will be alien to individuals with ecocentric values (sometimes called 'deep ecologists') who believe that there is a case for avoiding the destruction of species and ecosystems independently of human wishes. Such a view is involved in the 'land

ethic' of Aldo Leopold (1966) or the view that humankind has a stewardship role in relation to nature (Passmore, 1974). This view rejects democracy as the sole arbiter of values, that is popular opinions which run counter to these views. In fact, our society rejects popular opinion as an arbiter of social decision-making in a number of circumstances e.g. when it is likely to infringe on fundamental human rights. So popular opinion should not be regarded as sacrosanct. Social values are complex and economic valuation fails to capture their full variation and nuances.

In the above cases, deep ecologists will be angry and disillusioned if the ecosystem under consideration for preservation contains unique species but its destruction occurs sanctioned by economic evaluation which indicates that development is the 'best' option because the net economic return from development exceeds the total willingness of individuals to pay for conservation of the ecosystem.

In cases such as this, while economic evaluation may identify the best economic outcome, the economic solution may fail to settle social conflict effectively. When social conflict exists about a sustainability objective (that is about what ought to be retained) economics is limited in its ability to bring about conflict resolution. The economic input or bottom line will need to be subjugated in such cases to political input, or to arbitration and conciliation in which members of the legal profession are usually skilled.

The relationships between traditional economic values and other social values can be represented to some extent in Figures 1 and 2. Figure 1 indicates that anthropocentric economic values are only a subset of social values. In fact, they are only a subset of anthropocentric or man-centred

values. This highlights Pigou's (1932) view that social policy decisions ought not as a rule be made solely on the basis of economic criteria.

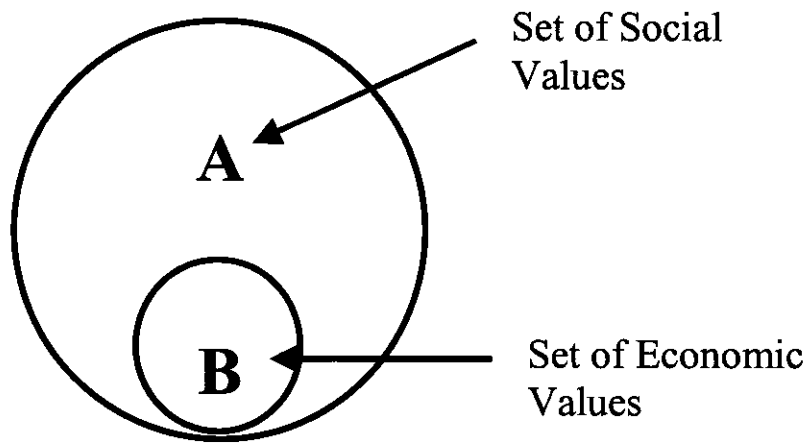


Figure 1 Traditional Economic Values are Anthropocentric and a Subset of Social Values

The possibility for a clash of the values, traditionally held by economists and those of others in society, can be seen by considering the potential for conflict between values of orthodox economists and those of 'deep' ecologists as illustrated by Figure 2. Deep ecologists believe that all species have an intrinsic right to existence independently of their value to humankind. The worth of their continuing existence is not to be judged solely by their benefit to *Homo sapiens*. Other species and sentient beings should not be assessed or valued solely as instruments for the production of human satisfaction (cf, Sagoff, 1988; Leopold, 1979) as traditional economists are want to do. Figure 2 illustrates two possibilities. If the rectangular set I in Figure 2 represents all values, those of traditional economists (set B) may show little overlap with those of deep ecologists (set C). Alternatively where set II represents all values, there may be no overlap

between those of traditional economists and deep ecologists. Either partial or complete conflict of values exist. Consequently, deep ecologists reject most economic techniques, such as social cost-benefit analyses, as instruments for social decision-making and for making policy choices.

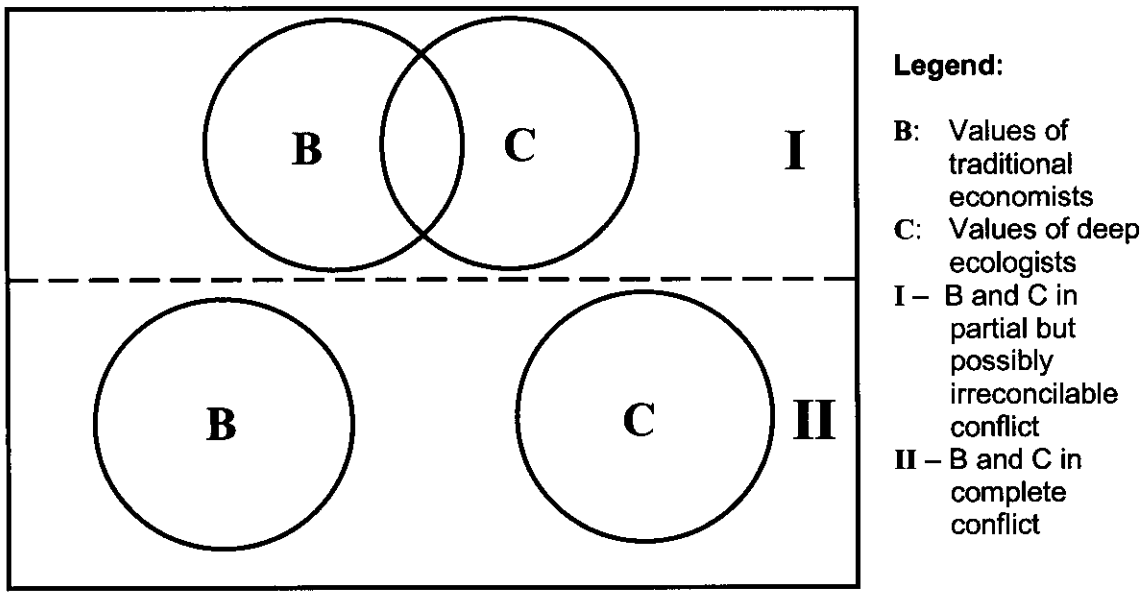
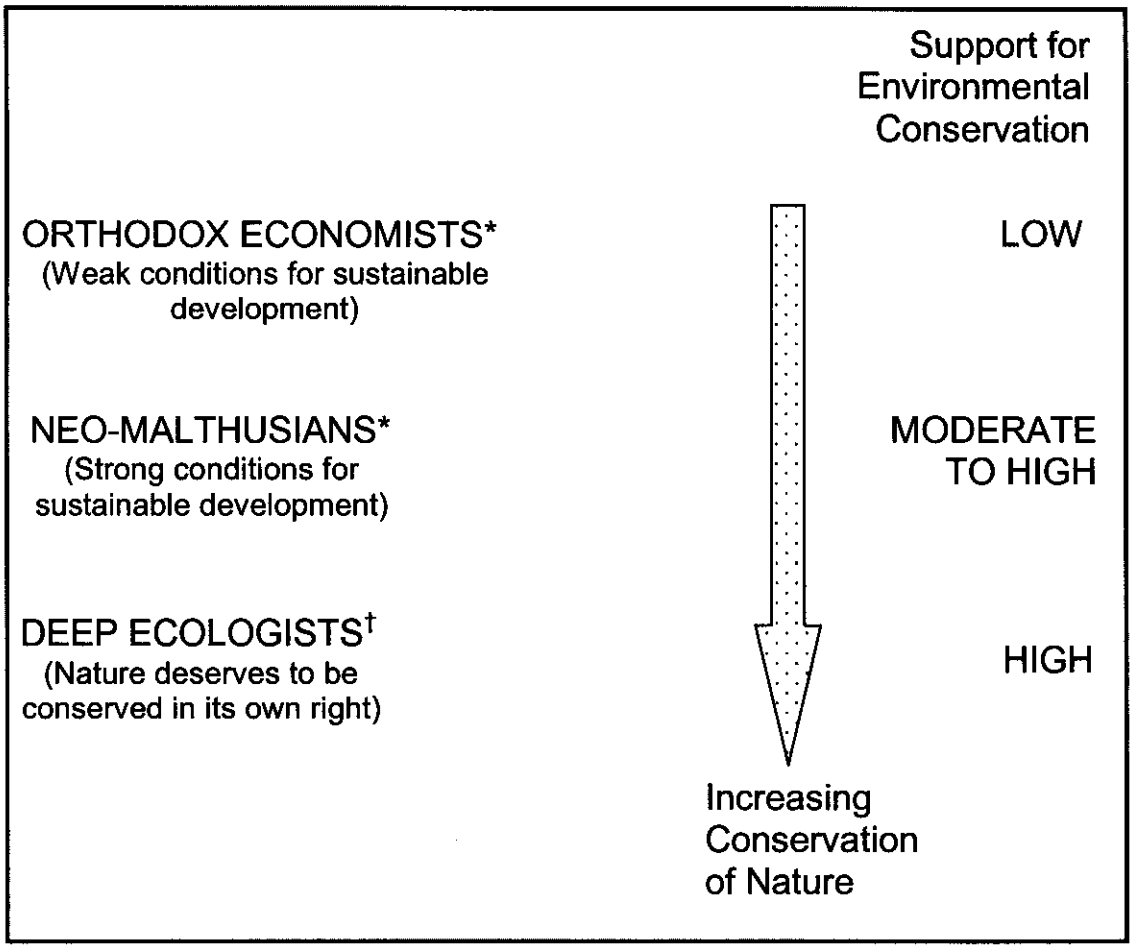


Figure 2 Traditional Economic Values Are Likely to be in Partial or in Total Conflict with Values of Deep Ecologists

The significance of values in relation to the debate about sustainable development can be highlighted by considering Figure 3. The differences in emphasis of orthodox economists and neo-Malthusian economists on the conservation of natural and environmental resources arises from differences of opinion about what is necessary to sustain the incomes or welfare of human beings. On the other had, the desire of deep ecologists to conserve natural resources arises because the existence of all species is valued intrinsically. Lack of conservation of such resources may benefit humankind but will drive other species to extinction. Therefore, deep ecologists believe that humans should be prepared to make some economic sacrifice, if necessary, to conserve natural resources and save other species from extinction. They are,

therefore, more strongly in favour of environmental conservation than neo-Malthusians, given their value-position.



* Values are anthropocentric

† Values not purely anthropocentric, includes strong ecocentric values

Note: Strategies for the objective of Ecologically Sustainable Development (ESD) are likely to be towards the lower portion of the above spectrum.

Figure 3 Spectrum of Emphasis on Natural Resource and Environmental Conservation

5. Can Sustainability be Achieved?

The question ought to be raised of whether, even with the best intentions and knowledge, it is possible to achieve sustainable economic development or the sustainability of economic subsystems. Furthermore, what is to be done if sustainability cannot be achieved?

Barbier (1987) was probably the first to suggest that the sustainability of systems involving economic activity depended on their being able to satisfy three conditions. In his view, sustainable systems should be

(a) economically viable;

(b) socially acceptable and

(c) biophysically sustainable.

Only those systems, for example agricultural systems, that simultaneously satisfy these three conditions would, in his view, be sustainable.

While the above factors are all important considerations in social choice, the possibility exists that no available or possible systems may satisfy all these conditions. If available or possible agricultural systems for a particular region are considered, none may for example, satisfy all the conditions in the above set, or some may do so but only for a limited period of time.

In such circumstances, there may be no agricultural system that ensures long-term sustainability. This actually may be the normal situation. In such circumstances one has no choice but to accept the situation. However, some available systems may show a greater degree of sustainability than others. Consequently, if sustainability (in some sense) is a high priority, the policy-makers or planners can choose the technique or systems that are the most sustainable, even if complete

sustainability is a dream. Clearly, many value judgements will be required in making such a choice.

The next difficulty that should be noted has to do with how we measure economic viability, social acceptability and biophysical sustainability. This is not nearly as straightforward as a superficial consideration of the matter might suggest. For example, is profit the appropriate indicator of economic viability? What if it is uncertain or variable? How is social acceptability to be measured? Is an agricultural technique that results in greater income inequality socially less acceptable for instance? Conway (1985, 1987) assumes that this is so. But income distribution may not be the only indicator of social acceptability. Again biophysical systems have many attributes. Which ones are important for gauging their sustainability? In the case of agricultural systems, for instance, Conway (1985, 1987) uses the ability of the system to return to normal agricultural yields after it has been subject to environmental stress and the stress is removed. But it may not be the only possible measure. We do ourselves little service if we do not recognize the conceptual issues involved in making such concepts operational.

In addition, it should be noted that taking into account the physical entropy issues raised by Georgescu-Roegen (1971) it is only possible to achieve completely sustainable development on a global scale by confining resource use to the flow of flow-resources and renewable resources provided by the sun. Use of resources beyond that level will lead to the biophysical 'running down' of resources. This will be slow if dependence on non-renewable resources is slight. Otherwise, it could be at a rapid rate. This implies that in many circumstances, the social choice is about how rapidly to run the biophysical system down. There is still, however, usually some available choice because some economic activities and techniques will run the system down at a faster rate than others. Note that depletion of the non-renewable part of the biophysical systems

need not imply that economic welfare necessarily continuously declines as this process continues. One can see, however, that the situation is complex, and that it can be very difficult, if not impossible, to achieve long-term biophysical sustainability. In addition, it is not really clear that this condition is absolutely essential for economic sustainability. For instance, within bounds, continuing technological progress can offset the economic consequences of resource depletion.

6. Concluding Comments

From some points of view, economics does provide the bottom line in determining whether policies for achieving sustainability will be adopted. In dealing with sustainability, it is however important to know what one wants to sustain and to decide just how worthwhile it is sustaining. An influential body of economists believes that sustainable development is worthwhile achieving but are divided about the best way of achieving this. Orthodox economists believe that only weak conditions need to be imposed on the conservation of natural and environmental resources whereas neo-Malthusians believe that strong conditions need to be imposed if sustainable development is to be achieved.

While economics is concerned with problems arising from resource scarcity and is a social science, it alone cannot provide solutions to sustainability issues. Economic systems are imbedded in social and biophysical systems. Lack of sustainability in social and biophysical systems can imperil the sustainability of economic systems. So from this point of view, economics is just one of several bottom lines for sustainability.

Social values are to a large extent culturally determined. Orthodox economics is anthropocentric and encapsulates a particular set of 'liberal' values. It uses democratic-style methods for the

purposes of social evaluation of conservation possibilities and rejects other types of evaluation, such as those favoured by deep ecologists, to justify conservation of biodiversity or ecological sustainability. In such circumstances, economics can only play a limited role in social conflict resolution – a wider perspective is needed which, to some extent, might be provided by members of the legal profession, politicians and social philosophers. As pointed out by the wise British economists, Arthur Pigou in the early part of the 20th century, economics is only a part of the process of social assessment. It is not the final arbiter (Pigou, 1932). So from this point of view, it is a part of the social evaluation process but not the bottom line, or just one of many bottom lines.

In summary, it has been pointed out that sustainability as such does not provide a clearcut guide to policy. First one has to decide what is to be sustained. If this is agreed, it must be in an operational from. However, difficulties may still emerge since opinions may differ about how to achieve sustainability. This was illustrated by differences in the views of economists about how sustainable development is to be achieved. Orthodox economists stress the importance of the accumulation of man-made capital to achieve this end whereas neo-Malthusians stress the importance of conserving natural resource and environmental capital. Both take an anthropocentric point of view. For political reasons the neo-Malthusian has had little support but it may eventually turn out to be correct.

Economics is concerned with reducing economic scarcity and economists have traditionally suggested four main ways of doing this of which economic growth is one. However, neo-Malthusian economists believe that this may not be a sustainable strategy and that it could result in future poverty.

It should be noted that economic systems are embedded in social and natural systems and depend on these. Economic sustainability depends on the sustainability of these other systems. So from this point of view, it is just one of several bottom lines.

Values must be considered in relation to sustainability. Traditional economics is completely anthropocentric in its approach. Therefore, economic approaches to conservation and sustainability can be at odds with the values of deep ecologists or those willing to accord rights to other sentient beings or ecosystems independent of human wishes, or those who want to make use of value judgments other than those based on the measuring rod of money. Consequently economics evaluation is sometimes ineffective in resolving social conflict, including conflict about what should be sustained. As a rule economics alone should not be the final arbiter of social decisions. It is a part (often an important part) of the social evaluation process but not the bottom line. It is just one of many lines.

Finally, it was suggested that in some circumstances, no completely sustainable economic system may be available. Thus, social choice may be about selecting systems that show more sustainability than others rather than selecting systems that guarantee absolute sustainability.

Acknowledgement

This is a revised and extended version of a paper presented to the Queensland Environmental Law Association Conference, 2000. Research for it was completed as part of a research project involving cooperation between The University of Queensland and the University of International Business and Economics, Beijing, supported by AusAID and MOFTEC. The usual *caveat* applies.

References

Barbier, E. B. (1987) "The Concept of Sustainable Economic Development", *Environmental Conservation*, **14**(2): 101-110.

Conway, G. (1985) "Agroecosystems Analysis", *Agricultural Administration*, **20**: 31-55.

Conway, G. (1987) "The Properties of Agroecosystems", *Agricultural Systems*, **24**: 95-117.

Etzioni, A. (1988) *The Moral Dimension: Toward a New Economics*, The Free Press, New York.

Etzioni, A. (1991) "Contemporary Liberals, Communitarians, and Individual Choices" in A. Etzioni and P. R. Lawrence (eds.) *Socio-economics: Toward a New Synthesis*, M. C. Sharpe, New York.

Georgescu-Roegen, N. (1971) *The Economic Low and the Entropy Process*, Harvard University Press, Cambridge, MA.

Leopold, A. (1966) *A Sand Country Almanac with Other Essays on Conservation from Round River*, Oxford University Press, New York.

Leopold, A. (1979) *A Sand Country Almanac*, Oxford University Press, New York.

Passmore, J. A. (1974) *Man's Responsibility to Nature: Ecological Problems and the Western Tradition*, Duckworth, London.

Pigou, A.C. (1932) *The Economics of Welfare*, Macmillan, London.

Sagoff, M. (1988) *The Economy of the Earth*, Cambridge University Press, Cambridge.

Smith, A. (1910) The Wealth of Nations, J.M. Dent and Sons, London. First published 1776.

Tietenberg, T. (1988) *Environmental and Natural Resource Economics*, 2nd ed., Scott, Foresman and Company, Glenview, Illinois.

Tisdell, C. A. (1993) *Environmental Economics: Policies for Environmental Management and Sustainable Development*, Edward Elgar, Cheltenham, U.K.

Tisdell, C. A. (1997) "Local Communities, Conservation and Sustainability: Institutional Change, Altered Governance and Kant's Social Philosophy", *International Journal of Social Economics*, 24:1361.

Tisdell, C.A. (1999a) "Conditions for Sustainable Development: Weak and Strong". Pp.23-36 in A.K. Dragun and C. Tisdell (eds.) *Sustainable Agriculture and Environment: Globalisation and the Impact of Trade Liberalisation*, Edward Elgar, Cheltenham, United Kingdom.

Tisdell, C.A. (1999b) *Biodiversity, Conservation and Sustainable Development*, Edward Elgar, Cheltenham, United Kingdom.

ISSN 1444-8890

PREVIOUS WORKING PAPERS IN THE SERIES

ECONOMIC THEORY, APPLICATIONS AND ISSUES

1. Externalities, Thresholds and the Marketing of New Aquacultural Products: Theory and Examples by Clem Tisdell, January 2001.

2. Concepts of Competition in Theory and Practice by Serge Svizzero and Clem Tisdell, February 2001.

3. Diversity, Globalisation and Market Stability by Laurence Laselle, Serge Svizzero and Clem Tisdell, February 2001.

4. Globalisation, the Environment and Sustainability: EKC, Neo-Malthusian Concerns and the WTO by Clem Tisdell, March 2001.

5. Globalization, Social Welfare, Labor Markets and Fiscal Competition by Clem Tisdell and Serge Svizzero, May 2001.

6. Competition and Evolution in Economics and Ecology Compared by Clem Tisdell, May 2001.

7. The Political Economy of Globalisation: Processes involving the Role of Markets, Institutions and Governance by Clem Tisdell, May 2001.

8. Niches and Economic Competition: Implications for Economic Efficiency, Growth and Diversity by Clem Tisdell and Irmi Seidl, August 2001.

9. Socioeconomic Determinants of the Intra-Family Status of Wives in Rural India: An Extension of Earlier Analysis by Clem Tisdell, Kartik Roy and Gopal Regmi, August 2001.

10. Reconciling Globalisation and Technological Change: Growing Income Inequalities and Remedial Policies by Serge Svizzero and Clem Tisdell, October 2001.