

ECONOMICS, ECOLOGY AND THE ENVIRONMENT

Working Paper No. 92

**Economic Incentives to Conserve Wildlife on
Private Lands: Analysis and Policy**

by

Clem Tisdell

December 2003



ISSN 1327-8231
**WORKING PAPERS ON
ECONOMICS, ECOLOGY AND THE ENVIRONMENT**

Working Paper No. 92

**Economic Incentives to Conserve Wildlife on
Private Lands: Analysis and Policy***

by

Clem Tisdell

December 2003

© All rights reserved

* A paper prepared for the 3rd International Wildlife Management Congress held in Christchurch, New Zealand, 1-5 December 2003 and was presented at the Symposium Session – “Private Landowners: Current and Future Issues Regarding their Role in Wildlife Conservation”.

WORKING PAPERS IN THE SERIES, *Economics, Ecology and the Environment* are published by the School of Economics, University of Queensland, 4072, Australia, as follow up to the Australian Centre for International Agricultural Research Project 40 of which Professor Clem Tisdell was the Project Leader. Views expressed in these working papers are those of their authors and not necessarily of any of the organisations associated with the Project. They should not be reproduced in whole or in part without the written permission of the Project Leader. It is planned to publish contributions to this series over the next few years.

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* was sponsored by the Australian Centre for International Agricultural Research (ACIAR), GPO Box 1571, Canberra, ACT, 2601, Australia.

The research for ACIAR project 40 has led in part, to the research being carried out in this current series.

For more information write to Professor Clem Tisdell, School of Economics, University of Queensland, Brisbane 4072, Australia.

ECONOMIC INCENTIVES TO CONSERVE WILDLIFE ON PRIVATE LANDS: ANALYSIS AND POLICY

Abstract

Some believe that provision of private property rights in wildlife on private land can provide a powerful economic incentive for nature conservation because it enables property owners to market such wildlife or its attributes. If such marketing is profitable, private landholders will conserve the wildlife concerned and its required habitat. But land is not always most profitably used for exploitation of wildlife, and many economic values of wildlife (such as non-use economic values) cannot be marketed. The mobility of some wildlife (their fugitive nature) adds to the limitations of the private property approach. While some species may be conserved by this approach, it is suboptimal as a single policy approach to nature conservation. Nevertheless, it is being experimented with in the Northern Territory of Australia where landholders have the possibility of harvesting on their properties a quota of eggs and chicks of red-tailed black cockatoos for commercial sale. This scheme is expected to provide an incentive to private landholders to retain hollow trees essential for the nesting of these birds. Aspects of this approach are analysed using this case, and related ones, from Northern Australia. It is noted that the private property rights approach adopted in southern Africa is unlikely to be equally successful everywhere.

The long-term survival of some species depends on their ability to use private lands without severe harassment, either for their migration or to supplement their available resources, for example, the Asian elephant in Sri Lanka. Nature conservation on private land is often a useful, if not essential, supplement to conservation on public lands. Community and public incentives for such conservation are outlined.

ECONOMIC INCENTIVES TO CONSERVE WILDLIFE ON PRIVATE LANDS: ANALYSIS AND POLICY

1. Introduction

Several questions need to be raised when considering the desirability of conservation of wildlife on private land and the provision of economic incentives for such conservation. First, why is such conservation desirable and why are economic incentives required for it and justified? Secondly, what types of economic incentives are available, how effective are they likely to be, and which ones are desirable on economic grounds? The answers to these questions depend to some extent on one's perspective. Consider the first matter.

Those with strong ecocentric values argue that more effort is needed to conserve wildlife on private land because a large proportion of Earth's land is in private hands and the survival of many species requires the use of private land by wildlife as well as the preservation of critical habitats needed by wildlife on this land. Without appropriate economic incentives, private landholders are likely to destroy these critical habitats, directly exterminate some species as pests, and in most cases, disregard wildlife in their land-use decisions. In the absence of such incentives, continuing biodiversity loss is inevitable. Such loss is undesirable because biodiversity has intrinsic merit, or it is a stewardship imperative of mankind to protect biodiversity, or the sustainability of ecological systems will be threatened by continuing biodiversity loss with potentially negative consequences for economic welfare. Thus, those with ecocentric values treat biodiversity conservation as a merit 'good'; a desirable goal in itself.

Assessment of the situation by economists is from a different viewpoint. Economics is based upon the view that social systems should be organised in a manner that enables human wants or desires to be satisfied to the maximum possible extent given the limited availability of resources, including wildlife resources. Some economists argue that perfectly operating market systems are theoretically capable of achieving the goal of satisfying human desires to the maximum possible extent, subject to the limited availability of resources. They often favour liberal economic policies in order to promote perfect market systems. However, in practice, perfect market systems are not used to manage all of society's resources. This is partly because perfect systems are often unattainable. Even when markets are developed to

the maximum extent attainable, they are not able to allocate or conserve all resources efficiently. For the supply of some commodities and the conservation of some natural resources, such as wildlife, irreducible market failures remain. In such cases, government intervention may be required to ensure that human wants are collectively more fully satisfied than otherwise, as for example, argued by Bishop (1981) in relation specifically to wildlife on private land.

The above arguments in favour of greater economic incentives for wildlife conservation on private land are not based on special economic interests. Nevertheless, special interest groups do often put forward arguments for greater economic incentives for conservation of wildlife on private land. Special interest groups include landholders who have based, or would like to base, much of their business on the economic utilisation of wildlife. Also the customers or potential customers of these landholders, such as recreational hunters or farm-stay visitors interested in wildlife, may form a special interest group. In addition, some landholders themselves obtain pleasure from wildlife and nature conservation and are prepared to forgo monetary economic gains for greater conservation of nature. They would, therefore, appreciate economic incentives for wildlife conservation. Such special interest groups usually seek their own self-interest rather than the collective or public interest, although they may incidentally also promote the latter.

First this paper examines, primarily from a collective perspective, the role that private property rights in wildlife and the complementary facilitation of markets in wildlife can play in conserving wildlife on private land. Limitations of this approach are then highlighted. Specific economic incentives to address failures in or promote wildlife conservation on private land are subsequently outlined, and policy approaches based on the granting of private property rights in wildlife in Africa and the Northern Territory of Australia are assessed.

2. Private Property Rights and Free Markets in Wildlife

It is sometimes argued that the best way to encourage private landholders to conserve wildlife is for governments to give them private property rights in wildlife, strengthen these rights where they exist, and promote the operation of free markets in the exchange and use of wildlife on private lands. Perceived deficiencies in the conservation of wildlife on private lands and lack of economic incentives for such conservation arise, according to this

viewpoint, from institutional inadequacies, and these can be overcome by adopting the policies just mentioned.

In most nation states, wildlife has historically been the property of the crown or state, not private property. However, the state has not always protected every species of wildlife. Therefore, on occasions some wildlife species have been in fact private property or common property. In some countries, some species of wildlife still do not have legal protection.

Proponents of private property rights in wildlife species usually argue that in the absence of such rights, private landholders have no economic incentive to conserve wildlife because they can make little or no money out of their presence. They will in such conditions develop activities on their land for which they have legal rights to the produce. In the process, landholders can be expected to destroy the habitat of some wildlife species and reduce biodiversity. In these circumstances, protection of critical wildlife habitat on private land will require direct intervention by governments. Furthermore, if the wildlife concerned is legally protected and regarded by landholders as a pest, many landholders may kill it illegally.

Proponents of private property rights contend that if private landholders are given full property rights to wildlife, these consequences would not arise, or they would be less serious than now. They believe that the wildlife concerned will as a result, have economic value for landholders and they will be able to make money or obtain more income from wildlife on their land than otherwise. If this is combined with free market trading in wildlife, this should provide private landholders with even greater economic incentive to conserve wildlife because it will enhance the level of income of landholders from wildlife-related economic activities.

Assessment of such a claim is quite complex. While this policy should result in the conservation of those species of wildlife from which adequate economic returns can be obtained by landholders, it may accelerate the loss of those species yielding inadequate economic returns. The composition of wildlife species can be expected to move in favour of those species that have greatest use value or more specifically, in favour of those wildlife species having the greatest net economic use value able to be appropriated by private landholders.

The likely impact of this policy on the pattern of wildlife conservation of wildlife on private lands is unclear. Compared to the current situation, it may result in a greater biomass of wildlife on private land but the species conserved may be mostly those of value for hunting, for game-meat and other by-products, and for non-consumptive recreational use on properties. Management practices are likely to be adopted on private properties to encourage the presence and survival of such species and discourage other species of lesser commercial value or in competition with the economically favoured species. Publications exist (for example, Burger, 1973) suggesting how landholders can change their land management to encourage particular types of wildlife. The resulting regime of wildlife biodiversity on private land is likely to be distorted in favour of wildlife species with significant commercial value.

Nevertheless, this policy does extend the range of species possessing commercial value. Hence, it can (but need not) result in more wildlife species being conserved on private land than with current institutional arrangements. In some localities, husbandry of existing domesticated or cultivated species will continue to be preferred by private landholders to the commercial use of wild species. Or if commercial use of a particular set of wildlife species becomes economically more valuable than other wildlife species, private land management practices are likely to be altered in favour of the commercially more valuable wildlife species. This would be at the expense of the commercially less valuable wildlife species, the commercially valueless or species regarded by private landholders as pests, that is of negative commercial value.

Wildlife species that are in ecological competition with species commercially favoured by this policy will be disadvantaged. However, those in a complementary ecological relationship should be favoured. Thus, the pattern of wildlife conservation is 'distorted' in a manner that is unlikely to be acceptable to supporters of the 'land ethic'. Furthermore, fewer wildlife species are likely to be conserved globally than desired by those strongly favouring biodiversity conservation as a goal in itself, and the policy will not give ideal economic results because commercially oriented landholders will not take account of unmarketable economic values.

In addition, fewer species may be conserved globally on private land than desired by advocates of maintenance of wildlife biodiversity as an important goal in itself. In addition, even if this policy maximises the net **commercial value** of wildlife, it is unlikely to maximise the **economic** value of wildlife, that is ensure that wildlife is utilised and conserved so as to maximise collective economic benefit given the limited availability of resources, including wildlife species. This is because commercially oriented landholders will not take account of unmarketable economic values (such as wildlife existence values) in their land-use decisions.

Note that this critical view does not imply that use of private property rights and free markets as a wildlife conservation technique has no place. Conservation of some wildlife species can be effectively promoted by such policies, but not all. As a result of private property rights and free markets for wildlife, nature conservation on private land may be better than in the absence of such policies but not ideal. However, to rely on these policies alone to conserve wildlife would be socially unsatisfactory. Better social results can be attained by using mixed systems of various kinds of which state protected land areas are a part. To appreciate this position, it is necessary to be aware of market failures that result intrinsically in the unmarketability of important economic values of some wildlife species.

3. Market Failures Limit the Effectiveness of Private Property Rights and the Usefulness of Markets as Means for Conserving Wildlife

Markets and private property rights for commodities work best in promoting a social economic optimum when non-owners can be economically excluded from the benefits from those commodities. In such circumstances, non-owners wishing to obtain benefit from the commodities can be forced by their owners to pay for their use, thereby providing an incentive to their owners to supply the commodities and in the case of wildlife, conserve those species that can provide their owners with sufficient economic gains. However, it can be too costly or impossible to make all wildlife private property. In such cases, landholders cannot appropriate economic benefits from the species concerned. Two types of problems arise.

First, some species of wildlife are fugitive or mobile and cannot be economically confined to a private property (Bishop, 1981; Ciriacy-Wantrup, 1968). Depending upon how mobile wildlife species are, other landholders can benefit from efforts by an individual landholder to conserve these if the species are economically valuable. This limits the economic incentive

of an individual landholder to conserve a highly mobile wildlife species, if the landholder only has private property rights to it while it is on his or her land.

Secondly, the total economic value of some species depends primarily on their non-use economic values rather than their use values. Many ecological economists divide the total economic value of commodities into economic use value **plus** non-use economic value. Non-use values cannot as a rule be marketed. This is true, for example, of existence value. Some individuals value the continuing existence of wildlife species and this valuation is not dependent upon their viewing these species or using them in other ways. For example, almost all the economic value of Australian tree kangaroos appears to be accounted for by their existence value (Tisdell and Wilson, 2003) and more than half the economic value of the Asian elephant in Sri Lanka seems to be accounted for by its non-use values (Bandara and Tisdell, 2003a).

Non-use economic values involve public goods and cannot be made private property and be marketed. Therefore, government intervention is required to conserve species that have high non-use economic values and species that are highly mobile. For example, if a wildlife species is mobile and an agricultural pest, the government may need to compensate farmers for agricultural damages caused by it in order to increase their tolerance of it and promote collective welfare. This can be appropriate from an economic viewpoint if society **as a whole** values the species highly. For example, despite the agricultural damage done by the Asian elephant in Sri Lanka, its collective economic value is positive because the collective economic value placed on it, especially by urban dwellers, exceeds the cost of the agricultural damage caused by it (Bandara and Tisdell, 2003b).

While private property rights will save some wildlife species from extinction, they are not an effective means for preserving all species. They are ineffective when owners of wildlife find that the proportion of total economic value appropriated by them is too low to provide an economic incentive to conserve the wildlife concerned. This can happen when a species is highly mobile or when it has a low economic use value, but at the same time a high economic non-use value.

Put differently, private property rights in wildlife species can save some species only from extinction. These are wildlife species that ensure landholders greater economic returns than from any other alternative form of land-use. These will usually be wildlife species

possessing high economic use value, low mobility or low cost of confinement to a private property, and not requiring a very large geographical range for their survival.

Note that even in cases where a private landholder is able to appropriate all, or a substantial part of, the economic value of a wildlife species, the landholder may not find it profitable to conserve the species. First, an alternative land use incompatible with survival of the species may be more profitable. Or, secondly, it may be most profitable to liquidate the wildlife asset and invest the monetary sum obtained in the capital market (Clark, 1973, 1976). Maximising net economic value (even net total economic value) does not ensure the survival of all species of wildlife. Thus, economic considerations lead to some species being extinguished, even if there are no market failures. Additional species are likely to be extinguished because of the presence of market failures. Some of these might be saved by institutional change that provides for private property rights in wildlife and for liberal market regimes. Other wildlife species will not be conserved in the absence of government intervention to support their conservation. Such support may come, for example, from the setting aside of state-protected areas or by the government providing economic incentives, such as subsidies, to private landholders, for critical habitat retention.

The situation can be summarised by Figure 1. Here wildlife species are divided into three sets A, B and C. Set A represents the group of wildlife species for which their survival reduces economic value or worth. Economic value or worth is, reduced however, if the species in sets B and C are lost. Set B represents the wildlife species that may be saved from extinction by making them private property and using market systems. Those species in set C cannot be saved from extinction by such institutional change and their survival is likely to depend on government intervention.

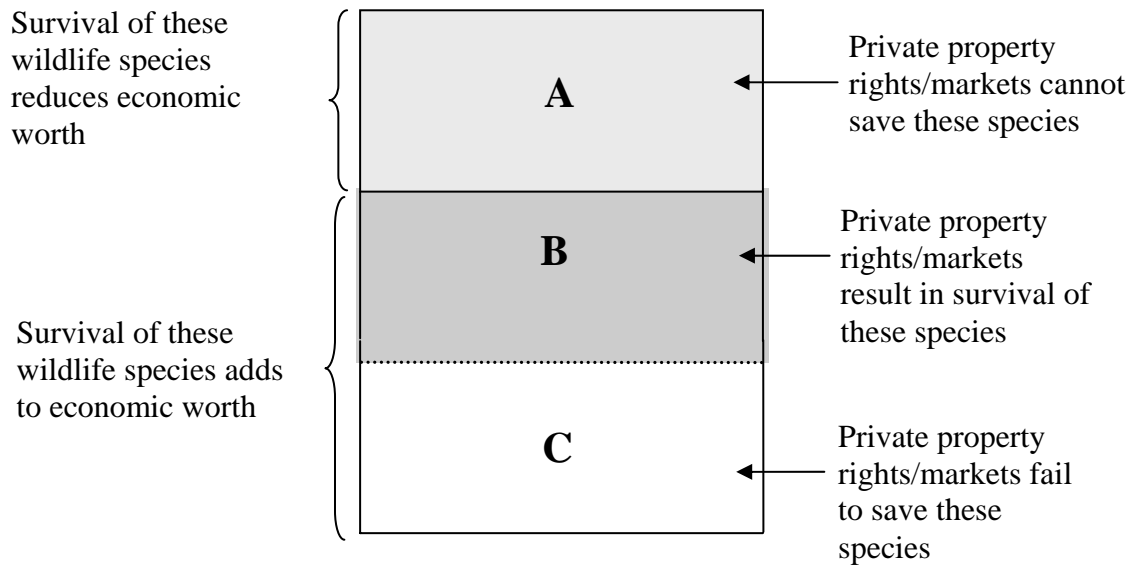


Figure 1: Limits to the private property market system as a means for conserving wildlife species

Of course, some individuals would argue that total economic value or worth should not be the final arbiter of the survival of wildlife species. They would also like the government to intervene to save at least some species in set A. Furthermore, it is appropriate to observe that economic values, especially future ones, are very uncertain and therefore, it may be wise on the basis of economic risk arguments to conserve (some) species that fall into set A. Consider here the safe minimum standard arguments (Bishop, 1978, 1979).

Observe that granting private property rights in wildlife species could result in increased populations of species in set B at the expense of populations in sets A and C. Some of the latter species could be crowded out and extinguished by these policies. Additional government action is likely to be required to conserve species in these sets. Such actions could include public economic incentives (subsidies) to landholders to conserve selected species in sets A and C. Before, however, considering the type of public incentives that could be provided to conserve wildlife species on private land, it might be wise to clarify further the possible impacts of private property rights on the survival of species on private land. Figure 2 can be used for this purpose.

Let the rectangular set Z represent all the wildlife species currently on private land. The set X may represent those that will survive in the long-term given current institutional

arrangements and Y may represent the set of wildlife species that will survive in the long-term if a private property/market regime for wildlife is established.

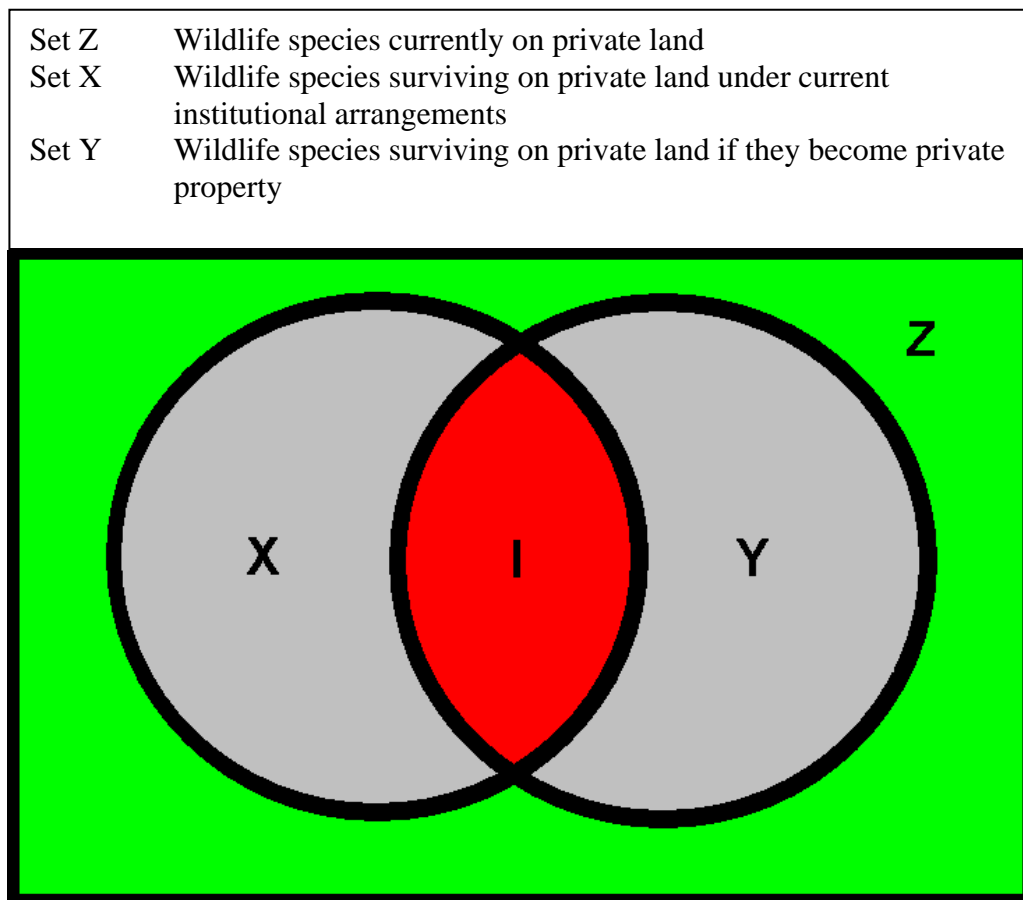


Figure 2: Potential impacts on the survival of wildlife species on private land of private property rights in wildlife

If this representation is correct, it implies the following:

- (1) Neither existing institutional arrangements nor the private property alternative will ensure the survival of all species currently on private land.
- (2) Sets X and Y are likely to overlap partially. They intersect in the case shown for set I. If so, some species that would survive under existing institutional arrangements disappear; some survive under either arrangement; and some species that would not otherwise survive, survive under the private property approach.
- (3) One cannot be sure that the set Y will be larger (will contain more species) than set X. The policy change might give different results in different parts of the world. For example, in regions where wild species have a high economic use value, Y might exceed X, but not in regions where wild species have a low

economic use value. Thus Y might exceed X in southern Africa but not in Australia.

- (4) It is possible for private property rights in wildlife to result in wildlife species being maintained on private land that are not in set Z. In that case, Y would extend beyond Z. When this occurs, however, it does not always have social support. For example, African wildlife species have been introduced to private properties in the United States for game hunting, and this has been the subject of some criticism (Freese and Trauger, 2000).

The particular representation shown in Figure 2 merely highlights one set of possible changes in wildlife biodiversity conservation with the adoption of the private property approach. It can, however, be used to illustrate other theoretical possibilities, and in practice, empiricism is needed to determine the relevance of these alternative possibilities. The diagram, however, makes it clear that the matter is not as simple as it might appear at first sight.

4. Particular Economic Incentives for Conserving Wildlife on Private Land

A number of lists have been drawn up of economic incentives that may be used to conserve wildlife on private land. For example, Benson et al. (1999, p.41) provide a relatively comprehensive list of factors (many of an economic nature) that may encourage or discourage wildlife conservation on private lands. A considerably modified form of this list, with additions, is shown in Table 1. Crosthwaite (1995) also provides a useful overview of financial incentives that could be used to encourage nature conservation on private and leasehold land.

Table 1:
**A List of Public Policies That Might Be Used to Provide Economic
 Incentives to Conserve Wildlife on Private Lands**

-
- 1 Subsidies for the cost of habitat restoration and protection.
 - 2 Annual subsidies for conserving areas of habitat as in the EU.
 - 3 Subsidies on marketing of species with use (market) value but a value too low to make their conservation by a landholder economic. For example, consider the failed experiment with private rights in red-tailed black cockatoos in the Northern Territory of Australia discussed in this article.
 - 4 Tax concessions for wildlife conservation activities on private land at least as generous as those allowed to agriculture and similar industries, for example, full tax deductability of expenses incurred in wildlife conservation. Also taxation concessions on local government taxes or rates can be important. The current local government system in Australia encourages landholders to develop their properties to meet their local government rates of taxes.
 - 5 Adequate public compensation/insurance for damages caused by selected wildlife species on farms.
 - 6 Harness community and NGO voluntary contributions for conservation efforts on private land. This will increase the financial gearing of any public contribution of funds for conservation. This has been done successfully in Australia eg. with Landcare.
 - 7 Benson et al. (1999) recommend stricter trespass law as and reduced legal liability of landholders.
 - 8 Increased public leasing of private land needed for wildlife conservation.
 - 9 More partnerships between state conservation bodies, private landholders and non-government bodies with all contributing some resources to wildlife conservation efforts.
 - 10 For some species (but not all), the granting of private property rights in these (or in some cases, communal property rights) can provide an effective economic incentive for their conservation.
-

While it is of value for rational decision-making about public policy to draw up such lists in order to make sure that no possible strategies are overlooked, this is likely to be the most straightforward part of the exercise. Before rushing into policy changes, several more fundamental issues need to be considered. These include the following:

- (1) Why are economic incentives for wildlife conservation on private land needed?

- (2) What type/nature of wildlife conservation on private land is being aimed for?
- (3) Why is the aim (socially?) justified?
- (4) How effective are the proposed economic incentives likely to be in promoting the desired wildlife conservation goals?
- (5) How cost-effective are the various alternative economic incentives, or how efficient are they in achieving the desired wildlife goals in relation to the costs involved?
- (6) How practical or workable are the various policy proposals, taking into account transaction costs and public agency costs in their implementation?
- (7) How equitable are the alternative proposals for encouraging wildlife conservation on private land?

Some of the issues involved have already been raised earlier in this article. However, the essential starting point for rational consideration of these matters is to clarify what is or should be the objective(s) to be achieved in conserving wildlife on private land. Until that is decided, it is impossible to evaluate the alternative available (economic) instruments for achieving greater wildlife conservation on private land. For example, is the purpose to increase the population of wildlife species with the greatest economic use value?

To what extent should non-use economic values of wildlife be part of the objective? Is the goal to maximise the **total economic** value of wildlife? Is the goal primarily one to sustain biodiversity or save certain rare species? Maybe it is only a particular wildlife species or a small set of wildlife species that is being targeted for wildlife conservation on private land in a particular region. Deciding on such ‘preliminaries’ is essential before rushing into policy implementation.

Where wildlife species have little economic non-use value that can be appropriated by private landholders, strengthening private property rights to wildlife will be in itself an ineffective policy for conserving the species concerned.

In such cases, subsidies for required habitat preservation on private land may be necessary or where the species have very limited commercial value, some subsidy on their marketing may be needed to stimulate their conservation on private land.

Not all landholders are profit-driven and opposed to the conservation of nature. Nevertheless, conserving wildlife on private land can often involve a landholder in financial outlays. For example, habitat restoration and protection is needed on some private properties to protect particular wildlife species but this can usually only be achieved with a financial outlay. For example, trees may have to be planted and watered when young, weeded and so on and fenced in so they are not damaged by livestock. While an individual landholder may have some willingness or demand to do this, the cost of carrying out the project may exceed his/her willingness to do so. However, with some financial subsidy for habitat restoration and protection, a landholder may undertake it to some extent.

This can be illustrated by Figure 3. Suppose that the cost per unit area of restoring and protecting targeted species of wildlife on a private property is OC , for example, \$500 per hectare. The property owner's marginal willingness to pay for it is as indicated by the line AB . Because OA is less than OC , the property owner is not prepared to restore any habitat. But if a subsidy of AG for each hectare restored is given, x_2 units of the owner's land are rehabilitated. Only a portion of the cost in value is met by the government and a part is met by the landholder. In the particular case shown, $OH \cdot x_2$ of the total cost is met by the landholder and $HC \cdot x_2$ by the government.

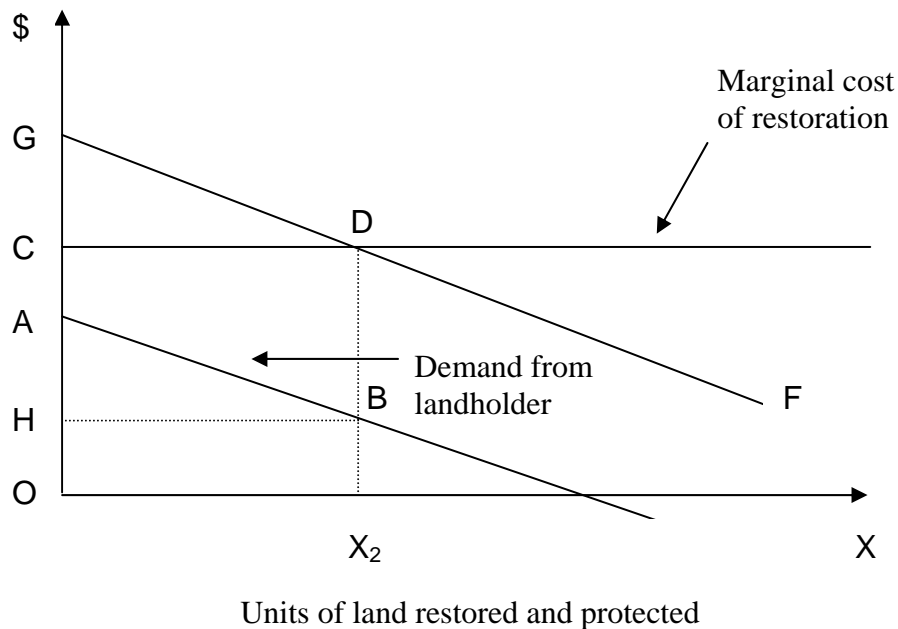


Figure 3: Illustration of how subsidies for habitat restoration and protection can attain the objective of habitat renewal and protection on private land.

The actual financial outlay by the government can be considerably reduced if non-governmental agencies are prepared to contribute some funds and volunteers provide labour, as in the case of Landcare in Australia, and other conservation organisations. Individuals are often prepared to donate their time and effort in helping with habitat restoration projects. Such co-operative efforts are well established in Australia. An example is an effort to provide tree corridors on private land for wildlife conservation on the Atherton Tablelands of northern Queensland. One possible beneficiary is the Lumholtz tree kangaroo.

If landholders can be convinced that they will obtain greater benefits from habitat restoration and preservation than they initially believe, this will increase the prospects of habitat conservation on private land and can reduce the necessary public outlay for it. It would have the effect in Figure 3 of shifting the landholder's demand curve for habitat restoration, AB, upwards so increasing the likelihood that the landholder will engage in more restoration than otherwise.

Subsidies of this nature can be justified on economic grounds when external benefits arise from wildlife species preservation made possible by habitat restoration or protection on private lands. Nearly all of the economic benefits from the conservation of some species of wildlife are external to a private landholder because the economic benefit from them consists primarily of non-use economic value. This is true, for example, of Australian tree kangaroos.

5. Observations on Some Actual Schemes to Provide Economic Incentives to Conserve Wildlife on Private Land

In southern Africa, private land and communal property rights in wildlife have been used extensively to encourage conservation of wildlife on private land. This strategy seems to have been successful as far as the conservation of many species are concerned. Its comparative success is probably due to the relatively high economic net value of southern African mammals for viewing, game meat and other products. While a considerable range of mammals seem to be conserved under these institutional arrangements, the pattern of species conservation may nevertheless display some selectivity in favour of wildlife species with the greatest commercial value on private properties. This requires empirical research.

It might be observed that if a 'fully balanced pattern of wildlife conservation on private land were to emerge as a result of private rights, there would be little or no economic justification

for government provision of protected areas and national parks as a means of wildlife conservation. Furthermore, it is unlikely that the southern African ‘success’ can be repeated everywhere because in some countries and regions, the cost of enclosing the relevant species is too high or their economic use value is quite low compared to their economic non-use value.

In some countries, public compensation is paid to private landholders for agricultural damages caused by some species of wildlife. For example, such schemes exist in Sri Lanka and in Yunnan, China, to compensate farmers for damages caused by elephants. Their purpose may be to provide some equity to affected farmers and make them more tolerant of the species. However, in developing countries the amount of compensation paid in relation to damages sustained by agriculturalists and delays in its payment usually make this mechanism ineffective as a conservation device (Tisdell and Zhu, 1998; Bandara and Tisdell, 2002). However, if compensation is of a sufficient magnitude and paid promptly, it can be of positive assistance in helping to conserve species that need a considerable range for their survival, such as the Asian elephant. The economic benefits that urban dwellers obtain from the continued existence of a species, such as the Asian elephant in Sri Lanka, can provide an economic justification for more generous compensation schemes for private landholders (Bandara and Tisdell, 2003b).

In Australia, policies involving the management of wildlife on private property vary according to the state. The Northern Territory of Australia has possibly displayed the greatest interest in policies for conserving wildlife through their sustainable use (Parks and Wildlife Commission of the Northern Territory, undated). In line with this strategy it has implemented several different wildlife management programmes. Those for the management of crocodiles (*Crocodylus porosus* and *Crocodylus johnstoni*) and for the red-tailed black cockatoo *Calyptorhynchus banksii* are worth commenting on here (Parks and Wildlife Commission of the Northern Territory, 1996, 1997).

The crocodile management programme of the Northern Territory (NT) is intended to ensure the long-term conservation of crocodiles in the NT. The aim is “to establish a commercial value for crocodiles and use it to make crocodiles and their habitats assets to owners, rather than liabilities” (Parks and Wildlife Commission of NT, 1996, p.2). By this means and regulation of sustainable commercial utilisation of crocodiles, it is intended to “maintain

viable wild populations of crocodiles and conserve the wetland habitats upon which they depend” (Parks and Wildlife Commission of NT, 1996, p.2).

The overall programme has been successful in increasing wild crocodile populations in NT, but this may be more due to quotas on harvest and other policies rather than greater wetland habitat conservation on private lands. No field study has been carried out yet to determine the impact of the management programme on habitat conservation by private landholders.

The programme for the red-tailed black cockatoo in the NT has not been a success so far. The key aim of this management programme is stated to be to conserve this species outside protected areas in NT and “to further this aim the commercial use of the species will be permitted on private lands, under strict controls” (Parks and Wildlife Commission of NT, 1997, p1). The aim of sustainable commercial use of this species on private land is stated to be to “promote retention and management of habitats on private lands and establish with landowners the concept that wildlife, wildlife habitats and biodiversity in general can be valuable economic assets worth considering” (Parks and Wildlife Commission of the NT, 1997, p.3).

Quotas for egg harvest and nestling harvest were to be made available to approved landholders satisfying particular requirements. For these quotas, the landholder would need to pay the Commission royalties (fees). Other costs would in addition, have to be borne by the landholders to ensure compliance and arrange for the marking of birds reared under the programme, for example, micro-chip identification of live birds. Quite a few records were also to be kept by landholders participating in the scheme. Furthermore, landowners were required to enter into a formal agreement with the Parks and Wildlife Commission to manage and protect some wildlife habitat of *C. banksii* (Parks and Wildlife Commission of the NT, 1997, p.4).

In fact, no landholder was prepared to enter into such an agreement. The obvious reason why this scheme has failed is that the cost to landholders of participating in it would significantly exceed any economic benefit they could hope to gain from it. The transaction costs are too high. For the scheme to work, it would be necessary to subsidise eligible landholders for birds made available under the programme and sold. Whether such a subsidy would,

however, be justified economically is not clear because the species does not seem to be endangered.

One can learn both from the successes and failures of policies designed to provide economic incentives to conserve wildlife on private land. The above review of some cases indicates that some have succeeded and that others have failed for economic reasons.

6. Concluding Comments

The management of wildlife is a complex subject and the economics of the management of wildlife on private land is even more complex. However, given trends in the decline in the biodiversity of wildlife, it is a subject that should be given much more research attention. The survival of many wildlife species depends upon how they fare on private lands.

Unfortunately there is no simple set of economic incentives, such as those provided by private property rights, that will be effective in conserving all the wildlife species that we wish to conserve or in ensuring the degree of abundance that we wish to have for the various species. However, as a result of further research, we should be able to identify policies that can be expected to be effective in particular circumstances and reject others as likely to be inadequate. The appreciation that there is no simple economic management that fits all cases seems essential for making practical progress with this issue.

Acknowledgements

I wish to thank Alex Park and Nick Footner for their helpful research assistance and Clevo Wilson for some discussion of this topic with me. This research has also benefited from a grant from the Australian Research Committee for a study of the Economics of Conserving Australia's Tropical Wildlife.

References

- Bandara, R. and Tisdell, C. (2003a) "Use and non-use values of wild Asian elephants", *Economics, Ecology and the Environment*, Working Paper No. 74, School of Economics, The University of Queensland.
- Bandara, R. and Tisdell, C. A. (2003b) "The net benefit of saving the Asian elephant: a policy and contingent valuation study", *Ecological Economics*, (in press).
- Bandara, R. and Tisdell, C. A. (2002) "Asian elephants as agricultural pests: economics of control and compensation in Sri Lanka", *Natural Resources Journal*, **42**, 491-519.
- Benson, D. E., Shelton, R. and Steinbach, D. W. (1999) *Wildlife Stewardship and Recreation on Private Lands*, Texas A&M University Press, College Station, Texas.
- Bishop, R. C. (1987) "Economic values defined". Pp.24-33 in D. J. Decker and G. R. Goff (eds) *Valuing Wildlife: Economic and Social Perspectives*, Westview Press, Boulder, Colorado.
- Bishop, R. C. (1981) "Economic considerations affecting land-owner behaviour". Pp.73-86 in R. Dumke, G. V. Burger and J. R. March (eds) *Wildlife Management on Private Lands*. Proceedings of a Symposium: Wildlife Management on Private Lands, 3-6 May 1981, Milwaukee Wisconsin, Printed by La Crosse Printing Co., La Crosse, Wisconsin, 54601.
- Bishop, R. C. (1979) "Endangered species, irreversibility and uncertainty: a reply", *American Journal of Agricultural Economics*, **61**(2), 377-379.
- Bishop, R. C. (1978) "Endangered species and uncertainty: the economics of a safe minimum standard", *American Journal of Agricultural Economics*, **60**(1), 10-18.
- Burger, G. V. (1973) *Practical Wildlife Management*, Winchester Press, New York.
- Ciriacy-Wantrup, S. V. (1968) *Resource Conservation: Economics and Policies*, 3rd ed., Division of Agricultural Science, Berkeley, CA.
- Clark, C. (1976) *Mathematical Bioeconomics: The Optimal Management of Renewable Resources*, John Wiley, New York.
- Clark, C. (1973) "Profit maximisation and the extinction of animal species", *Journal of Political Economy*, **81**, 950-961.
- Crosthwaite, J. (1995) "A review of potential financial incentives to achieve nature conservation goals on private and leasehold land". Pp. 191-200 in Bennett, A., Backhouse, G. and Clark, T. (eds) *People and Nature Conservation: Perspectives on Private Land Use and Endangered Species Recovery*, The Royal Zoological Society of New South Wales, Mosman, NSW.

- Freese, C. H. and Trauger, D. I. (2000) "Wildlife markets and biodiversity conservation in North America", *Wildlife Society Bulletin*, **28**(1), 42-51.
- Parks and Wildlife Commission of the Northern Territory (no date) *A Strategy for Conservation through the Sustainable Use of Wildlife in the Northern Territory of Australia*, Palmerston, NT.
- Parks and Wildlife Commission of the Northern Territory (1996) *A Management Programme for Crocodylus porosus and Crocodylus johnstoni in the Northern Territory of Australia*, Palmerston, NT.
- Parks and Wildlife Commission of the Northern Territory (1997) *A Management Programme for the Red-Tailed Black Cockatoo Calyptorhynchus banksii in the Northern Territory of Australia*, Palmerston, NT.
- Tisdell, C. A. and Wilson, C. (2003) "The public's knowledge of and support for conservation of Australia's tree-kangaroos and other animals", *Biodiversity and Conservation* (in press).
- Tisdell, C. A. and Zhu, C. (1998) "Protected areas, agricultural pests and economic damage: conflicts with elephants and pests in Yunnan", *The Environmentalist*, **18**, 109-118.

PREVIOUS WORKING PAPERS IN THE SERIES ECONOMICS, ECOLOGY AND ENVIRONMENT

1. Governance, Property Rights and Sustainable Resource Use: Analysis with Indian Ocean Rim Examples by Clem Tisdell and Kartik Roy, November 1996.
2. Protection of the Environment in Transitional Economies: Strategies and Practices by Clem Tisdell, November 1996.
3. Good Governance in Sustainable Development: The Impact of Institutions by K.C.Roy and C.A.Tisdell, November 1996.
4. Sustainability Issues and Socio-Economic Change in the Jingpo Communities of China: Governance, Culture and Land Rights by Ren Zhuge and Clem Tisdell, November 1996.
5. Sustainable Development and Environmental Conservation: Major Regional Issues with Asian Illustrations by Clem Tisdell, November 1996.
6. Integrated Regional Environmental Studies: The Role of Environmental Economics by Clem Tisdell, December 1996.
7. Poverty and Its Alleviation in Yunnan Province China: Sources, Policies and Solutions by Ren Zhuge and Clem Tisdell, December 1996.
8. Deforestation and Capital Accumulation: Lessons from the Upper Kerinci Region, Indonesia by Dradjad H. Wibowo, Clement a. Tisdell and R. Neil Byron, January 1997.
9. Sectoral Change, Urbanisation and South Asia's Environment in Global Context by Clem Tisdell, April 1997.
10. China's Environmental Problems with Particular Attention to its Energy Supply and Air Quality by Clem Tisdell, April 1997.
11. Weak and Strong Conditions for Sustainable Development: Clarification of concepts and their Policy Application by Clem Tisdell, April 1997.
12. Economic Policy Instruments and Environmental Sustainability: A Second Look at Marketable or Tradeable Pollution or Environmental-Use Permits by Clem Tisdell, April 1997.
13. Agricultural Sustainability in Marginal Areas: Principles, Policies and Examples from Asia by Clem Tisdell, April 1997.
14. Impact on the Poor of Changing Rural Environments and Technologies: Evidence from India and Bangladesh by Clem Tisdell, May 1997.

15. Tourism Economics and its Application to Regional Development by Clem Tisdell, May 1997.
16. Brunei's Quest for Sustainable Development: Diversification and Other Strategies by Clem Tisdell, August 1997.
17. A Review of Reports on Optimal Australian Dugong Populations and Proposed Action/Conservation Plans: An Economic Perspective by Clem Tisdell, October 1997.
18. Compensation for the taking of Resources Interests: Practices in Relations to the Wet Tropics and Fraser Island, General Principles and their Relevance to the Extension of Dugong Protected Areas by Clem Tisdell, October 1997.
19. Deforestation Mechanisms: A Survey by D.H. Wibowo and R.N. Byron, November 1997.
20. Ecotourism: Aspects of its Sustainability and Compatibility by Clem Tisdell, November 1997.
21. A Report Prepared for the Queensland Commercial Fisherman's Organisation by Gavin Ramsay, Clem Tisdell and Steve Harrison (Dept of Economics); David Pullar and Samantha Sun (Dept of Geographical Sciences and Planning) in conjunction with Ian Tibbetts (The School of Marine Science), January 1998.
22. Co-Evolutions in Asia, Markets and Globalization by Clem Tisdell, January 1998.
23. Asia's Livestock Industries: Changes and Environmental Consequences by Clem Tisdell, January 1998.
24. Socio-Economics of Pearl Culture: Industry Changes and Comparisons Focussing on Australia and French Polynesia by Clem Tisdell and Bernard Poirine, August 1998.
25. Asia's (Especially China's) Livestock Industries: Changes and Environmental Consequences by Clem Tisdell, August 1998.
26. Ecotourism: Aspects of its Sustainability and Compatibility with Conservation, Social and Other Objectives, September 1998.
27. Wider Dimensions of Tourism Economics: A Review of Impact Analyses, International Aspects, Development Issues, Sustainability and Environmental Aspects of Tourism, October 1998.
28. Basic Economics of Tourism: An Overview, November 1998.
29. Protecting the Environment in Transitional Situations, November 1998.
30. Australian Environmental Issues: An Overview by Clem Tisdell, December 1998.
31. Trends and Developments in India's Livestock Industries by Clem Tisdell and Jyothi Gali, February 1999.

32. Sea Turtles as a Non-Consumptive Tourism Resource in Australia by Clevo Wilson and Clem Tisdell, August 1999.
33. Transitional Economics and Economics Globalization: Social and Environmental Consequences by Clem Tisdell, August 1999.
34. Co-evolution, Agricultural Practices and Sustainability: Some Major Social and Ecological Issues by Clem Tisdell, August, 1999.
35. Technology Transfer from Publicly Funded Research for improved Water Management: Analysis and Australian Examples by Clem Tisdell, August 1999.
36. Safety and Socio-Economic Issues Raised by Modern Biotechnology by Dayuan Xue and Clem Tisdell, August 1999.
37. Valuing Ecological Functions of Biodiversity in Changbaishan Mountain Biosphere Reserve in Northeast China by Dayuan Xue and Clem Tisdell, March 2000.
38. Neglected Features of the Safe Minimum Standard: Socio-economics and Institutional Dimension by Irmi Seidl and Clem Tisdell, March 2000.
39. Free Trade, Globalisation, the Environment and Sustainability: Major Issues and the Position of WTO by Clem Tisdell, March 2000.
40. Globalisation and the WTO: Attitudes Expressed by Pressure Groups and by Less Developed Countries by Clem Tisdell, May 2000.
41. Sustainability: The Economic Bottom Line by Clem Tisdell, May 2000.
42. Trade and Environment: Evidence from China's Manufacturing Sector by Joseph C. H. Chai, June 2000.
43. Trends and Development in India's Livestock Industry by Clem Tisdell and Jyothi Gali, August 2000.
44. Tourism and Conservation of Sea Turtles by Clem Tisdell and Clevo Wilson, August 2000.
45. Developing Ecotourism for the Survival of Sea Turtles by Clem Tisdell and Clevo Wilson, August 2000.
46. Globalisation, WTO and Sustainable Development by Clem Tisdell, August 2000.
47. Environmental Impact of China's Accession to WTO in the Manufacturing Sector by Joseph Chai, August 2000.
48. Effects of Cartagena Biosafety Protocol on Trade in GMOs, WTO Implications, and Consequences for China (English version) by Dayuan Xue and Clem Tisdell, August 2000.

49. Effects of Cartagena Biosafety Protocol on Trade in GMOs, WTO Implications, and Consequences for China (Chinese version) by Dayuan Xue and Clem Tisdell, August 2000.
50. The Winnipeg Principles, WTO and Sustainable Development: Proposed Policies for Reconciling Trade and the Environment by Clem Tisdell, September 2000.
51. Resources Management within Nature Reserves in China by Dayuan Xue, October 2000.
52. Economics, Educational and Conservation Benefits of Sea Turtle Based Ecotourism: A Study Focused on Mon Repos by Clem Tisdell and Clevo Wilson, October 2000.
53. Why Farmers Continue to use Pesticides despite Environmental, Health and Sustainability Costs by Clevo Wilson and Clem Tisdell, November 2000.
54. Wildlife-based Tourism and Increased Tourist Support for Nature Conservation Financially and Otherwise: Evidence from Sea Turtle Ecotourism at Mon Repos by Clem Tisdell and Clevo Wilson, November 2000.
55. A Study of the Impact of Ecotourism on Environmental Education and Conservation: The Case of Turtle Watching at an Australian Site by Clem Tisdell and Clevo Wilson, December 2000.
56. Environmental Regulations of Land-use and Public Compensation: Principles with Swiss and Australian Examples by Irmi Seidl, Clem Tisdell and Steve Harrison.
57. Analysis of Property Values, Local Government Finances and Reservation of Land for National Parks and Similar Purposes by Clem Tisdell and Leonie Pearson, March 2001.
58. Alternative Specifications and Extensions of the Economic Threshold Concept and the Control of Livestock Pests by Rex Davis and Clem Tisdell, May 2001.
59. Conserving Asian Elephants: Economic Issues Illustrated by Sri Lankan Concerns by Ranjith Bandara and Clem Tisdell, June 2001.
60. World Heritage Listing of Australian Natural Sites: Tourism Stimulus and its Economic Value by Clem Tisdell and Clevo Wilson, September 2001.
61. Aquaculture, Environmental Spillovers and Sustainable Development: Links and Policy Choices by Clem Tisdell, October 2001.
62. Competition, Evolution and Optimisation: Comparisons of Models in Economics and Ecology by Clem Tisdell, October 2001.
63. Aquaculture Economics and Marketing: An Overview by Clem Tisdell, October 2001.

64. Conservation and Economic Benefits of Wildlife-Based Marine tourism: Sea Turtles and Whales as Case Studies by Clevo Wilson and Clem Tisdell, February 2002.
65. Asian Elephants as Agricultural Pests: Damages, Economics of Control and Compensation in Sri Lanka by Ranjith Bandara and Clem Tisdell, February 2002.
66. Rural and Urban Attitudes to the Conservation of Asian Elephants in Sri Lanka: Empirical Evidence by Ranjith Bandara and Clem Tisdell, May 2002.
67. Willingness to Pay for Conservation of the Asian Elephant in Sri Lanka: A Contingent Valuation Study by Ranjith Bandara and Clem Tisdell, May 2002.
68. Bioeconomic Analysis of Aquaculture's Impact on Wild Stocks and Biodiversity by Clem Tisdell, May 2002.
69. Will Bangladesh's Economic Growth Solve its Environmental Problems? by Clem Tisdell, May 2002.
70. Socioeconomic Causes of loss of Genetic Diversity: Analysis and Assessment by Clem Tisdell, June 2002.
71. Empirical Evidence Showing The Relationships Between Three Approaches For Pollution Control by Clevo Wilson, August 2002.
72. Energy-Use, the Environment and Development: Observations with Reference to China and India by Clem Tisdell and Kartik Roy, September 2002.
73. Willingness of Sri Lankan Farmers to Pay for a Scheme to Conserve Elephants: An Empirical Analysis by Ranjith Bandara and Clem Tisdell, January 2003.
74. The Public's Knowledge of and Support for Conservation of Australia's Tree-kangaroos by Clem Tisdell and Clevo Wilson, February 2003.
75. Ecotourism/Wildlife-based Tourism as Contributor to Nature Conservation with Reference to Vanni, Sri Lanka by Clem Tisdell, March 2003.
76. Visitor Profiles and Environmental Attributes, especially of Birds, Attracting Visitors to Lamington National Park: Tourist Attitudes and Economic Issues by Clem Tisdell and Clevo Wilson, March 2003.
77. Wildlife Damage, Insurance/Compensation for Farmers and Conservation: Sri Lankan Elephants as a Case by Ranjith Bandara and Clem Tisdell, May 2003.
78. Open-Cycle Hatcheries, Tourism and Conservation of Sea Turtles: Economic and Ecological Analysis by Clem Tisdell and Clevo Wilson, May 2003.
79. Attitudes to Entry Fees to National Parks: Results and Policy Implications from a Queensland Case Study by Clevo Wilson and Clem Tisdell, June 2003.

80. Use and Non-use Values of Wild Asian Elephants: A Total Economic Valuation Approach by Ranjith Bandara and Clem Tisdell, June 2003.
81. Valuation of Tourism's Natural Resources by Clem Tisdell, August 2003.
82. Visitors Reaction to Pinnawala Elephant Orphanage in Sri Lanka, by Clem Tisdell and Ranjith Bandara, August 2003.
83. Property Rights of Landholders in Non-Captive Wildlife and Prospects for Conservation, by Clem Tisdell, August 2003.
84. Wildlife-Based Recreation and Local Economic Development: The Case of the Pinnawala Elephant Orphanage in Sri Lanka, by Clem Tisdell and Ranjith Bandara, August 2003.
85. Willingness to Pay for Different Degrees of Abundance of Elephants, by Ranjith Bandara and Clem Tisdell, September 2003.
86. Conflicts Over Natural Resources and the Environment: Economics and Security, by Clevo Wilson and Clem Tisdell, September 2003.
87. The Net Benefit of Saving the Asian Elephant: A Policy and Contingent Valuation Study, by Ranjith Bandara and Clem Tisdell, October 2003.
88. Economics of Wildlife Tourism, by Clem Tisdell and Clevo Wilson, October 2003.
89. Notes on Market Failure and the Paretian (Kaldor-Hicks) Relevance and Irrelevance of Unfavourable Externalities, by Clem Tisdell, December 2003.
90. Does Ecotourism Contribute to Sea Turtle Conservation? Is the Flagship Status of Turtles Advantageous?, by Clem Tisdell and Clevo Wilson, December 2003.