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The Value of Backyard Biodiversity in New Zealand.

Authors:

Pamela Kaval, Richard Yao, Terry Parminter, and Frank Scrimgeour

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### **Abstract**

New Zealand's biodiversity consists of over 80,000 types of native plants, animals and fungi, a considerable number of which are indigenous and located on private property. To preserve and enhance native biodiversity and discourage activities that may deplete it, economic values can be calculated which can, in turn, guide the use of policy tools, such as incentives, that can be used. This can support behavioural changes by encouraging individual self-interest to coincide with social interest. In this project, we used the contingent valuation, choice modelling and well-being approaches to estimate native biodiversity values for Wellington residents. In this paper, we present a summary of our initial results.

### **Keywords:**

New Zealand, biodiversity, non-market valuation, well-being, native species, private landholders

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## **Introduction**

New Zealand became a party to the Convention of Biological Diversity in 1993. By signing this agreement, a commitment was made to create a national biodiversity strategy and action plan to reduce biodiversity loss. The New Zealand's Biodiversity Strategy was finalized in 2000. One of the goals of the strategy was to "enhance community and individual understanding about biodiversity, and inform, motivate and support widespread and coordinated community action to conserve and sustainably use biodiversity." Another goal was to "halt the decline in New Zealand's indigenous biodiversity" by maintaining and restoring the remaining habitats and ecosystems to a healthy state as well as to sustain other ecosystems. If these goals were achieved, there should continually be viable populations of indigenous species throughout the country (Ministry for the Environment, 2000)

One way to reduce biodiversity loss is to create public conservation estates. Currently, approximately 30% of the land area in New Zealand is protected within the public conservation estate. However, much of the land that is protected is land that is unfit for grazing or occupation, such as the high mountains of the Southern Alps. Less than 20% of the lowland areas, where a majority of residents work and reside are protected. Therefore, to thoroughly protect biodiversity, not only does public land need to be protected, but protection also needs to occur on private land (Ministry for the Environment, 2000).

The importance of private land for conservation has not only been recognized in the New Zealand Biodiversity Strategy but it has also been recognized in many other government initiatives and laws such as the Resource Management Act of 1991, the Forest Amendment Act of 1993, the preliminary report of the Ministerial Advisory Committee entitled "Bio-What?," and the final report of the Ministerial Advisory Committee entitled "Biodiversity and Private land," to name a few (Norton, 2001; Ministry for the Environment, 1991, 2000, and 2003). The most powerful and far reaching in its impact of

those government initiatives is the Resource Management Act, the purpose of which is to affect activities on private land (Jay, 2000; Ministry for the Environment, 1991)

Many councils and other governmental organizations have learned that private support is a key issue in biodiversity management (Department of Conservation/Ministry for the Environment, 1998; Department of Conservation/Ministry for the Environment, 2003; Ministry for the Environment/Department of Conservation/Local Government New Zealand, 2003; Kneebone *et al.*, 2000; Kneebone, 2000). Private land is important not only for its indigenous biodiversity but also because that is where the human population is living, working, and recreating (Norton, 2000). Private landowners can make a large contribution to biodiversity conservation. The Taranaki Regional Council reports that for every \$1 they spend on biodiversity conservation, a landowner will spend \$10. Not only are some landowners concerned with biodiversity on their own properties, but they are also concerned with biodiversity in their communities and have started many community groups to help achieve these goals, such as the Mangakotukutuku Stream Care Group in Hamilton, Friends of Maara Roa in Wellington, as well as the Royal Forest and Bird Protection Society throughout the country (Mangakotukutuku Stream Care Group, 2007; Friends of Maara Roa, 2007, Royal Forest and Bird Protection Society, 2007; Ministry for the Environment/Department of Conservation/Local Government New Zealand, 2003).

In conserving biodiversity on private lands, it is necessary to find ways to integrate indigenous biodiversity conservation with land uses rather than separate them (Kneebone *et al.*, 2000; Kneebone, 2000; Norton, 2000; Hartley, 1997). There is a need to take a “whole-property” perspective, which recognizes the need both to accommodate the economic use of the land and to reduce the impacts on biodiversity (Kneebone, 2000). Given the right support and incentives, landowners make the most effective stewards of the land and of the biodiversity associated with it (Kneebone, *et al.* 2000).

In this project, our goal was to discover how residents feel about indigenous biodiversity conservation on both private as well as public lands. This information could then be used to discover how to motivate people to contribute to indigenous biodiversity in New Zealand by way of planting native trees and shrubs to attract native birds, insects, and fish. We obtained our information by surveying people in the Wellington Region of New Zealand.

## **Methods**

The goal of this study was to determine the value that Wellington residents placed on biodiversity. We decided that the best way to accomplish this goal was to conduct a survey. As one of the most important activities of any survey is the design of the survey instrument, care was taken in its construction to ensure the collection of useful and relevant information.

The first version of our survey was created in September of 2006. It was edited and revised with feedback from several colleagues as well as results from two focus group sessions. The first focus group took place on 12 October 2006 at a conference room in a centralized location in Rotorua and was attended by eight participants (For more detail on Focus Group 1, refer to Kaval and Yao, 2006). The second focus group session took place on 15 November 2006. Twelve participants came to this focus group session held at a conference room in a centralized location in Cambridge. Since the survey was well understood by participants at the Cambridge Focus Group session, only minor changes needed to be made to the survey before it was finalized (For more detail on Focus Group 2, refer to Yao and Kaval, 2006).

The final version of our survey was entitled “Trees and Shrubs on Private and Public Lands: What Do You Think.” It contained a cover page with a colour picture of a koru as well as eight pages of questions. Questions were divided into seven sections: 18 questions ask respondents about trees and plants in the area they live, 16 questions ask about their views of an ‘ideal’ property, 20 questions about their views of parks or

reserves in their local area, 2 contingent valuation questions, 4 choice modelling questions, 3 well being questions and 12 demographic questions.

### **The Survey Sample**

In December of 2006, using randomly selected phone numbers from the Wellington region, 551 homes were called. Of the 551 homes, 251 people were contacted; the 300 homes that were not contacted either had no answer at their home or an answering machine picked up. Of the 251 Wellington households that were contacted, 120 agreed to complete the survey for a willingness-to-participate response of 47.8%. The 120 willing participants were each sent a survey packet which included a cover letter explaining the survey, a handwritten note thanking them for completing the survey, the survey, a freepost return envelope, as well as a \$1 scratch off lottery ticket used as an incentive to thank them for completing the survey. As of 8 January 2007, we received 94 fully completed surveys from the respondents for a sample response rate for those that agreed to participate in the survey of 78.3%. This report presents the results of these 94 surveys.

### **Results**

Survey respondents were located in five areas of the Wellington Region; the Kapiti Coast (15%), Lower Hutt (17%), Porirua (10%), Upper Hutt (13%), and Wellington City (46%). Approximately 80% of respondents owned their own property. Almost all of them (96%) had trees on their property, with 71% of them having planted some or all of the trees themselves. All of the respondents knew of parks or scenic reserves in their area and had visited them.

When asked whether they would volunteer to plant trees and shrubs in their community on public land, 48.38% said they would. When asked whether they would volunteer to plant trees and shrubs on their own properties, 69.56% said they would. However, some of those that said they were not able to mentioned that they were too old or that they were renting the property and did not feel like they could.

Features that were important on an ‘ideal’ property included: ‘having trees, shrubs, or plants,’ ‘seeing native birds,’ ‘having a lawn to relax or play games,’ ‘having trees for shade and/or shelter,’ ‘trees to stabilize the soil,’ and ‘seeing birds’ (that are not necessarily native).

Features that were important for local parks and reserves included ‘having trees, shrubs, and plants,’ ‘having plants and trees for park visitors fifty years from now,’ ‘seeing native birds,’ ‘having trees for shade and/or shelter,’ ‘walking tracks,’ ‘birds’ (that are not necessarily native) as well as ‘having native trees and shrubs.’ Therefore, it seems that, while they may not need to be native, respondents found trees, shrubs, and plants to be the most important aspect for both private lands as well as public parks and reserves in their area.

Finally we asked respondents if they participated in any community organizations. We found that 70% of respondents did participate in a community organization, with some participating in more than one. Of those, ‘church groups (23%),’ ‘playgroups, kindergartens, or kohanga reo’s (16%),’ and ‘sports, hunting and fishing clubs (13%)’ were most popular.

### **Well Being Questions**

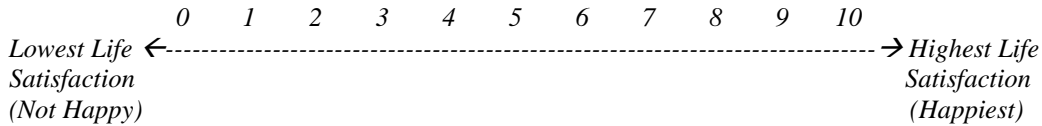
In this survey we used the Well Being Evaluation Method (WBEM) (Cantril, 1965; van Praag, 1988; van Praag and Baarsma, 2000; Kaval and Loomis, 2007) to estimate the change in utility associated with an increase in native biodiversity. Using this questioning method, well-being was rated on a life satisfaction scale of zero through ten being both ordinal and ordered where zero represented the lowest possible life satisfaction and 10 represented the highest possible life satisfaction:

**Your Life at the Current Location of Your Property**

Think about your life now and where you are living. You may be living near a city, living within walking distance from a school, being close to work, or living near a gully, to name a few.

On a scale from zero to ten, where zero is very unhappy with your life and ten is the best possible life, how would you rate your satisfaction with your life?

Please circle the appropriate number.



Upon answering the base well being question, respondents were presented with two situations:

*If there were more native bush in the area you live (whether it be on your property or properties near you) and this attracted more native wildlife to your area such that you would now see native animals such as Tui's and Green Tree Geckos on a regular basis, how would you rate your satisfaction with your life in this case?*

*If there were more native bush on the parks and reserves closest to your property or residence and this attracted more native wildlife to the parks and reserves in your area such that you would now see native animals such as Tui's and Green Tree Geckos on a regular basis if you went to those parks, how would you rate your satisfaction with your life in this case?*

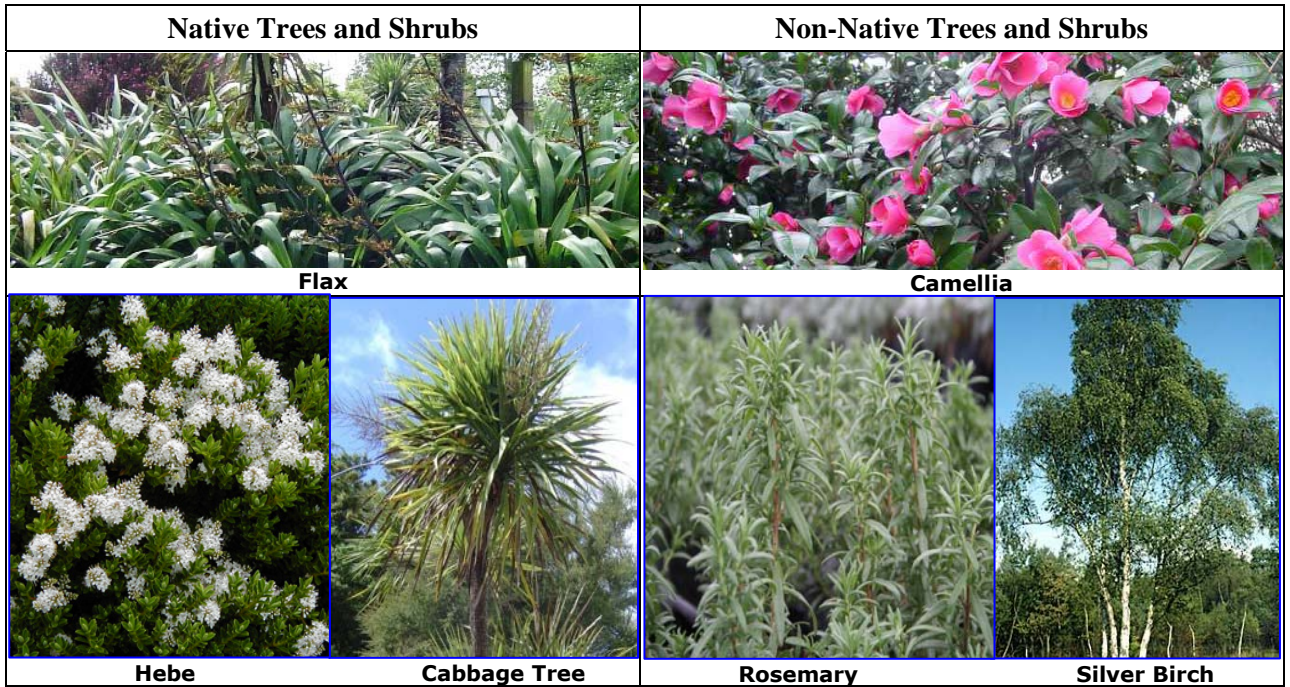
The mean overall response to how people feel about their life currently on the 0 to 10 well-being scale (where 0 is the worst possible life and 10 is the best) was 7.76. This was the base level. If they were to have more native plants and animals in their residential area, their well being increased to 7.97. This was a significant increase of 0.21 (ANOVA, p=0.05). If they were to have more native plants and animals in parks in their area, their well being again increased to 8.04. This was an increase of 0.28 over the base level, however, it was not a significant difference (ANOVA, p=0.24). All three of these variables had a median value of 8. A one way ANOVA test showed that when looking at all three variables together, these values were not statistically different (ANOVA, p=0.15).



### **Choice Modelling Questions**

Another thing we wanted to determine was what people would prefer to receive if they were to receive an incentive to plant trees and shrubs on their properties. We wanted to see if they preferred either native plants, non-native plants, or both. We also wondered if they would rather purchase trees and shrubs themselves and get a refund from their councils or if they preferred getting trees directly from the councils. We had three different choice sets. The first choice set question was as follows:

**Plants on private land: what do you prefer?**



Some councils encourage people to plant trees and shrubs (such as natives like the flax, hebe, and cabbage tree or non-natives like the camellia, rosemary, or silver birch pictured above) on their land. If you were offered an incentive to plant trees on your property, which option below appeals to you the most (assume that you have enough land to plant trees). Read the descriptions then tick the box below.

	<b>OPTION 1</b> <i>Non-native trees and/ or shrubs from councils</i>	<b>OPTION 2</b> <i>Native trees and/ or shrubs from councils</i>	<b>OPTION 3</b> <i>Native trees and/ or shrubs you purchase</i>	<b>OPTION 4</b> <i>No free trees, only free advice</i>
<b>Trees to plant</b>	20 <u>non-native</u> trees and/ or shrubs	20 <u>native</u> trees and/ or shrubs	20 <u>native</u> trees and/ or shrubs	No trees
<b>What tree incentive do councils provide?</b>	Free trees and/ or shrubs	Free trees and/or shrubs	Rebate for trees and/or shrubs you purchase	Nothing
<b>Will councils provide free expert advice about trees on your property?</b>	Yes	Yes	Yes	Yes
<b>Value of trees and advice you can get</b>	\$95	\$145	\$145	\$45
<b>Your preference (Tick one box)</b>	<b>Option 1</b> <input type="checkbox"/>	<b>Option 2</b> <input type="checkbox"/>	<b>Option 3</b> <input type="checkbox"/>	<b>Option 4</b> <input type="checkbox"/>

The second choice set provided the options of:

1. *Native and non-native trees and/or shrubs from councils (10 native and 10 non-native, value \$120)*
2. *Native trees and/or shrubs from councils (20 native, value \$145)*
3. *Native and non-native trees and/or shrubs you purchase (10 native and 10 non-native, value \$120)*
4. *No free trees, only free advice (Value \$45).*

The third choice set provided the options of:

1. *Non-native trees and/or shrubs from councils (20 non-native, value \$95)*
2. *Native trees and/or shrubs you purchase (20 native, value \$145)*
3. *Native and non-native trees and/or shrubs you purchase (10 native and 10 non-native, value \$120)*
4. *No free trees, only free advice (Value \$45)*

Results from the choice set questions are found in Table 1. Overall, 6% of respondents did not select an option and 9% were not interested in trees and shrubs, but welcomed free advice about trees and plants. 37% were interested in both native and non-native plants with 28% preferring to purchase their own plants and getting a refund back from councils afterwards. 42% of respondents were interested only in native plants with 22% preferring to purchase their own plants. Only 6% of respondents were interested only in non-native plants. We have not, as of yet, conducted any statistical analysis for these questions, and therefore, can not make any strong interpretations.

Table 1. Responses to Whether Wellington Residents Would Prefer to Get Plants from Councils or Purchase Plants Themselves and Get a Refund for the Purchase Later.

	Choice Set A	Choice Set B	Choice Set C
Did Not Select An Option	13%	3%	3%
Native and Non-Native Plants from Councils		26%	
Native and Non-Native Plants you Purchase		35%	48%
Native Plants from Councils	34%	26%	
Native Plants you purchase	34%		32%
No Trees only Advice	9%	10%	6%
Non-Native Plants from Councils	9%		10%
Total Number of Respondents	32	31	31

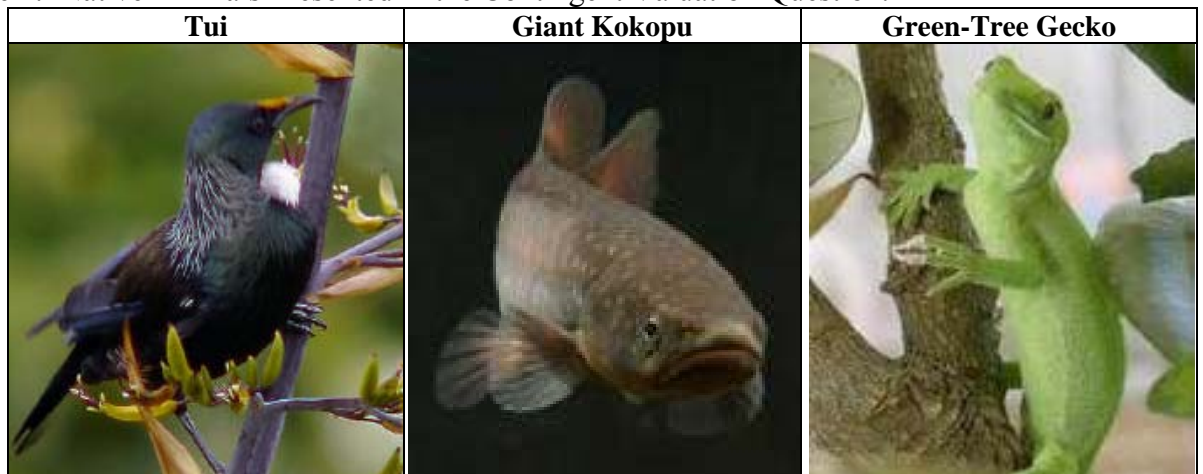
### Contingent Valuation Questions

To try to understand the value that people place on native biodiversity in New Zealand, we asked two contingent valuation questions. Contingent valuation questions try to capture the value people would be willing-to-pay for a particular good. In this paper, the goods we were referring to are native plants and animals on public lands as well as native plants and animals on private lands.

We first presented the respondents with a picture of a native tui, giant kokopu, and a green-tree gecko (Figure 1). We then gave respondents some background on biodiversity:

“New Zealand's native plants and animals are dependent upon each other. For example, the *Tui* and *Green Tree Geckos* will eat nectar from native flowers like the flax and pohutukawa while the *Giant Kokopu* likes to live in slow moving streams shaded by overhanging native vegetation. With the development of the land to meet the needs of people and the introduction of possums and rats, much of the native bush has disappeared, and what is left provides valuable food and places to live for native birds and other animals. Some of the native bush is on public land, but there is a lot of native bush on privately owned land.”

Figure 1. Native Animals Presented in the Contingent Valuation Question.



Finally, we asked them two questions. The first related to private land and the second related to public land. We placed actual bid amounts in each survey. Bid amounts were

determined during the focus group sessions and ranged from \$0.50 to \$500. The questions were as follows:

1. Sometimes incentives are offered to private landowners to encourage planting native trees on their property. Incentives can be free trees or rebates for trees that you purchase, but it can also be free advice about trees you can plant on your property.

If part of your annual rates were dedicated to support programmes to plant **native trees and shrubs** on **private land**, would you be willing-to-pay an additional \$ (*Note: number handwritten here*) in your annual rates? (If you do not own land now, please answer the question as if you did own land).

Note: All funding would go towards this programme and not administrative fees.

Please tick:  Yes  No

2. Sometimes community organisations or council staff will plant native trees and shrubs on public land (e.g., gully restoration projects).

If part of your annual rates were dedicated to support programmes to plant **native trees and shrubs** on **public land** (e.g. city parks and reserves), would you be willing-to-pay an additional \$ (*Note: number handwritten here*) in your annual rates?

Note: All funding would go towards this programme and not administrative fees.

Please tick:  Yes  No

To determine the willingness-to-pay (WTP) amounts for the questions, logit regressions were run. Our model for whether people were willing-to-pay for a program to plant trees on public land was significant at the 99% level. The results of the public model are as follows (with P-Values in parenthesis):

$$\text{WTP for Plants on Public Land (yes, no)} = 1.590228 - 0.007001 \text{ Bid Amount} \\ (0.0000) \quad (0.0031)$$

Our base model for whether people were willing-to-pay for a program to plant trees on private land was significant at the 95% level. The results of the private model are as follows:

$$\text{WTP for Plants on Private Land (yes, no)} = 1.074385 - 0.005352 \text{ Bid Amount} \\ (0.0001) \quad (0.0135)$$

We can use the logit results to calculate the median, mean and confidence intervals for WTP. To calculate the median value, we use the formula from Hanemann (1984):

$$\text{Median} = C / (-\text{Bid Coefficient}), \text{ where } C \text{ is the constant term.}$$

To calculate the mean value, we use the formula from Hanemann (1989):

$$\text{Mean} = \ln(1 + e^C) / (-\text{Bid Coefficient})$$

And to calculate the confidence intervals, we use the simulation approach from Park et al. (1991).

Calculated mean, median, and confidence intervals (CI) are presented in Table 2. These results show respondents have a significant WTP for the planting of native trees and shrubs on private and public lands, therefore indirectly indicating their value for biodiversity. The median value for trees and shrubs on public lands was \$227.14 with a mean of \$253.65. While the median value for private lands was \$200.75 with a mean of \$255.64.

Table 2. Wellington Respondents Willingness-to-pay for A Program to Plant Trees and Shrubs on Public and Private Lands

			90% Confidence Interval on Mean WTP	
	Median WTP	Mean WTP	Lower Bound	Upper Bound
Public Land				
WTP	\$227.14	\$253.65	\$171.17	\$533.90
Private Land				
WTP	\$200.75	\$255.64	\$164.42	\$685.99

### Discussion and Conclusions

In this paper, we presented the general results from a survey conducted to discover how Wellington residents feel about native biodiversity. We discovered that many people felt that trees and shrubs were very important, with several being interested in helping to plant trees and shrubs on both private lands and public lands. We also found that having more native plants and animals on their property as well as their neighbouring properties would significantly increase their level of life satisfaction, or utility.

If there were an incentive for councils to provide people with plants directly or to be reimbursed for the plants they purchase themselves, it seems that a majority of respondents preferred to get an incentive only for native plants being indifferent as to

whether plants were provided or they were reimbursed. However, this is just a general observation as we did not conduct any statistical tests on these responses. In addition, respondents had a high willingness-to-pay value for programs to establish plant trees and shrubs in their areas. However, they had a higher willingness-to-pay for these programs on public lands than on private lands. Overall, it seems that Wellington residents are interested in biodiversity via native plants and animals in their area. Respondents had a high willingness-to-pay value for programs to establish trees and shrubs in their areas. This willingness-to-pay was higher for programs on public lands than on private lands. Overall, we find that Wellington residents are interested in biodiversity via native plants and animals in their area.

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