Non-timber Values from Planted Forests: Recreation in Whakarewarewa Forest

James A. Turner[1], Bhubaneswor Dhakal[1], Richard Yao[1,*], Tim Barnard[1] and Colin Maunder[2]

Executive Summary

Recreation is an important environmental service provided by many planted forests. The value of this service, however, is not well known. For policy makers and land managers to make informed decisions on planted forest management for multiple benefits, they need to recognise the value of the environmental services provided.

The objective of our study was to estimate the economic value that mountain bikers and walkers place on recreation in a planted forest on the fringe of Rotorua; Whakarewarewa forest. We used the travel cost method to estimate the economic value of the existing recreational use of the forest. The choice experiment method was used to elicit the economic value that users place on changing different features of the forest, such as adding more trees species and decreasing the proportion of radiata pine in the landscape. The data for the study were collected from face-to-face interviews of 709 forest users.

The median economic value of the forest under current management, estimated using the travel cost method, is $5.2 million per year from walking and $10.2 million per year from mountain biking. As estimated here, these values are the maximum amount walkers or mountain bikers visiting the forest spend travelling to the forest and the value of time visiting the forest.

Our results suggest that users would not increase the number of visits or amount of time spent in the forest for changes in the forest features considered in the study. However, many showed a preference for alternative forest features; such as variety of species, age classes within stands and less radiata pine in the landscape.

The results of this study provide some quantum of the community good freely provided by the forest and land owners. It is important to note, however, that the results of this study do not imply that charging the public for access to Whakarewarewa forest would yield to the forest or land owners the economic benefit estimated here. The value does, however, allow a comparison of the value of the forest for recreation in addition to the value of the forest for timber production. The value for mountain biking is five times the annual timber revenue from the forest based on indicative planted forest costs and revenues. The extent to which this value could be realised if appropriate systems were in place to generate revenue from the recreational opportunities that forests provide is a subject of future studies.

Introduction

Although planted forests account for only 7% of New Zealand's land area (MAF 2008), they provide important multiple benefits: productive (timber, fibre, firewood), supportive (biodiversity conservation, soil stabilisation), assimilative (carbon sequestration), and social (recreational, aesthetic, cultural identity) (Hock *et al*. 2009). The value of these benefits is increasing with the growing degradation and scarcity of natural resources and increased environmental awareness (Howarth and Farber 2002). To realise the real value of these benefits, it is important to account for forests' timber and non-timber values in decision-making.

Most non-timber benefits from planted forests are not traded in markets. As such, users demand and realise these benefits at no cost, while forest owners have little economic incentive to include them in management decisions. In addition, policy makers face the problem of allocating scarce resources to promote non-timber benefits without information on the full value of these (Howarth and Farber 2002). It is therefore essential to estimate the economic value of non-timber benefits from planted forests to ensure sound decision-making.

One important non-timber benefit from planted forests is recreation, including mountain biking, camping, walking, horse riding, hunting and fishing. The annual recreational benefit from a planted pine forest near Adelaide, Australia, was estimated to be almost 30% of the total standing timber value (Smailes and Smith 2001). In New Zealand, about 26.2 million days are spent on recreation annually, with forest recreation accounting for a significant proportion (Blaschke *et al*. 2006). Demand for forest based recreation is increasing (Schofield *et al*. 2005), with single day visits to forests predicted to increase by 1% per year between 2008 and 2014 (MOT 2008). Numerous studies have estimated the economic value of forest recreation in North America, Europe and Australasia. Table 1 presents estimated forest recreation values in New Zealand and the United States.

[See Table 1 on the next page.]

[1] *New Zealand Forest Research Institute Ltd. (trading as Scion), Rotorua, New Zealand*

[2] *Timberlands Ltd., Rotorua, New Zealand*

* *Corresponding author:*
Tel +64-7-343-5899; Fax +64-7-343-5528;
Email: richard.yao@scionresearch.com

Table 1: Summary of estimates of the economic value of recreation in New Zealand and the United Statesa (derived from Kaval and Yao (2007)).

	New Zealand			United States		
Activity	Mean	Range of values	No. of estimates	Mean	Range of values	No. of estimates
Tramping	258	31-485	5	179	61-298	6
Mountain climbing	117	104-129	4	150	26-274	27
Fishing	87	29-144	18	72	21-123	173

[a] Reported values are in New Zealand dollars deflated to 2009.

The purpose of the study described here was to estimate the economic benefit of mountain biking and walking in a planted forest, Whakarewarewa Forest. Our study addressed three questions:

1. What value does a typical forest user place on recreation in Whakarewarewa forest?
2. What particular features (if any) would forest users prefer to see improved in Whakarewarewa forest?
3. How much would a typical forest user be willing to pay for these changes in forest features?

Because the economic value of recreation in the forest cannot be directly obtained from market transactions, such as entry fees, we used non-market valuation to estimate these values.

Study Location

Whakarewarewa forest (Figure 1) is located close to the urban centre of Rotorua (population 66,000). The forest is known nationally and internationally as a venue for recreation, due to its proximity to a major tourist centre and high quality mountain bike tracks (APR 2007). The forest is also relatively accessible from major cities: three hours drive from Auckland (population 1.3 million), 1.5 hours from Hamilton (population 129,000), three hours from Napier-Hastings (population 136,000), and one hour from Tauranga (population 104,000). A recent survey of users in Whakarewarewa forest found that of the over 94,000 users per year, almost three quarters were from outside the Rotorua region. Forest users contributed to a total 282,000 recreational visits during 2007 (APR 2007).

The public have free access to the forest for recreation; mountain biking, walking, running, hiking and horse riding (Figure 2). There are two main types of management within the 5667 ha of Whakarewarewa forest park: commercial production and conservation. The Rotorua District Council manages 288 ha of the forest (bounded by Nursery, Tarawera and Tokorangi Pa roads; Figure 1) as a recreational forest park. This area includes the iconic redwoods and a mix of other exotic species, and is popular for tourism, walking and running.

A timber management company, Timberlands Ltd, manages 2427 ha of the forest for timber production. This area includes commercial timber species, such as radiata pine (*Pinus radiata*; 1681 ha), Douglas-fir (*Pseudosteuga menzesii*; 521 ha), *Eucalyptus* spp. (40 ha) and other minor species (185 ha). This species mix is not typical of New Zealand planted forests where a higher proportion of radiata pine would be expected. The high proportion of non-radiata species is not considered the economic optimum by the forest manager.

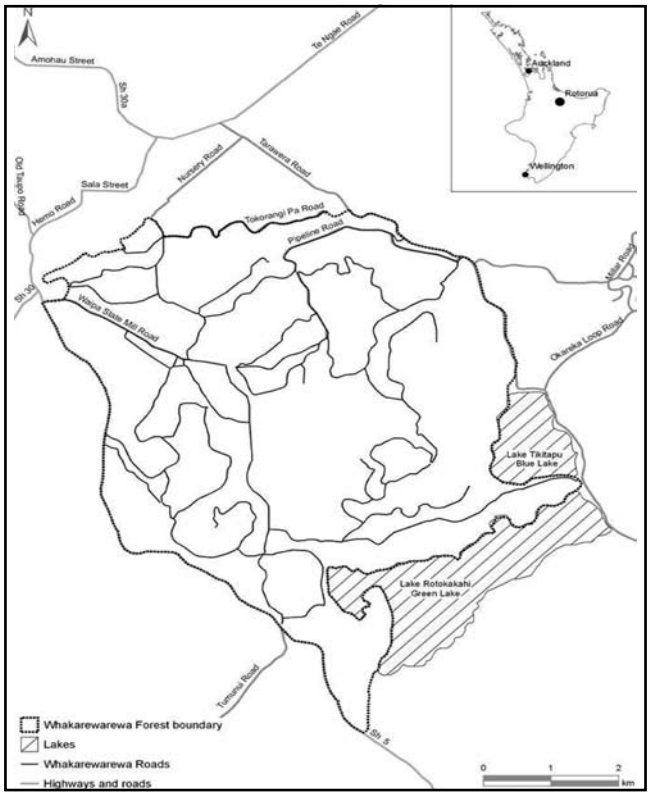

Figure 1: Map of Whakarewarewa forest, study site, and location of Rotorua

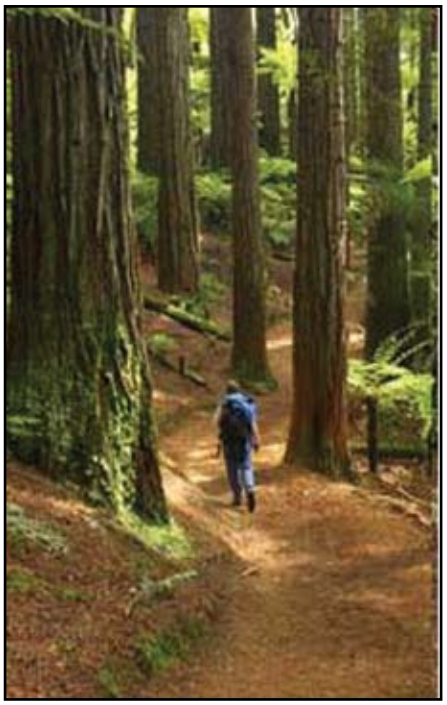

Figure 2: Recreational activities in Whakarewarewa forest

Recreational activities in this area include mountain biking, horse riding and walking (Figure 2). This area was the focus of our study. Current management of this area is predominantly single-species and same-aged trees at the stand level, at an average stocking of approximately 400 stems/ha (depending on stand age), with limited understorey. Forest management blocks are predominantly 30 ha or greater.

Estimating the value of recreation in Whakarewarewa forest

There are several non-market valuation methods for estimating the economic value of recreation. These are broadly divided into revealed and stated preference (Freeman 2004). Revealed preference methods, such as hedonic pricing and travel cost method, infer economic values from people's actual choices (Freeman 2003). The additional value of a house on Lake Tarawera compared with a similar house in Rotorua provides an indication of the value people place on living next to the lake. Stated preference methods, such as contingent valuation and choice experiments, ask people to directly state their values under hypothetical scenarios (Freeman 2003). Individuals could be asked what fee they would pay to use Lake Tarawera, as a measure of the value of the lake. Stated preference values are therefore based on what people say they would do, rather than what they are observed to do (Train 2003).

Stated preference methods do, however, have an advantage in identifying economic values under new or different scenarios. The information collected from revealed preference methods generally reflect an existing situation and cannot predict the impact of alternative management (Freeman 2003). For example, would people be willing to pay more to visit Lake Tarawera if its edges were planted in native forest?

Our study combined revealed and stated preference methods, using both travel cost (revealed preference) and choice experiment (stated preference) methods. The travel cost method implicitly estimates recreational value based on the total cost to the user of visiting the forest (i.e. time and petrol used to drive, entry fees) (Parsons 2003). Essentially the greater the cost of visiting a forest in terms of travel, etc., the greater the implicit value to the individual of recreation in that forest. A limitation of the travel cost method is that it is not possible to estimate how visit cost and frequency might be affected by changes in recreational features, such as improvements in walking tracks (Christie *et al*. 2007).

The choice experiment method focuses on individuals' preferences by examining what levels of forest features would give forest users a greater level of satisfaction. Using this method an individual is provided with a set of alternative forest types with different forest features, including cost, and asked to choose which they would prefer. Individuals therefore choose among alternative scenarios based on a trade-off between cost and the forest features desirable for recreation. The economic value of individual forest features can then be estimated by the extent to which people trade off individual forest features against cost.

Choice experiments may give misleading results when people do not like how cost is represented in the choices they are asked to make. For example, if the value

of recreation in a forest with free access is represented by an entry fee. This disadvantage, however, can be overcome by combining the method with the travel cost method (Christie *et al*. 2007).

Value of recreation in Whakarewarewa forest

The travel cost method was used to estimate the value of recreation in Whakarewarewa forest. An individual's cost of visiting the forest was estimated as the sum of the return trip vehicle cost (petrol and other running costs) and one-half the cost associated with travel time (Haab and McConnell 2002). The latter is an estimate of the value of the individual's time, assuming that if they were not travelling to the forest they would be doing something else which could be more rewarding (Hensher *et al*. 2005). For walkers, the vehicle cost was 0.62c/ km for a private car (IRD rate), 0.05c/ km for bicycle users (ECAN 2009), and $2.20 for local public bus. For mountain bikers using their own bicycle to get to the forest, the travel cost was estimated from the bike expenses the individual reported in the survey. Where an individual shared a ride, the cost was divided equally among the passengers.

Preference for and value of changes in forest features

The choice experiment method was used to estimate the value that forest users place on changes in forest features. The first step in the method was to identify the hypothetical forest types against which the current Whakarewarewa forest management was compared. This was done based on a literature review, experts' opinion and focus groups with forest users. The set of forest features (attributes) used in the choice experiment choice sets are shown in Figure 3.

The level of forest features in Whakarewarewa forest under its current management (status quo) and under two

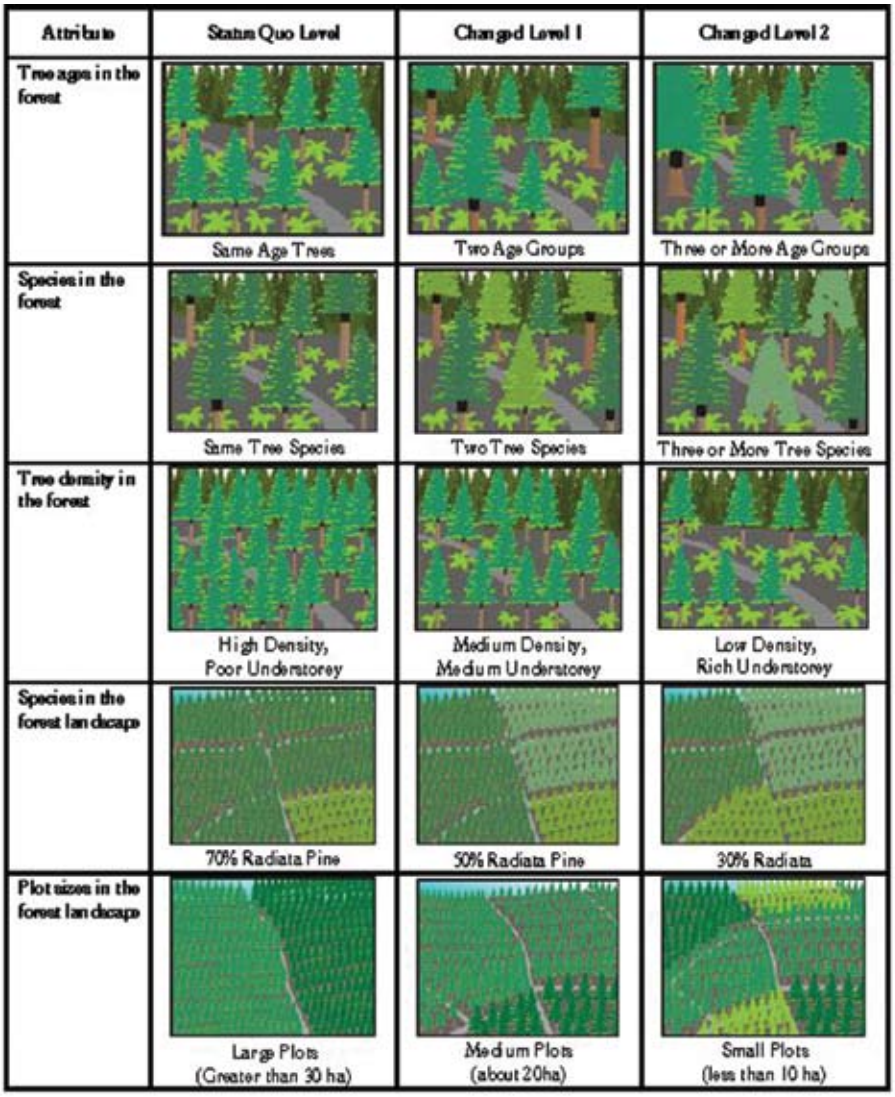

Figure 3: List of forest features (attributes) and levels. The attribute levels in the first column represent the current management of Whakarewarewa forest. Those in the second and third columns represent outcomes from alternative forest management.

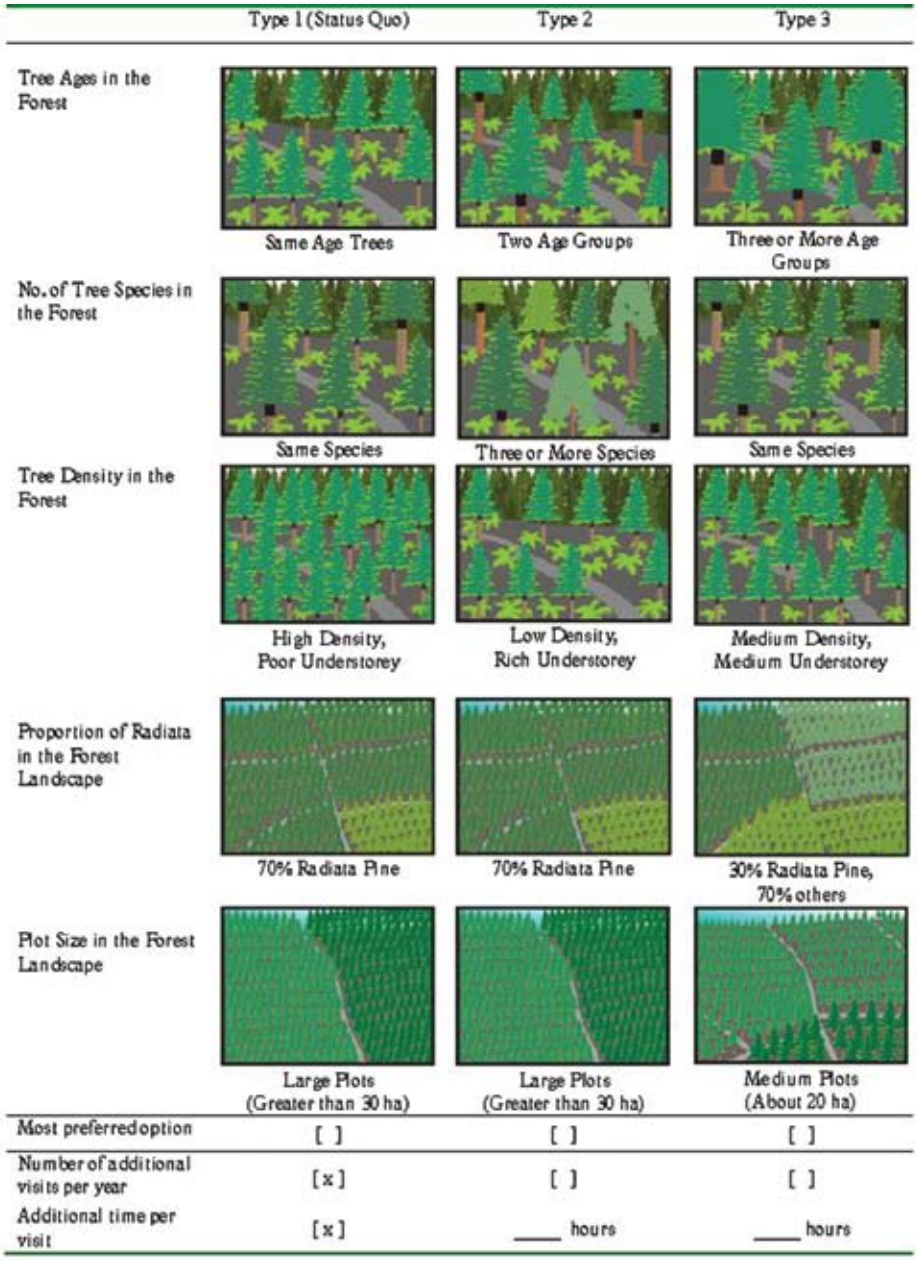

Figure 4: An example choice set

levels of forest modification for recreation are shown in Figure 3. In its current condition Whakarewarewa forest has a single species and same aged trees at the stand level, at an average stocking of approximately 400 stems/ha (depending on stand age), with limited understorey, radiata pine covers about 70% of the forest area, and forest management blocks are 30 ha or greater.

To elicit the economic value of recreation associated with the five planted forest features survey respondents were presented with hypothetical options for changes in the forest's condition based on combinations of the forest features and levels shown in Figure 3. Each set of options had three alternatives composed of the current forest condition (status quo) and two modified alternatives. This set of three alternatives is called a *choice set* (Figure 4).

For each choice set, respondents were asked to choose a single preferred forest type from the set of three (Figure 4). Each alternative forest type is defined by the same five forest features, plus two features that represent how much the respondent would be willing to pay for each alternative. In this study these were represented by two open-ended questions asking users for the number of additional visits and amount of additional time they would be willing to spend if the forest was managed under their preferred alternative. This information was used in conjunction with the values from the travel cost method described above to determine the value users place on the forest under different alternatives.

The survey was undertaken using face-to-face interviews by intercepting users at the main entrance

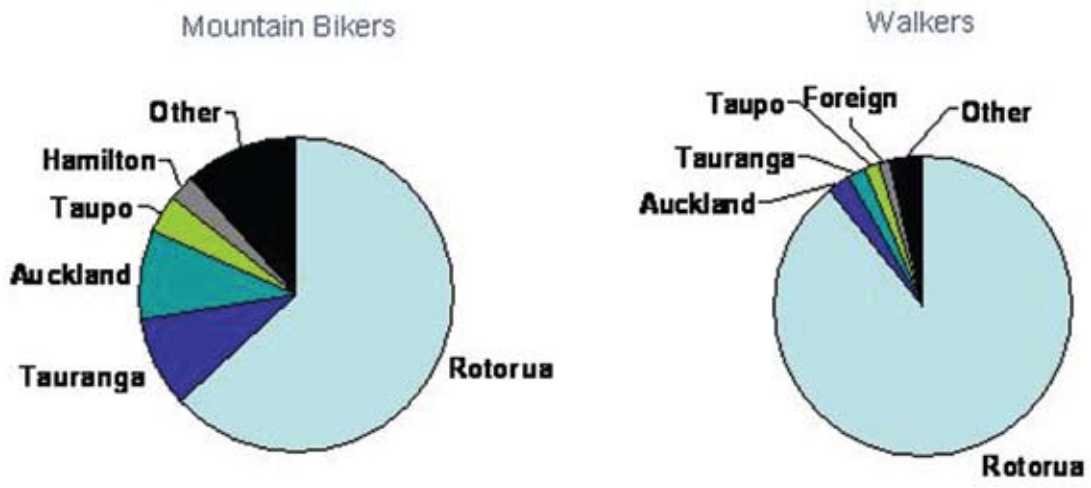

Figure 5: Where are visitors to Whakarewarewa forest from?

points to Whakarewarewa forest after they had finished mountain biking or walking. The survey was carried out from November 2008 to February 2009.

Results and Discussion

Of the 709 users of Whakarewarewa forest surveyed, 40% identified their main activity on the current visit as walking, 48% as mountain biking, and 12% as other activities (e.g. horse riding, jogging). A large proportion of people surveyed were from Rotorua; 89% of walkers and 63% of mountain bikers (Figure 5). A number of visitors travelled over 200 km to get to the forest; 4% of walkers and 21% of mountain bikers. A small number of respondents made an unusually high number of visits, while a few others had a high cost of travel associated with visiting the forest. Compared with overseas forest recreation studies (Hesseln *et al*. 2003, Loomis *et al*. 2001), our study's mean number of visits by walkers to the forest is higher, while the average length of stay in the forest is lower. The high number and short duration of visits to the forest reflect the forest's proximity to most users.

Value of recreation in Whakarewarewa forest

Results from the travel cost method suggest that the median willingness to pay (WTP) to visit Whakarewarewa forest was $61/visit for walkers and $120/visit for mountain bikers. This estimated WTP is an economic measure of the overall enjoyment a walker or mountain biker gains from a visit to Whakarewarewa forest. As estimated here, using the travel cost method, WTP is the maximum additional cost a visitor to Whakarewarewa forest would be willing to pay for vehicle and bike costs and travel time, before they would decide not to visit the forest.

Using these estimates of WTP the total recreation benefits of Whakarewarewa forest were calculated. An APR (2007) survey estimated that there were 85,000 visits by walkers and a similar amount by mountain bikers to Whakarewarewa forest in 2007. If we multiply the per visit values by the total number of visits each year the median economic benefit of the forest could be $5.2 million from walking and $10.2 million from mountain biking. The estimated recreational benefit from mountain biking is almost five times the annual timber revenue from the forest based on indicative planted forest costs and revenues (Turner *et al*. 2008).

Preference for changes in forest features

Walkers showed a significant preference for a change from the status quo in all of the forest features considered except for the size of management blocks. The preference was for more species and tree ages within stands and less radiata pine in the landscape. Interestingly walkers preferred medium stocked stands to those more or less stocked. A possible reason for this could be that medium stocked stands provide the right space for internal views within the stand.

Mountain bikers in general have a preference to keep the forest as it is. However, if given the chance to have a more diverse forest, they preferred more tree ages and a greater mix of tree species in stands and less radiata pine in the landscape. These results suggest that mountain bikers have a mix of preferences, possibly due a larger proportion of mountain bikers coming from outside Rotorua compared to walkers.

Value of changes in forest features

Results from the choice experiment analysis suggest that users do not place a significant economic value for recreation on the particular forest features studied (Figure 3). This may be due to more than two thirds of walkers not being willing to make additional visits to the forest, were its features modified for recreation. A possible reason for this

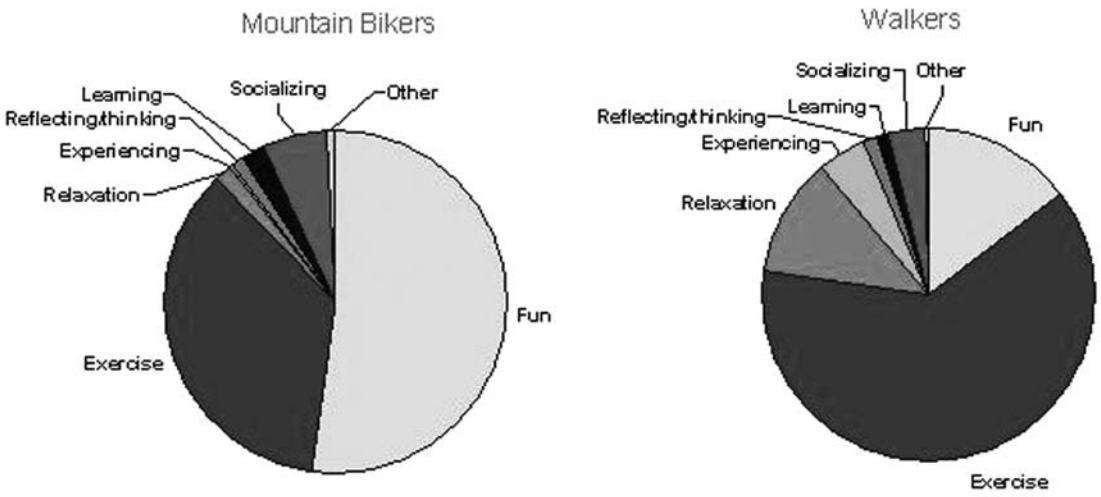

Figure 6: Why do mountain bikers and walkers use Whakarewarewa forest?

is that the changes to forest features studied are valuable for adding amenity and natural values to the forest. Based on responses in the survey, the main objective of visiting the forest was not to experience nature. Only a few people (4.8% walkers and 0.6% mountain bikers) stated this as their main objective. Most of the respondents visited the forest either for exercise or fun (Figure 6).

Conclusions

The purpose of our study was to estimate the economic value of recreation in Whakarewarewa forest as a whole and of particular forest features individually. Using the travel cost method the estimated median value of the forest is $5.2 million per year for walking and $10.2 million per year for mountain biking. These figures provide an economic measure of the overall enjoyment walkers and mountain bikers gain from visiting the forest. As estimated here, these are the maximum walkers or mountain bikers spend on travelling to the forest and the value of time spent in the forest. However, the estimated value provides a useful measure of the community good freely provided by the forest and land owners.

Our results suggest that both walkers and mountain bikers would not increase their number of visits or time spent in the forest were modifications made to the forest features studied; multiple tree ages and species within a stand and lower stand stockings, and a lower proportion of radiata pine and smaller management blocks at the landscape level. However, forest users do prefer particular levels of forest features. Walkers prefer to see changes in the forest, in particular more tree ages and species at the stand level, and less radiata pine in the landscape. While mountain bikers appear to prefer to keep the forest as it is, if there were a change in the forest they would prefer to see similar changes as for walkers.

Timberlands Ltd, as managers of Whakarewarewa forest have used the results from this study to provide evidence of the true extent to which use of the forest is influenced by forest management practices. Firstly, they have been able to demonstrate with some confidence that the popularity of the forest is driven more by location, accessibility, free access and existing tracks and less by forest management practices and forest species choice. Secondly, the study helps the managers to plan future forest operations (harvest and replant) with some confidence that their economic forest production decisions are not necessarily of detriment to the community.

Whakarewarewa forest lies in close proximity to an urban and tourism centre so its value is unique. However, this study suggests that planted forests have the potential to provide a significant recreational value in addition to their timber value. In New Zealand a number of planted forests are readily accessible from urban areas (Bottle Lake near Christchurch, Woodhill forest near Auckland, and Wrights Hill Fortress in Wellington) and their inferred recreational value to adjacent and wider communities may be substantial. Provision of these benefits though is also dependent on the costs associated with changed management to provide them. This is a topic for further research, though our study provides a basis for comparison of those costs against the benefits estimated here.

Acknowledgements

We thank Scion, Future Forests Research Ltd., and the New Zealand Ministry of Agriculture and Forestry for funding this study. We are also grateful for the participation of the Whakarewarewa forest manager, Timberlands Ltd. The research greatly benefited from the contributions of Gerard Fitzgerald, Thomas Adams, Andrew Dunningham, Tim Payn, Simon Swaffield, Ramesh Bhaskeran, Robert Ribe, Ian Bishop, Shaun Killerby, Deryck Shaw, Stefanie Pattle, Elvis Bowring, Russell Dale and Kit Richards. We also appreciate the valuable input of Scion staff and

local community members in the focus group discussions that were an essential part of this research. We would like to thank Geoff Kerr of Lincoln University and David Hensher of the University of Sydney for useful advice on data analysis. Finally we thank our survey interviewers and the more than 700 anonymous survey respondents who participated in this survey.

References

APR Consultants Ltd. 2007. Recreational Use of Whakarewarewa Forest. Rotorua District Council Economic Development Unit. Rotorua.

Blaschke, P, Warren, J., Taylor, N., Gough, J., Pihema, W., Baily, M., and Whitney, P. 2006. *Natural Based Tourism: Panacea for Sustainable Development in New Zealand Regions?* Parliamentary Commissioner for Environmental Review of Progress with Sustainable Development in New Zealand. Wellington.

Christie, M., Hanley, N. and Hynes, S. 2007. Valuing enhancements to forest recreation using choice experiments and contingent behaviour methods. *Journal of Forest Economics*. 13(2), 75-102.

Freeman, A.M. 2003. The measurement of environmental and resource values: Theory and methods. (2nd ed.) *Resources for the Future,* Washington D.C.

Environment Canterbury (ECAN). 2009. GoSmarter calculator. Available online on 23 February 2009 at http://www.gosmarter.org.nz/journeyest.asp

Haab, T.C. and McConnell, K.E. 2002. *Valuing Environmental and Natural Resources: The Econometrics of Nonmarket Valuation*, Edward Elgar Publisher.

Hensher D. A., Rose, J. M. and Greene, W. H. 2005. *Applied Choice Analysis: A Primer*. First Edition. Cambridge , Cambridge University Press.

Hesseln, H., Loomis, J. B. González-Cabán, A. and Alexander, S. 2003. Wildfire effects on hiking and biking demand in New Mexico: A travel cost study, *Journal of Environmental Management* 69 (4): 359-368.

Hock, B., Payn, T., Clinton, P. and Turner, J.A. 2009. Towards green markets for New Zealand plantations. *New Zealand Journal of Forestry* 54(1): 9-19.

Howarth, R. B. and Farber, S. 2002. Accounting for the value of ecosystem services, *Ecological Economics.* 41(3), 421-429.

Kaval, P. and Yao, R. 2007. *New Zealand Outdoor Recreation Benefit*s. Working Paper in Economics 07/14. Department of Economics, Waikato University. Hamilton.

Loomis, J.B., González-Cabán, A. and Englin, J. 2001. Testing for differential effects of forest fires on hiking and mountain biking demand and benefits, *Journal of Agricultural and Resource Economics* 26 (2): 508-522.

Ministry of Agriculture and Forestry (MAF). 2008. New Zealand Forest Industry Facts & Figures 2007/2008. Available online on 15 December 2009 at http://www.maf.govt.nz/statistics/forestry/other-forestry-releases/facts-figures/

Ministry of Tourism (MOT). 2008. Tourism Leading Indicators Monitor. Series 2008/8 New Zealand. The Ministry of Tourism, PO Box 5640, Wellington, New Zealand.

Parsons, G. R. 2003. *The travel cost method. In A Premier in Non-market Valuation* edited by Patria A. Camp, Kevin J. Boyle and Thomas C. Brown. Kluwer Academic Publisher: London. pp 269-329.

Schofield, G., Badlands, H. and Oliver, M. 2005. Objectively-measured physical activity in New Zealand workers. *Journal of Science and Medicine in Sport.* 8, 143-151.

Smailes, P. J. and Smith, D. L. 2001. The growing recreational use of state forest lands in the Adelaide hills. *Land Use Policy*. 18(2), 137-152.

Train, K.E. 2003. *Discrete Choice Methods with Simulation*. Cambridge University Press.

Turner, J.A., West, G.G. Dungey, H.S., Wakelin, S.J., Maclaren, J.P., Adams, T.H., and Silcock, P.A. 2008. *Managing New Zealand planted forests for carbon - a review of selected management scenarios and identification of knowledge gaps*. A Report Prepared for the Ministry of Agriculture and Forestry by Scion. Ministry of Agriculture and Forestry, Wellington. Available online on 15 December 2009 at http://www.maf.govt.nz/climatechange/slm/grants/research/2007-08/2008-09-summary.htm