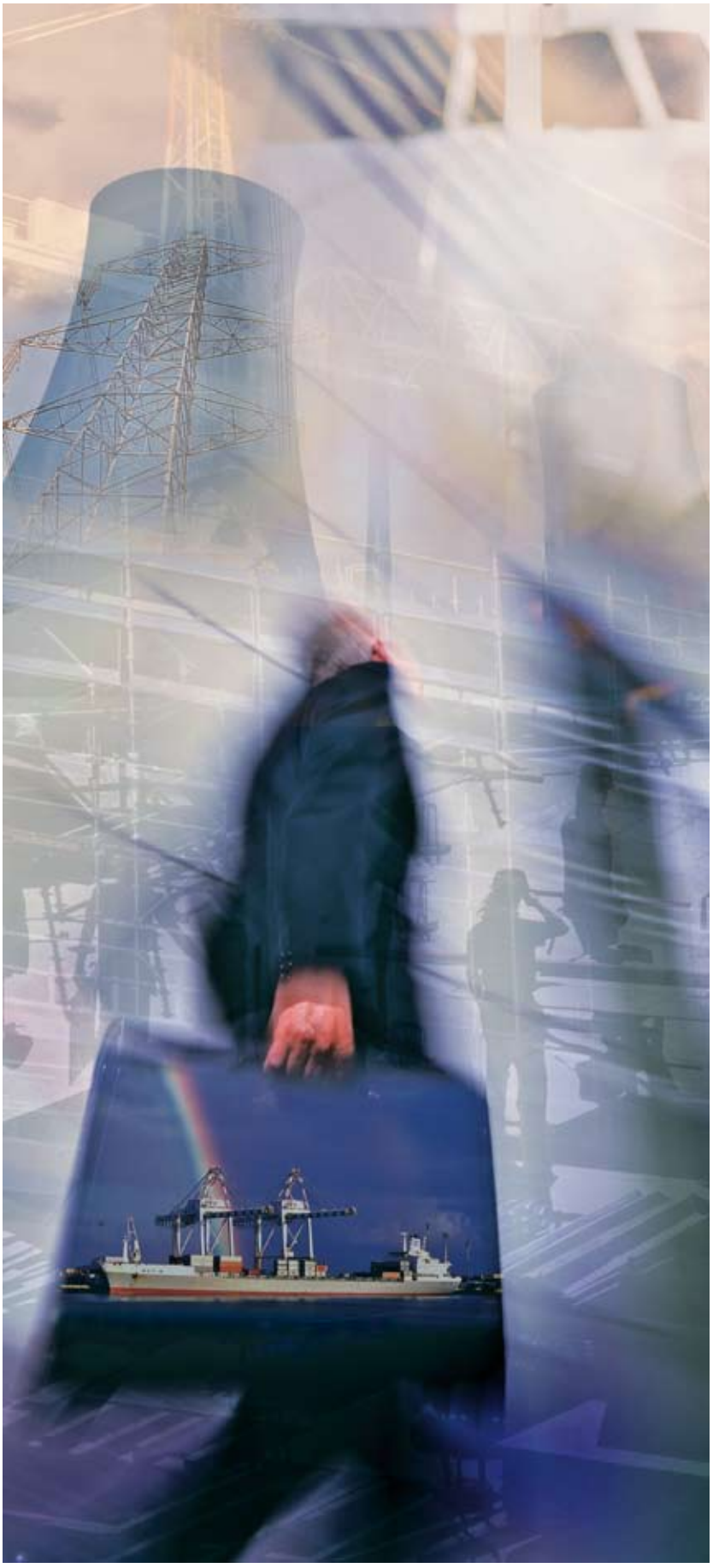

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Nature-Based Tourism In Lesser Known Species And Their Implications For Conservation

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Abstract

Examines tourism expenditures arising from two lesser known and nocturnal forms of wildlife, namely, tree-kangaroos and glow-worms in Australia. Comparisons are made. For this purpose two field surveys were conducted to determine expenditures relating to viewing these two forms of wildlife and then estimate the local economic impact. Field survey data are also used to estimate the consumer surplus for visitors arising from these two forms of tourism. The study shows that these two forms of wildlife can generate economic activity, but not much of it flows to owners of land providing the resources. The relevant issues relating to economic use and non-use values are discussed and it is shown that market systems fail to adequately compensate owners of these resources for providing refuge despite the existence of economic use and non-use values. This calls for intervention of the government in the system to take into account of the un-marketed economic values in their conservation. The field survey data is also used to estimate the factors influencing visitors' maximum willingness to spend for tree kangaroo and glow-worms viewing.

Keywords: Lesser known; nocturnal; wildlife conservation; ecotourism; total economic value

Lesser Known and Nocturnal Species in Tourism and their Implications for Conservation – A Case Study

Introduction

Although some literature exists on the economic value of nature-based tourism in relatively rural and undeveloped sites (e.g. Shrestha, et al. 2007), no known literature exists that examines the economic importance of lesser known and nocturnal species in tourism and their implications for conservation. It is important to examine the role tourism dollars (use values) can play in their conservation because it is perceived in the literature that wildlife tourism can bring about economic benefits which can support wildlife conservation and local communities (The Economist, 2008; Shackley, 1996). While these arguments are in general correct, it is not certain that all species have the potential to attract sufficient tourism dollars to justify landholders to set aside land for their conservation. Furthermore, the economic benefits to the local community can also be small. Therefore, it is all the more important to take into account the un-marketed economic values (non-use values) of wildlife as well to show their total economic values. For some lesser known and nocturnal species non-use values account for the major part of their total economic values and that tourism use values constitute only a small fraction of these values. Hence, it is important to examine some of the issues involved, especially for species that are less known.

This study concentrates on two lesser known and nocturnal species, namely glow-worms and tree-kangaroos. Glow-worms are the larva of an insect while the tree-kangaroos are tree dwelling marsupials which have a restricted distribution in Far North Queensland (FNQ) in Australia. There is evidence to show that at least one of the species, namely, tree-kangaroos are less known to the public. A study by Tisdell and Wilson (2004a) show that out of a sample of 204 respondents, only 36% said that they knew of the existence of tree-kangaroos and the remainder did not know of their existence.

Interestingly, these two species are used for tourism in Australia and in the case of glow-worms, tourism is conducted in New Zealand as well. Of these two species, glow-worms-based tourism is better known in the tourism industry. For these two species the only known economic use values are from tourism while non-use values also exist as for most species.

This paper examines the expenditures generated from these two species from tourism which are both night time activities. For this purpose two field surveys involving tourists viewing glow-worms and tree-kangaroos were conducted obtaining 207 and 133 usable survey forms respectively. The surveys, amongst other objectives, were specifically intended to estimate expenditures of visitors associated with traveling to see these two forms of nocturnal wildlife and to estimate the money spent in the local area where the viewing takes place. Data was also collected to estimate the consumer surplus of visitors and to identify factors that influence visitors' maximum willingness to pay for this experience.

The remainder of the paper is set out as follows. Section 2 describes the background to glow-worms and tree-kangaroo tourism while Section 3 describes the survey and survey methodology. Section 4 discusses the socio-economic profile of independent visitors viewing glow-worms at Natural Bridge (Springbrook National Park), Southeast Queensland and tree-kangaroos in the Atherton Tablelands in Far North Queensland. Section 5 discusses the economic values generated from tourism and Section 6 examines the factors influencing visitors' maximum willingness to spend for glow-worms and tree-kangaroos viewing and Section 7 presents the Tobit regression results. The final section summarises and concludes.

Background to glow-worms and tree-kangaroo tourism

In this section we provide some general background to glow-worms and tree-kangaroo-based tourism in Australia and their overall significance as a tourist attraction. We also

outline features of these two forms of tourism. Glow-worm-based tourism is first discussed. Insect-based tourism is a particular form of wildlife tourism that has remained mostly unnoticed in Australia despite its potential for further development as a tourism drawcard. Despite this situation, one form of insect-based tourism, namely glow-worms, shows that it an economic asset and that it is much more widespread than it is being credited for. Butterflies provide another Australian example. They are important in tourism in some East Asian countries such as China.

Glow-wormss *Arachnocampa genus* are found only in Australia and New Zealand and have been a tourist attraction for several decades, especially in the Waitomo Caves in New Zealand. There is one species of glow-worms in New Zealand and three in Australia (Pugsley, 1983), with several new species awaiting formal identification and naming (Baker, 2003; Baker, 2002). All species of glow-worms have the potential to be tourist attractions. Glow-worms in Australia occur in areas of high humidity from the rainforests/caves of Far North Queensland to Tasmania in the south, but are only present in eastern Australia. Tourism (small to large scale) utilises some of these sites in all of the four states concerned namely, Queensland, New South Wales, Victoria and Tasmania. Tourism usually occurs in sites where the glow-worms colonies are large.

For tourism purposes, it is the glow-worms stage that is attractive. Glow-worms unlike larva of butterflies and moths are predatory and lure their prey by glowing in the dark. Hence, unsuspecting prey (insects) get entangled in their web to become food for the glow-worms.

Glow-worms viewing in its natural habitat is a night-time activity that occurs in a cave or in a rainforest. It is an activity conducted throughout the year, but the abundance of these insects is found in wetter months of the year. Because of the potential that glow-worms have in attracting visitors during the day and in order to make glow-worms more easily accessible, some entrepreneurs have created artificial habitats for glow-worms to attract day-time (fee-paying) visitors in at least two known locations in Australia. Such activity highlights the demand that exists among daytime visitors for such viewing.

Each year thousands of tourists visit glow-worms colony sites to see them and watching glow-worms has become a valuable commercial activity for tour operators at some sites in Australia and New Zealand. Statistics collected by Queensland Parks and Wildlife Service (QPWS) show as many as 300 such visitors are brought on some nights by commercial tour operators to the most popular and largest glow-worm viewing site in Australia[1]. This site is known as the Natural Bridge located in the Springbrook National Park approximately 60 km from Brisbane. However, this number fluctuates according to the arrival of the Asian tourists to Australia.

Table 1 shows the number of independent tourists and tourists brought by commercial tour operators to Natural Bridge since 2001. Commercial tour operators bring in large numbers of Asian tourists (e.g. from Japan, South Korea, Taiwan) in addition to other visitors (both foreign and Australian) to Natural Bridge.

Table 1. Estimated number of visitors brought by commercial tour operators and 'independent visitors' during the period 2001-2003 to view glow-worms at Natural Bridge

Month/ Year	2001		2002		2003		2004-2007	
	Tours	Ind	Tours	Ind	Tours	Ind	Tours	Ind
Total	**67,444**	**15,978**	**47,912**	**9,552**	**49,236**	**13,839**	**Similar to 2002-2003 figures**	**Similar to 2002-2003 figures**

Source: QPWS (2001-2003) unpublished data. Visitor numbers since 2004 have not been recorded by the park. However, Michael Hall (2008) from QPWS is of the view that visitor numbers are more or less similar to previous years.

Note: Figures in Table 1 are probably underestimates of visitor numbers. This is because QPWS rangers record data only when they are stationed at the park entrance and often do not record numbers from independent visitors who enter the park while the rangers are on patrol. Furthermore, on certain evenings rangers are not present in the park. They work only five nights per week.

Table 1 indicates that commercial tour operators brought on average more than 50,000 visitors a year during the period 2001-2003 to view glow-worms at Natural Bridge when statistics were maintained. However, numbers have fluctuated from year to year and

[1] It must be pointed out here that although tourist numbers appear large, it is likely that the number of tourists visiting glow-worm colonies in New Zealand outstrip numbers in Australia. However, we were unable to obtain figures for New Zealand.

numbers have dropped. This is partly due to events of September 11, 2001, SARS and drop in Japanese tourism to Australia during the last few years. However, the large numbers of tourists brought in by commercial tour operators demonstrate that the importance of this attraction to them. In addition to the mostly Asian visitors brought by commercial tour operators, many independent visitors, both Australian and foreign, travel to Natural Bridge to view glow-worms on their own. Some school groups and groups of elders are also included in the non-commercial (independent) visitor category. On average, the number of independent visitors has been around 13,000 from 2001 to 2003 as shown in Table 1. However, they account for less than 20 percent of visitors coming to Natural Bridge to view glow-worms.

Glow-worms tours in Australia, like in New Zealand, are well advertised on the internet by most commercial tour operators. An internet search shows at least 13 sites being advertised in Australia. This is shown in Table 2.

Table 2 Some Australian glow-worms sites advertised on the internet

Country	State/Region	Private and Public Locations
Australia	**QLD**	Springbrook Glow-worms Research Centre, Gold Coast
		Forest of Dreams, Springbrook, Gold Coast
		Natural Arch, Spring Brook National Park, Gold Coast
		Mt Tamborine
		Cairns Highlands
		Mt Tamborine Curtis Falls
	NSW	Wollemi National Park, Glow-worms Tunnel
		Hawksbury River
	VIC	Otway, Lavers Hills
		Otway, Melba Gullys
		Mt Buffalo National Park
	Tas	Mole Creek, Marakoopa Wet Cave

Source: On-line tourist information sites, as at 21 April 2008.

Note: It is possible that there are many more sites used for tourism purposes in Australia which are not either advertised on the internet or captured by the search. Most of these sites charge an entry fee and at least two of the sites have been artificially created and accommodate daytime visitors. The viewing at Natural Bridge site is a night time activity although in New Zealand they are mainly day time activities. At Natural Bridge visitors brought in by tour operators pay a few to the tour operator who in turn pays for a license issued by Queensland Parks and Wildlife Service. Access is free to independent visitors.

Entry to watch glow-worms in the Natural Bridge cave and the surrounding national park is free for independent visitors as is the case for visitors to almost all national parks in Queensland. Although there is no direct entry fee for visitors, Queensland Parks and Wildlife Service (QPWS) has a system of charging commercial (bus) tour operators and for access to the site for tour groups viewing glow-worms. To some extent, these charges are likely to be passed on to tourists joining these commercial tours but the exact degree to which this is so is not known. This scheme has, amongst other things, provided funds to QPWS to maintain rangers close to the glow-worms viewing area in the evening/night when commercial tourists visit the site. The presence of rangers also gives some protection to the glow-worms and provides an opportunity for independent visitors to interact with the rangers. There is an educational component involved.

Tree-kangaroo-based tourism remains mostly unknown in the tourism literature, although nocturnal wildlife tours in Far North Queensland (FNQ) have targeted them in the past 25 years (Alan Gillanders, personal communication, 2008). There are two species of tree-kangaroos in Australia, namely the Lumholtz tree kangaroo, *Dendrolagus lumholtzi* and Bennett's tree kangaroo, *Dendrolagus bennettianus*. More species of tree-kangaroos occur in PNG. The two species of tree-kangaroo occur in geographically disjoint rainforests, some of which are fragmented, but their range overlap in certain locations (Winter, 1997, p.502). Of the two species it is believed that the Bennett's is more secretive and hence more difficult to observe. This is a barrier to tourism, although it is believed that this species is also used for tourism purposes in at least two locations in Far North Queensland (Alan Gillanders, personal communication, 2008). It is the Lumholtz tree-kangaroo that is better known as a tourist attraction.

Tree-kangaroo-based tourism like the viewing of glow-worms is mainly a night-time activity where small groups of tourists are taken to the rainforests as part of a nocturnal wildlife tour which involves the viewing of other wildlife, but in most cases the tree-kangaroos remain the main interest. Early morning (before sunrise) tours are also conducted by some guides on request. The rainforest habitat covered involves fragmented forests on farms, private and state forests and national parks. Tour guides involved keep to well known tree-kangaroo 'hot spots' to maximise the chances of seeing the tree-

kangaroos. Unlike in the case of glow-worms where hundreds of tourists can be involved at one given time, the number of tourists involved in tree-kangaroos tourism can range from one to a maximum of 15 per party[2]. During the tour other mammals, birds, insects and plants are shown and introduced. The time taken is approximately one and a half hours. A good introduction to tree-kangaroos, their habitats and conservation status is provided by the guides involved in this form of tours. These tours are mostly conducted by guides on a part-time basis and are small-scale in nature, although there is at least one medium-sized tour operator advertising nocturnal tours involving tree-kangaroos. This is in contrast to glow-worms viewing where large tour operators are involved in Australia and New Zealand in addition to small-scale tour operators. It is possible to see many wildlife during these guided walks and apart from tree-kangaroos other wildlife seen are birds, possums (several species) and insects. The sighting of other species adds 'value' to the tour.

Unlike in the case of glow-worm viewing, the number of tourists involved are very small, but the numbers are growing. As in the case of glow-worms it is not possible to obtain data relating to tourist numbers that cover all tree-kangaroos based tourist activities, but we present data in Table 3 from one nocturnal wildlife tour operator which shows that the tourist numbers involved are small, but are increasing. This could be attributed to increased publicity given in recent times to this kind of activity in hotels, motels and public places in areas where this tourism takes place.

Table 3: Estimated number of visitors undertaking the Alan Gillanders nocturnal tour involving tree-kangaroos in the Atherton Tablelands, Cairns, FNQ

Year	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**Total**
Total	50	120	250	320	360	180	360	1640

Source: Alan Gillanders Nocturnal Tours (2001-2007), unpublished data. It would not be incorrect to say that Alan's wildlife tours attract a significant percentage of visitors interested in seeing tree-kangaroos. Cyclone Larry in 2006 affected visitor numbers. If it were not for some group tours the numbers for 2006 would have been even lower. For almost four months there were no tourists and then the season was very poor all wildlife tour operators in the region.

[2] No more than ten tourists are taken if they are not known to each other.

Although it is possible to view tree-kangaroos in the wild without the assistance of guides, sightings are more difficult than when accompanied by guides. In the case of glow-worms it is possible for independent tourists to see glow-worms in their natural habitat such as Natural Bridge where as it is uncommon for tourists to seek out tree-kangaroos on their own. In the case of tour guide accompanied tours the chances of seeing tree-kangaroos are better and in the case of Alan Gillanders nocturnal tour the sightings ratio was approximately 86% during the survey period[3]. Nocturnal wildlife tour guide charges vary. In the case of Alan Gillanders tours, the cost during the survey period was Aus$ 60 per couple with Aus$ 25 per extra adult and Aus$ 10 per child. However, when large families and parties are involved per tour, then the average cost per head falls to approximately Aus$ 15[4].

Alan's nocturnal wildlife tour is conducted on private farmland where patches of rainforest exist and on nearby state forests. The visitors assemble at a spot in the village of Yungaburra in the Atherton Tablelands, 90 km from Cairns. They are met by Alan and then travel to the nearby farms where the nocturnal wildlife tour begins. However, the arrangements made for tree-kangaroo viewing differs from place to place. This form of tourism is advertised by the guides/tour operators who conduct them. An internet Google search shows that there are at least four nocturnal tours that refer to tree-kangaroos in their tours.

The Survey

In this study only independent visitors were surveyed. The tourists brought in by commercial tour operators in the case of glow-worms were not surveyed. One reason was the language barrier because most visitors on commercial tours are from Asia. Another reason was that many of these tourists (especially the Asian tourists) have already pre-paid for their whole visit and hence, it was thought that they would be unable to answer

[3] During the last 18 months (September, 2007 – March 2008) the sightings ratio has been approximately 72%. However, sightings have been highly irregular with some months recording a sightings ratio as high as 90% and in some months as low as 60%. This is due to the change in the population structure and the movements of some animals due to cyclone Larry that affected the region in March 2006 (Allan Gillanders, personal communication, 2008).

[4] The Tree-kangaroo viewing charges had not changed much during the last few years. Only the charges per child had increased from Aus$ 10 to 15 and group costs from Aus$ 15 to 20.

many of the questions in the survey independently. Furthermore, many of these visitors travel to Natural Bridge as part of an evening tourist package that often involves other attractions and dinner. Because of the differences between these two distinct types of visitors it was decided to concentrate the study only on independent visitors. Limited time and budgetary constraints also favoured studying only the independent visitors. In the case of tree kangaroo viewing all visitors are independent visitors who meet the guide at pre-determined sites.

Conducting direct interviews for both these studies was not practical mainly because both these forms of tourism are conducted in the night. We decided to adopt the following approach for both surveys. One member of each independent group or party was to be handed a survey form together with a postage paid self addressed envelope. Respondents were asked to complete the survey in the next few days and post it. In the case of glow-worms, Queensland National Parks and Wildlife (QPWS) gave permission for the conduct of the survey inside the Springbrook National Park (Natural Bridge section). QPWS rangers handed out the survey forms to independent visitors. This they did on those evenings which they were present to monitor bus tours and other visits. They were handed out by QPWS staff at the commencement of the circuit track to the Natural Bridge glow-worms viewing site.

Survey forms were intended to be handed to each individual person (if travelling alone) or party who visited Natural Bridge for the purpose of watching glow-worms from January, 2003 to February, 2004 on a voluntary basis. However, the distribution of survey forms was halted for several months because of the transfer of rangers and new rangers having to be made aware of the project. The survey resulted in 207 usable responses. After allowing for a party size of 4.15, this gave a coverage of approximately six percent of the independent visitors in the period covered.

In the case of tree-kangaroos, too, it was not possible to conduct direct interviews and was conducted only among Alan's nocturnal tour participants in the Atherton Tablelands. The main reasons for not being able to conduct direct interviews was that it is a night-

time activity and there is no place where the interview could be conducted. Furthermore, soon after the tour visitors wish to leave. Even if the above issues can be resolved, the cost of conducting direct interviews would have been prohibitive since the numbers involved are small. In such situations the best strategy is to distribute survey forms to the visitors with postage paid envelopes as was done in the case of the glow-worms survey. Necessary instructions were provided in the questionnaire. The survey forms were handed out to the visitors soon after the tour by Alan Gillanders who conducts the nocturnal wildlife tour. The survey was conducted from September, 2004 to October, 2005. The survey resulted in 133 usable responses. After allowing for a party size of 2.52, this gave a coverage of approximately 98% of the visitors during the survey period.

The socio-economic profile of independent visitors viewing glow-worms at Natural Bridge and tree-kangaroos in the Atherton Tablelands, FNQ

The majority of surveyed visitors for the glow-worms survey (81 %) were from Australia while in the case of tree-kangaroos the majority were foreigners (54%). Of the foreigners most were from Europe and North America for both these activities. In the case of glow-worms there were several from New Zealand, but few undertaking tours to view tree-kangaroos. Asians were poorly represented in both studies, but there were visitors from Hong Kong, Singapore and from other countries in South East Asia in the case of glow-worms. One of the reasons why Asians are not well represented in the case of glow-worms is because the survey excluded Asian tourists brought by commercial tour operators. Also most Asian visitors to Australia are not independent visitors. In all, of those who answered the questionnaire, there were visitors from 14 different countries visiting Natural Bridge to view glow-worms and in the case of tree-kangaroos there were visitors from 16 countries. It is clear that there is a larger diversity of nationalities undertaking tree-kangaroo viewing in small numbers than visitors from fewer nationalities viewing glow-worms in larger numbers. As might be expected, most of the Australian visitors in both studies were from Queensland, followed by those from NSW and Victoria.

Most of the surveyed respondents in both surveys were female. In the case of glow-worms it was 56% and in the case of Tree-kangaroos it was 53%. Approximately, 1% did not indicate their gender. Interestingly, in both cases the visitors belonged to younger age groups. In the case of tree-kangaroos (33%) belonged to the 31-40 age group. The visitor numbers begin to diminish quite sharply for the 50s group (21%) and the number in their 60s and those above is small (13%). This is more marked for glow-worms than for tree-kangaroos. One reason for this could be that since both these activities are conducted during the night it could well be discouraging older visitors from undertaking such visits.

As observed in many other studies involving ecotourism (Tisdell and Wilson, 2004c) the level of education of both groups is high. The number of visitors having a degree or a postgraduate qualification was 63% in the case of tree-kangaroos. It was 41% in the case of glow-worms.

As would be expected from those with higher education, the income levels were also quite high. In the case of tree-kangaroos those earning more than Aus$ 60,000 or more per annum (family income before tax) was 59% while it was 32% in the case of glow-worms. As discussed in Section 2 it costs more to undertake tree-kangaroo viewing than glow-worms. Hence, this activity favours those with higher incomes than those with lower incomes. Because most of the visitors are from North America and from Europe and due to the favourable exchange rate there were more foreigners in the Aus$ 60,000 and above category than Australians.

Economic values generated from tourism

The economic value generated from wildlife tourism is both use and non-use values. Economic use values may be consumptive (e.g. recreational fishing or hunting) or it may be non-consumptive as in the case of viewing wildlife generally. This section concentrates only on non-consumptive use values. When such uses are free (e.g. when entry to a national park is free) or is underpriced, the true values of these resources are overlooked and it leads to the false conclusion that the wildlife concerned ‘has little or no

economic value and in turn, can result in inappropriate social decisions about wildlife conservation' (Tisdell and Wilson, 2004b).

For instance if the use of wildlife resources is free or underpriced other alternatives for use of the land (e.g. grazing) may be profitable. Hence there is little economic rational to justify the preservation of habitat for species' concerned. In this section we discuss the economic use and non-use values of lesser known species and show that it is important to consider them in order to justify the preservation of their habitat. It is important to take into account non-use values because the use values are likely to be low. It has implications for the conservation of species.

A large percentage of the visitors (95%) viewing glow-worms said that it was worthwhile travelling the distance to see glow-worms. The average distance travelled was 112 km per person or party. However, despite the high satisfaction and the distance travelled, the amount of money spent by an average independent visitor was small. It was estimated that the average expenditure per person was only AUS$14.5 per trip. In the case of tree-kangaroos the percentage of visitors saying that the visit was worthwhile travelling the distance to see the tree-kangaroos was 96%. The average distance travelled was 31 km. The average expenditure per person was a lot higher than in the case of glow-worms. It was Aus$ 33.7 per person.

Most of the visitors (94%) stated that their visit to see glow-worms was worth their cost and effort. Only around 2% said that the cost was not worth the visit and 4% did not answer this question. Of those who said that they felt that the visit to see glow-worms was worth the effort and cost, 73% said that their experience was worth more than the cost and only 24% said that the experience was not worth more than the cost. Approximately 3% of the respondents did not answer this question. In the tree-kangaroo survey, too, most visitors (92%) stated that their visit was worth their cost and effort. Only 6% said that it was not worth the visit and 2% did not answer this question. Of those who said that their visit was worth the effort and cost, 32% said that their

experience was worth more than the cost and 41% said that it was not worth more than the cost. Approximately, 27% of the respondents did not answer this question.

The results in both studies relating to visitors saying that the experience was worth more than the cost demonstrate the existence of an economic surplus to the visitors. In order to measure the economic surplus the visitors were asked the following question in both studies:

If yes, how much more would you personally have been prepared to pay for this experience?

In the case of glow-worms the average additional amount a respondent was personally prepared to pay for the experience was Aus$15.85[5]. This provides a measure of the economic surplus for the average visitor. In the case of tree-kangaroos the average additional amount a respondent was personally prepared to pay was Aus$ 54.5 which is more than three times the amount of money glow-worms visitors were willing to pay[6].

This estimate of the economic surplus is useful in providing a measure of the economic value that independent visitors obtain annually from viewing glow-worms and tree-kangaroos where the surveys were conducted. A lower bound estimate of this can be obtained as follows: Suppose that the sample of respondents and the average party size of 4.15 in the case of glow-worms is representative of the population of independent visits. Then 13,839/4.15 = 3,335 independent parties would have visited the site to view glow-worms in 2003. Of these one would expect a potential respondent in 41 per cent of each

[5] The figure was estimated by taking into account only those who said that their glow-worms experience was worth more than the cost. There were 144 respondents who said yes out of which 48 did not say how much more they would personally have been prepared to pay for this experience. Furthermore an outlier of $550 was removed together with 10 respondents who said they were willing to pay 'nothing'. For the calculation, only 85 responses were taken into account.

[6] The figure was estimated by taking into account only those who said that their tree-kangaroos experience was worth more than the cost. There were 123 respondents who said yes out of which 54 did not say how much more they would personally have been prepared to pay for this experience. Furthermore, 16 observations were removed as respondents said they were willing to pay 'nothing'. For the calculation, only 53 responses were taken into account.

of these parties (995) to be prepared to spend an average of AUS$15.85 more than was actually spent to see the glow-worms at Natural Bridge. This would amount to AUS$15,770.75 for the year based on the number of independent visitors to the site in 2003. This can be regarded as a lower bound estimate of the total economic surplus obtained by independent visitors to view glow-worms. This is because it is only based on the actual response of one person in a party averaging 4.15. The actual figure could be higher. The economic surplus was also calculated for the tree-kangaroo survey in a similar manner to the glow-worms study. The economic surplus for tree-kangaroos was AUS$ 8,022 per year. The actual sum of this economic surplus of visitors could be higher because some non-respondents in the parties surveyed may have been prepared to pay extra. Furthermore, some of those respondents who said they would not have been prepared to spend more to could have said so for strategic reasons.

What these results indicate, however, is that visitors are obtaining a net economic benefit from viewing the two forms of wildlife. It is an economic benefit even though visitors do not pay for it.

In addition to estimating the economic surplus, we also estimated the economic impact arising from visitor expenditure. The economic impact in terms of total expenditure incurred by visitors travelling to Natural Bridge to watch glow-worms is relatively small. An average party in the sample spent AUS$65.39 = $14.5 x 4.51 on a visit. If the sample was on average representative of all independent visitors in 2003, the total expenditure associated with their journey to view glow-worms at Natural Bridge would have been $13,839 x 14.5 = $200,665.5. The economic impact for tree-kangaroos is a lot smaller than in the case of glow-worms although an average party spent Aus$ 84.92 per visit. The low economic impact is due to smaller numbers of tourists undertaking such activity. The total expenditure associated with tree-kangaroos tourism is approximately Aus $10,662 per year. These expenditures are primary impacts which generate income and employment. However, these impacts can be diffused over a large area and does not necessarily benefit owners of land providing the resources.

In addition to the above expenditures which were incurred specifically for the purpose of travelling to view the wildlife, we also estimated the benefits resulting from the two forms of wildlife to the local economy. However, it should be pointed out that some of the above expenditures could have also benefited the local economy. In order to determine the local economic impact in addition to the expenditures associated with the wildlife viewing, we asked the following question:

For glow-worms:
On the day of your visit to Natural Bridge National Park to see glow-worms, did you or your travel party spend any money at the village nearby or within 25 km (approx) of it? If Yes, how much did you (or if accompanied, your party) spend?

For tree-kangaroos
On the day of the nocturnal tour involving tree-kangaroos, did you or your travel party spend any money at the village nearby or within60 km (approx) of it? If Yes, how much did you (or if accompanied, your party) spend?

Of the surveyed visitors in the glow-worms study, only 19% spent money in the local village or nearby. The majority (80%) did not and another 1% did not answer this question. Of the 19% who spent money in the village or within 25 kilometres of the site, the maximum amount spent per person was AUS$40 and the minimum amount was AUS$1.75. The average amount was AUS$10.50 per person. The total expenditure for 2003 was Aus$ 276,008.80. The low level spending within a 25 kilometres radius of the site could be attributed to several factors including: (a) many tourists do not spend the night in the nearby vicinity and (b) there are no other nearby major attractions where tourists can spend their money.

In the case of tree-kangaroos 87% of visitors spent money at the village nearby or within 60km of it. The maximum amount spent was Aus$ 900 and the minimum was Aus$ 0. The average amount was Aus$ 117 per person which is almost 12 times larger than in the case of glow-worms. The total expenditure for 2004 was Aus$ 32,572.80. The above

expenditure estimates show that even lesser known species can generate economic activity (although small)[7], but how much of it flows to owners of land providing the resources for these two forms of tourism? In the case of glow-worms, viewing is free of charge for independent visitors and in the case of commercial tour operators they pay a licence fee to national parks which enables QNPW to maintain rangers close to the glow-worms viewing area in the evening/night when commercial tourists visit the site. In the case of tree-kangaroo viewing where the activity takes place on private property the owners have an understanding with the local tour guide(s) about the use of their property.

Because of the nature of the these forms of wildlife tourism activities such as short time spent on the property viewing wildlife, time of day, free entry as in the case of national parks, low visitor numbers as in the case of tree-kangaroo viewing, the amount of economic benefits accruing to owners of private land providing the resources is small compared to the overall spending associated with travelling to view the wildlife and spending that takes place in the local area. In such instances owners of land may fail to conserve the wildlife resources to the extent desirable for tourism and other purposes, because the monetary payments/rewards for conservation do not exist in the market system for these resources. In other words the alternative uses of the land such as cultivating more crops or using the land for grazing by clearing the land (forest) is more profitable. As shown above, the relevant monetary payment in the market system for these wildlife resources is much less than their total economic value, as indicated, for example, by the maximum amount that individuals would be prepared to pay to see these forms of wildlife. Hence market systems fail to adequately compensate landowners providing refuge to wildlife despite the existence of economic use values.

The existence of market failure may call for the intervention of the government in the system to take account of the unmarketed economic values by, for example, declaring such land as protected areas as in the case of Natural Bridge (Springbrook National Park). Another alternative, where appropriate, is to introduce a system of compensation for

[7] Shrestha et al. (2007) point out from their study that it is important to provide adequate information to visitors to attract them to undeveloped natural areas. We also believe that visitor numbers could be increased, especially in the case of tree-kangaroo viewing, if this form of tourism is given sufficient publicity.

landholders who still provide a sanctuary for such wildlife as in the case of tree-kangaroos despite having very little or no economic incentive to do so. In order to justify such intervention it is not only important to take into account the total economic use values of the resource, but also the total economic non-use values. This is termed Total Economic Value of a resource (cf. Pearce et al., 1994).

Non-use economic values involve intangible benefits to society from the existence of wildlife. Society places such values on wildlife and hence is prepared to pay for their continued existence. Non-use economic values include existence values of the species, its bequest value and option values. The option value refers to the possibility of using a natural resource in the future. Individuals often place economic non-use values on species that they will never see by willing to pay for their continued existence. Individuals also want to conserve species for future generations and are prepared to pay for this.

The available information/data suggests that for at least one of the species the non-use economic values accounts for the major part of their total value and that the tourism use value only constitute only a small fraction of this value. Tisdell and Wilson (2004a) found that non-use values accounted for more than 80 percent of the total economic value of tree-kangaroos for more than half of a sample of over 200 respondents in Brisbane, Australia. Those surveyed were asked how much they were prepared to donate as a one-off payment to help conserve Australian Tree-kangaroos. They were then asked to state what percentage of this payment (an indication of economic valuation) was dependent on their being able to see or use tree-kangaroos. The residual was used to indicate non-use economic value. The non-use values are useful in fostering political support for their conservation while tourism dollars (economic use values) provide economic support for their conservation.

There is a further aspect to this. In the case of wildlife viewing as shown by the two case studies, the non-use economic values of the wildlife species may be increased by watching it and by favourable ecotouristic experiences (Tisdell and Wilson (2002). This is evident in many studies conducted (cf. Tisdell and Wilson, 2005).

Taking into account non-use economic values which are often high may imply that the best economic value of the land is to set aside the land for wildlife tourism. This characteristic of wildlife brings into focus the 'public goods' arguments in conserving wildlife. Although private landowners such as in the case of tree-kangaroos gain very little financially from wildlife tourism, such tourism, however, provides monetary benefits and creates employment outside the land where the wildlife exists as shown from the two studies. In such a case governments or states have an incentive to conserve wildlife even though all the benefits cannot be estimated or may not remain in the areas or regions where the wildlife is viewed and because market systems fail to take into account some aspects of use values and non-use values of wildlife. This may be achieved by declaring land as protected areas, compensating landowners or taking into account unmarketed economic values. Monetary benefits from wildlife provide an important incentive for government intervention in conserving wildlife because the overall benefits to an area/region/country from wildlife tourism are positive. However, it must be pointed out that it may not necessarily be higher than the benefits arising from agricultural development.

Factors influencing visitors' maximum willingness to spend for glow-worms and tree-kangaroos viewing

The survey data in both studies show that a sizeable number of visitors are willing to spend more than they have already spent to view glow-worms and tree-kangaroos. It is useful to determine what probable factors influence visitors' maximum willingness to spend for their experience. This is important for several reasons including the likely fall in demand for such activities as a result of increasing costs and for marketing of these ecotourist activities. Targeting of these variables can also increase the number of tourists undertaking glow-worms and tree-kangaroo viewing.

For these reasons Tobit regression analyses were conducted using the field survey data. The data were transformed into square roots to minimize the problems associated with heteroscedasticity.

In both cases the dependent variable (maximum willingness to pay for the experience) was derived from the following two questions in the survey:

(1a) *How much do you estimate that you (or, if accompanied, your whole party) spent specifically for the purpose of travelling to go on to the nocturnal tour involving Tree-kangaroos? Please include all costs including the guide fee*

(2b) *Total AUS$ (approx) …… for …… person(s)*

This question was followed by another question which was framed as follows:

(3c) *Do you feel that the nocturnal tour involving Tree-kangaroos was worth the cost and effort?* □ *Yes* □ *No*

(4d) *If **Yes**, do you feel this experience was worth more than the cost? ?*

□ *Yes* □ *No* □ *Unsure*

(5e) *If **Yes**, how much **more** would you **personally** have been prepared to spend for this experience? Aus $ ……..*

The maximum willingness to spend variable was constructed using per person cost from question (1a) and Question (5e). The independent variable for the two studies are as follows:

In the glow-worms study seven independent variables were considered. They were nationality, distance travelled, have seen glow-worms before, gender, age, education and income.

In the case of nationality, the dummy variable was coded as Australia = 1 and Foreigners = 0. The hypothesis here is that Australians are more likely to spend more for the experience than foreigners. Distance was given in approximate kilometers. The

hypothesis is that longer is the km that needs to be traveled then it is likely that fewer visitors would be willing to spend to seek this experience. Having previously seen glow-worms was also used as a explanatory variable. The hypothesis is that if a visitor has had prior experience, then it is likely that the demand would be less. Gender was another explanatory variable that was considered. The dummy variable was coded as follows: Male = 1 and Female = 0. The hypothesis is that males are more willing to spend extra than females. In the case of age, the hypothesis is that the younger and middle age groups will be more willing to demand this experience than older age groups. A study by Tisdell and Wilson, (2004c) show that most ecotourists fall into the middle age groups. A dummy variable is used for this purpose. Those who were older than 41 years was coded as 1 and those below 41 years was coded 0. Education variable is expected to show that those with higher education are likely to demand more this type of ecotourist experience. Those who were completed year 12 or less than that was coded as 0 and those who got diploma/degree or above was coded 1. Income is another important explanatory variable that is used. The hypothesis here is that higher income groups are more likely to pay more for these experiences. In the model we use the average income for each income bracket.

In the tree-kangaroo study 12 independent variables were considered. They were the above seven explanatory variables plus five other variables. The extra five variables were (a) prior information gathering on tree-kangaroos before traveling to see them, (b) willingness to be a member of the tree-kangaroo conservation group ($11 membership fee), (c) number of nocturnal animals seen during the tour, (d) visitor satisfaction and (e) donations made to conservation causes in the past.

The hypothesis in the case of (a) is that those who have prepared for the experience are willing to spend more for their experience than those who did not. It is also hypothesised that those who were willing to join the tree-kangaroo conservation group are willing to pay a higher amount for this experience (b). The number of animals seen during the nocturnal tour (c) was also included as an explanatory variable and it is hypothesised that when more animals are seen during tour the more likely it is that visitors are willing to

demand more of the nocturnal tour involving tree-kangaroos. Visitor satisfaction of the entire experience (d) is another useful explanatory variable. The hypothesis is that when visitors were satisfied, the more willing were they to spend for the experience. Finally, those visitors who had a history of donating money for conservation causes were more willing to spend more for this kind of ecotouristic experience.

The model for the tree-kangaroo survey is as follows:

$$Dd_{T-K} = \beta_0 + \beta_1 nationality + \beta_2 dist + \beta_3 seen + \beta_4 gender + \beta_5 age + \beta_6 educ + \beta_7 income + \beta_8 gathering + \beta_9 member + \beta_{10} seenanimals + \beta_{11} satisfaction + \beta_{11} donorhist$$

The latter five variables were not included in the glow-worms survey because the glow-worms survey did not cover these questions. Hence, the model is as follows:

$$Dd_{GW} = \beta_0 + \beta_1 nationality + \beta_2 dist + \beta_3 seen + \beta_4 gender + \beta_5 age + \beta_6 educ + \beta_7 income.$$

A Tobit regression analysis was carried out using the field survey data from the two surveys. For the glow-worms regression analysis 207 observations are used and for the tree kangaroo regression analysis 115 observations are used. A few observations had to be dropped from the tree kangaroo survey because of missing data. A Tobit analysis is used in preference to Ordinary Least Squares (OLS) because it is the more theoretically appropriate method for willingness to pay data sets. The basic expression of the Tobit model is as follows:

$$Y_i^* = \begin{cases} X_i'\beta + u_i & Y_i^* > 0 \\ 0 & Y_i^* \le 0 \end{cases}$$

Where Y_i^* is the latent variable while X_i' is the vector of independent variables. For comparative purposes we present both the Tobit and OLS regression results.

The summary statistics of the relevant variables used in the regression analysis are presented in Table 4.

Table 4: Descriptive statistics for the non- dummy regression variables

	Tree Kangaroo (Sample size 115)				Glow-worms (Sample size 207)			
Variables	Mean	Std. Dev.	Min	Max.	Mean	Std. Dev.	Min	Max.
Willingness to Pay (Aus $)	54	45.2	0	300	24	49.4	0	656
Income (AUD $)	49,895	15,549	20,000	65,000	45,000	13,750	20,000	65,000
Distance (km)	31	48.3	1	200	112	111.4	1	900
No of nocturnal animals seen	3.6	1.2	2	6	Na		Na	Na

Note: Na = not applicable

Since there are a number of dummy variables used in the regression analysis it is not possible to provide the mean, standard deviation and the minimum and maximum for these variables. However, Table 5 provides percentages for the dummy variables used in the two regression analyses.

Table 5: Percentages for dummy variables used in the regression analysis

Variables		**Tree Kangaroo (%)**	**Glow-worms (%)**
Nationality	Australian Foreigners	46 54	85 15
Gender	Male Female	47 53	44 56
Visitor satisfaction	Same or more Less	80 20	 Na
Willingness to be a member of conservation group	Yes No	28 72	 Na
Donor history	Yes No	68 32	 Na
Seen tree kangaroo/Glow-worms before	Yes No	29 71	66 24
Prior information gathering	Yes No	31 69	 Na
Age	Older 41 Less 41	35 65	80 20
Education	Completed year 12 or less Diploma/degree or above	15 85	42 58

Empirical results

Tables 6 and 7 present the estimated coefficients, p-values and levels of significance for tree-kangaroo and glow-worm viewing. The asterisks indicate the levels of significance for a one tailed test. Both, Tobit and OLS results are presented and as can be seen the differences between the estimates are small. This is because the number of zero values in the dependent variable is small.

Table 6: Tobit and OLS results showing factors influencing visitors' maximum willingness to spend for Tree Kangaroo viewing

Variables	OLS Coefficient	Tobit (ML Estimation)
Constant	0.634(0.636)	0.553(0.662)
Nationality	1.072(0.009)*	1.066(0.005)*
Seen TK before	-1.501(0.001)*	-1.539(0.000)*
Distance travelled	0.084(0.102)****	0.086(0.073)***
Prior Info. gathering on TK	1.045(0.018)**	1.043(0.011)**
Willingness to be a member of Conservation Group	1.152(0.005)*	1.153(0.003)*
No. of nocturnal animals seen	-0.275(0.110)****	-0.272(0.092)***
Gender [c]	0.469(0.229)	0.450(0.221)
Age	-0.054(0.685)	-0.059(0.640)
Education	2.025(0.000)*	2.080(0.000)*
Income	2.56E-05(0.037)**	2.53E-05(0.027)**
Visitor's satisfaction	0.863(0.103)****	0.897(0.071)***
Donor history	1.083(0.017)**	1.100(0.009)*
R-squared	0.576	
Adjusted R-squared	0.516	Log likelihood- 223.05
Durbin-Watson stat	1.912	Hannan-Quinn criter. 4.38
F-statistic	9.543	
Prob(F-statistic)	0.000	

Note: a. P values are shown in parentheses

b. *, **, *** and **** indicate 1%, 5%, 10 % and 15% level of significance, respectively.

c. This variable is significant under 25percent level of significant

Table 7: Tobit and OLS results showing factors influencing visitors' maximum willingness to spend for glow-worms viewing

Variables	OLS Coefficient	Tobit (ML Estimation)
Constant	3.669(0.000)*	3.541(0.000)*
Nationality	-0.813(0.108)****	-0.814(0.120)****
Distance travelled	0.088(0.044)**	0.091(0.043)**
Seen glow-wormss before	-0.590(0.120)****	-0.612(0.118)****
Gender	0.603(0.096)***	0.651(0.084)***
Age	-0.099(0.825)	-0.058(0.899)
Education	0.957(0.085)***	1.041(0.069)***
Income	0.629(0.080)***	0.626(0.093)***
R-squared	0.104	
Adjusted R-squared	0.073	Log likelihood - 477.20
Durbin-Watson stat	2.025	Hannan-Quinn criter. 4.75
F-statistic	3.313	
Prob(F-statistic)	0.002	

Note: a. P values are shown in parentheses
b. *, **, *** and **** indicate 1%,5%, 10% and 15% levels of significance, respectively.

There are seven identical variables which can be compared between the two studies. They are nationality, distance traveled, have seen the species previously, gender, age, education, and income. The levels of significance differ in the two studies. In the glow-worms survey distance traveled is significant at 1% level and education, gender and income are significant at 10% level. The variable 'having seen glow-worms before' and nationality are significant at 15% level. In the case of tree-kangaroos, nationality, seen tree-kangaroos before, education and willingness to join the tree-kangaroo conservation group are significant at 1% level of significance while income, obtaining prior information about tree-kangaroos, history of making donations for conservation are significant at 5% level. Distance traveled, number of nocturnal animals seen and visitor satisfaction are significant at 15% level while gender is significant at 25%.

Conclusions

The paper reported that the glow-worms colony in Natural Bridge (Springbrook National Park) attracts more than 60,00 visitors a year, both independent visitors and those brought in by commercial tour operators. Most of the visitors are Asian tourists brought by

commercial tour operators as part of the pre-paid tour. Although this form of tourism has remained largely understudied and its contribution to tourism has remained unnoticed, the number of tourists it attracts is large, although the number of independent visitors is smaller. On the other hand, the number of tourists undertaking the tree-kangaroo-based nocturnal tours is very small, although numbers are growing as shown. This form of tourism has existed for almost 25 years on a small-scale.

The study showed that they generate economic expenditures, but the benefits are dispersed widely. Because of the nature of expenditures, the benefits accruing to private owners of land providing the wildlife resources are small. In such situations, owners of land may fail to conserve the wildlife resources to the extent desirable for tourism and other purposes, because the monetary payments/rewards for conservation do not exist in the market system for these resources. In other words the alternative uses are more attractive.

Hence, market systems fail to conserve wildlife despite the existence of economic use values. In such situations government intervention is imperative in conserving wildlife. In order to justify government intervention it is not only important to take into account the total economic use values of the resource, but also the total economic non-use values. Non-use economic values involve intangible benefits to society from the existence of wildlife.

For some species such as tree-kangaroos non-use values account for the major part of their total economic value and that the tourism use values constitute only a small fraction of this value (Tisdell and Wilson, 2004a). Therefore, taking into account non-use economic values (which are often high) may imply that the best economic value of the land is to set aside the land for wildlife tourism. Monetary benefits from wildlife tourism provide an important incentive for government intervention in conserving wildlife because the overall benefits to an area/region/country from wildlife tourism are positive.

The survey also showed that a sizeable number of visitors are willing to spend more than they have already spent to view glow-worms and tree-kangaroos. All variables in both models are significant (below 15%) except age which is insignificant in both models and gender is significant only at 25% level in the tree-kangaroo model.

The survey results show that both these forms of wildlife tourism activities were highly rated among visitors. The satisfaction rates were high. The popularity of these activities indicates that tourism numbers will increase in the future. Hence, the economic benefits from such tourism will continue to increase. This makes it all the more important for government intervention to correct market failures. Governments in both Australia and New Zealand have declared several glow-worms sites as national parks and nature reserves and much research has been undertaken to study these insects and to identify threats facing them, especially those arising from habitat loss and global warming. In the case of tree-kangaroos several national parks give protection to them but their future is at stake from in-breeding, dog attacks and road kills. Furthermore, it is important to create incentives for private landholders to protect tree-kangaroos on their land and their habitat.

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