

The Benefits and Costs of Establishing a National Park in Madagascar¹

This case study presents the application of the opportunity cost, contingent valuation, and travel cost methods to estimate some of the benefits and costs associated with the creation of a National Park in Madagascar. This study is innovative because it is one of the first applications of contingent valuation to measure the economic impacts of a park on local villagers. An additional strong point of the study is that it uses more than two different valuation techniques to estimate each benefit or cost and compares the estimated results. The study is derived from the work of Kramer, Munasinghe, Sharma, *et al.* (1993, 1994), and Kramer (1993).

Madagascar's high rates of endemism make it one of the ecologically richest countries in the world. It is also one of the economically poorest countries in the world, with a per capita annual income of only \$190. This combination of factors has put great stress on Madagascar's biodiversity, while also making the country a prime target for investment in conservation. One action the government is undertaking to protect biodiversity is the creation of a system of parks and reserves, one of which is the subject of this study: the Mantadia National Park.

This study estimates both the costs to nearby villages of establishing the park, and the benefits to foreign visitors of the park as an international tourism destination. These estimates are useful in making a rational decision about whether or not to protect the park, estimating the size of consumer's surplus enjoyed by visitors, and assessing the compensation required by local villagers in order for them to forgo access to the park.

COSTS TO LOCAL VILLAGERS

Establishment of the park will pose an economic cost on the local population in terms of their losing access to the park and the resources it contains. The villagers have traditionally depended on the forest in and around the park for forest products and agricultural land for swidden (shifting) cultivation of rice. Commonly harvested forest products include fuelwood, fish and animals, grasses, and medicines. The traditional form of shifting cultivation practised by the villagers is also the primary cause of deforestation in the park. If the park is established, the villagers will lose those products harvested or grown in the park lands. In the study, the costs imposed on the villagers were measured using both the opportunity cost approach and the contingent valuation method.

The *opportunity costs* associated with traditional activities were measured using a survey of 351 households in 17 villages surrounding the park. The survey contained questions related to socio-economic variables, land use, time allocation among economic activities, and household production. Price data on forest products and time spent gathering them were obtained from shop owners, household and village leaders, and published reports. This information was used to estimate total value of forest products collected by the villagers (Table 34). These estimates were then combined with

¹ This Annex is excerpted with permission from Dixon, *Economic analysis Environmental Impacts*, Second Edition Earthscan Publications Ltd, London 1994.

information on land use and resource extraction in the park to determine the share of total household income coming from the park that would be potentially lost each year. The mean value of losses to villagers of establishing the Mantadia National Park was thus estimated at \$91 per household per year. The village survey also contained *contingent valuation questions*. These questions were phrased in terms of compensation which would make the household as well off with the park as they would have been if they continued to have access to the forests in the park. The numeraire used to elicit willingness-to-accept bids was units of rice, because rice is the main crop in this region and transaction in rice are well known to the local people. The results of the contingent valuation survey indicate that the average household requires \$108 worth of rice per year as compensation to forgo use of the park.

Table 34 Value of Forest Products Collected by Villagers

<i>Forest Products</i>	<i>Number of Observations</i>	<i>Total Annual Value of all Villages (\$US)</i>	<i>Mean Annual Value per Household (US\$)</i>
Rice	351	44,928	128.0
Fuelwood	316	13,289	42.0
Crayfish	19	220	11.6
Crab	110	402	3.7
Tenreck	21	125	6.0
Frog	11	71	6.5

Source: Kramer *et al.*, 1994

BENEFITS TO INTERNATIONAL TOURISTS

The second part of the study focused on the benefits from the establishment of the park. Travel cost and contingent valuation are used to estimate the economic value of international nature tourism. Estimating demand by international tourists requires reformulation of traditional travel cost models, because individuals that travel to a country like Madagascar engage in a variety of activities. The visit to the proposed national park would be only one of a number of activities visitors engage in.

Questionnaires based on this model were prepared and administered to visitors to the small Perinet Forest Reserve adjacent to the proposed Mantadia National Park. Table 35 presents selected summary statistics from these questionnaires for the sample of international visitors. The average visitor tended to be well-off and well-educated: they had an annual income of \$59,156, 15 years of education, and stayed in Madagascar for 27 days. Political unrest in the country cut short the survey process at 94 interviews, however, and required the data to be supplemented with data from an expert survey of US and European tour operators who specialize in nature tourism. Using combined data from the two surveys, and econometric analysis was conducted to apply the travel-cost approach. The model was then used to predict the project benefits to tourists assuming

that the Mantadia National Park will result in a 10 percent increase in the quality of local guides, educational materials, and facilities for interpreting natural areas in Madagascar. The travel cost method produced an average increase in willingness to pay per trip of \$24 per tourist. Based on the conservative assumption that 3,900 foreign tourists would visit the new park (the same number as currently visit the Perinet Reserve), this is equivalent to an annual 'benefit' to foreign tourists of \$93,600.

Table 35 Summary Statistics for International Visitors

<i>Variable</i>	<i>Number of Observations</i>	<i>Range</i>	<i>Mean</i>
Annual Income	71	\$3,040 to \$296,400	\$59,156
Education	86	10 to 18 years	15 years
Age	87	16 to 71 years	38.5 years
Number of Days in Madagascar	83	3 to 100 days	26.6 years
Number of Days in Perinet	80	1 to 8 days	2 days
Total Cost of Trip to Madagascar	78	\$355 to \$6,363	\$2,874

Source: Kramer *et al.*, 1993

The *contingent valuation method* was also used to directly estimate the value of the park for foreign tourists. Visitors to the Perinet Forest Reserve were provided with information about the new park and, using a discrete choice format, they were asked how much more they would have been willing to pay for their trip to Madagascar to visit the new national park if they saw twice as many lemurs, or if they saw the same number of lemurs as on their current visit. Since most of these visitors are only expected to visit Madagascar once, their response represents a one-time, lump sum payment they are willing to make in order to preserve the park. Mean willingness-to-pay for the park (conditional on seeing the same number of lemurs) was \$65. Assuming current visitation patterns, the total annual willingness-to-pay for the park would be \$253,500.

COMPARISON OF RESULTS

For the village component, the welfare estimates, which are based on the two quite different valuation methods of opportunity cost and contingent valuation, are remarkably similar (\$91 and \$108 per household per year). Based on estimated household incomes for this area, this amount is equivalent to about 35 percent of present household income, a very significant amount for a poor population.

For the international visitor benefits, travel cost and contingent valuation produced somewhat more disparate estimates (\$24 and \$65 per trip). The contingent valuation estimate may be higher because it includes some non-use values, whereas the travel cost estimate contains only direct use values. As seen from Table 35 these

estimates represent a virtually insignificant amount of the average visitor's annual income.

Table 36 provides a summary of the economic analysis of Mantadia National Park in terms of the opportunity cost to nearby villagers and the consumer's surplus enjoyed by international visitors. The analysis reveals that villagers will require approximately \$500,000 to \$700,000 of compensation to forgo the use of the park and international tourists are willing to pay an additional \$800,000 to \$2,160,000 to visit the park. The establishment of the park potentially produces many benefits, including local income from tourism, protection of biodiversity, watershed protection and climate regulation. The existence of substantial consumer's surplus on the part of international visitors can be used to help devise a compensation scheme for local villagers who will be losing part of their economic base. The actual form in which compensation is made -- direct methods -- still has to be determined. What is clear, however, is that the creation of Mantadia National Park will impose costs on nearby villagers but the Park also creates benefits that can be used to meet those costs.

Table 36 Summary Economic Analysis of Mantadia National Park

Estimates of Welfare Losses to Local Villagers from Establishment of the Park

<i>Method Used</i>	<i>Annual Mean Value per Household (\$)</i>	<i>Aggregate Present Value^a (\$)</i>
Opportunity Cost	\$91	\$566,070
Contingent Valuation	\$108	\$673,078

Estimates of Welfare Gains to Foreign Tourists from Establishment of the Park

<i>Method Used</i>	<i>Annual Mean Value per Trip (\$)</i>	<i>Aggregate Present Value^a (\$)</i>
Travel Cost	\$24	\$796,870
Contingent Valuation	\$65	\$2,160,000

^a Aggregated over 20 years at a 10% discount rate.

Source: Kramer, 1993; Kramer, *et al.*, 1993.

Sources:

- Kramer, R.A. 1993. 'Tropical Forest Protection in Madagascar'. Paper prepared for Northeast Universities Development Consortium. Williams College.
- Kramer, R.A., M. Munasinghe, N. Sharma, E. Mercer, and P. Shyamsundar, 'Valuation of Biophysical Resources in Madagascar' in M. Munasinghe, *Environmental Economics and Sustainable Development*, World Bank Environment Paper Number 3. Washington, D.C.: The World Bank, 1993.
- Kramer, R.A., N. Sharma, P. Shyamsundar, and M. Munasinghe, 'Cost and Compensation Issues in Protecting Tropical Rainforests: Case Study of Madagascar', Environment Working Paper No. 62, Washington, D.C.: The World Bank, January 1994.