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The Economic Value of Biodiversity in New Zealand: Results from a Household Survey

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Abstract

This paper presents the results of a national study examining the economic value of biodiversity in New Zealand. Three valuation techniques were used to collect information from respondents: the contingent valuation method, the well-being method and the choice modelling method. Results revealed that respondents were familiar with the native plants and animals in their areas and valued them highly, therefore having a strong value for native biodiversity.

Keywords

native biodiversity
New Zealand
well-being
contingent valuation
choice modelling
community volunteers

JEL Classification

Q57; Q2; Q25

Acknowledgements

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Introduction

This report presents the results of a New Zealand (NZ) biodiversity enhancement survey. Data was collected from 729 people around NZ using a national household survey. The survey was administered through a phone-mail survey technique between December 2006 and January 2008. The study primarily aims to determine the value of biodiversity enhancement in New Zealand. We split our survey into five regions for comparison purposes: (1) the Greater Wellington Region, (2) the Greater Bay of Plenty region, (3) the Greater Waikato region, (4) all other North Island regions not included in (1),(2) or (3), and (5) the South Island regions. The focus of our study was on the Greater Wellington region, and therefore, 30% of our respondents are from that region.

I. The Survey

In October 2006, wecreated an eight page mail survey aimed at determining New Zealand (NZ) resident's biodiversity values. The survey was tested and updated from information provided during two focus groups and several one-on-one pretesting sessions (Kaval and Yao, 2006; Yao and Kaval, 2006). The survey was finalized in December of 2006 and ready for distribution. The eight page survey was divided into seven sections. The first section asked respondents questions about the area in which they live, the second focussed on their views of an ideal property, and the third asked about their views of parks and reserves in their local area. The fourth section focussed on native plants and animals, the fifth focussed on plants on private land, the sixth asked questions about their well-being, and the survey concluded with section seven on demographics.

Potential respondents were selected from five regions around NZ: (1) the Greater Wellington region (GW); (2) the Greater Bay of Plenty region (BP); (3) the Greater Waikato region (WK); (4) regions of the North Island (NI) not included in regions (1),(2), and (3); and (5) all regions of the South Island (SI). Contact details for potential respondents were obtained from the latest issues of the White Pages, Telephone Book, as well as from the online version of the White Pages accessed at www.whitepages.co.nz. Phone numbers were randomly selected and potential respondents were called to see if they would be willing to participate in our mail survey. Initial phone contacts occurred in late 2006, early 2007, and late 2007. All respondents who agreed to participate in the survey were mailed a copy of the survey, a letter discussing the survey, which included the contact details of the surveyors, a handwritten note thanking them for helping us with the survey, a NZ$1 scratch-off lottery ticket to thank them for their time, and a pre-paid return envelope. As the focus of the project was aimed at people living in the GW, 30% of our respondents are from the GW.

Overall, 3,211 phone calls were placed. Of the placed calls, 1,617 people answered the phone and almost half of the people spoken to agreed to participate in the survey (Table 1).

Table 1. Distribution of phone calls made to potential respondents

Item	Survey regions					All Survey Regions
	Bay of Plenty	Wai-kato Region	Greater Welling-ton	North Island	South Island	
Number of phone calls placed	485	549	1089	607	481	3,211
Number of residents contacted by phone	285	272	509	284	267	1,617
Number who agreed to complete the survey	135	143	242	148	135	803
Phone invitation success rate	*47.4%*	*52.6%*	*47.5%*	*52.1%*	*50.6%*	*49.7%*
Number of surveys returned	120	121	220	129	119	709
Mail survey response rate	*88.9%*	*84.6%*	*90.9%*	*87.2%*	*88.1%*	*88.3%*

In total, 803 surveys were mailed to respondents. Of those, 709 were returned, for a response rate of 88.3%. Response rates in the regions ranged from 85% in WK to 91% in GW (Figure 1). Overall, we were happy with such high response rates.

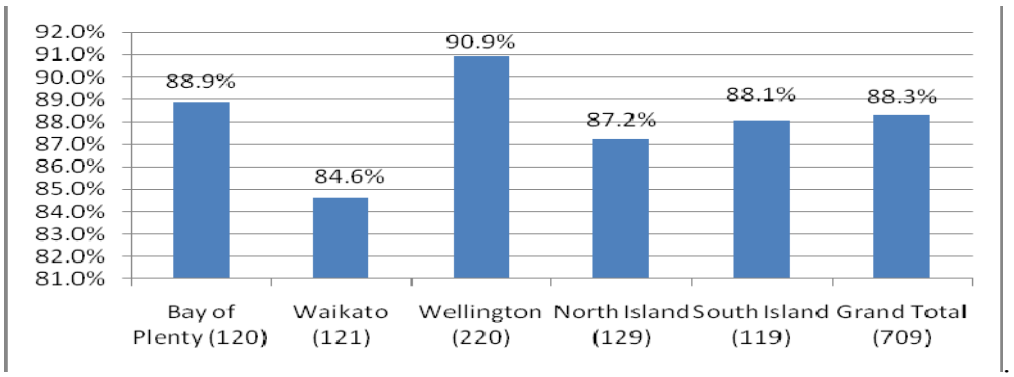

Figure 1. Response Rates, Percent (number of surveys returned in parentheses)

II. Survey Results

A. Survey Section 1: Questions About Where the Respondent Lives

The first question in this section asked respondents in which town or city their home was located. From this, we could verify their respective region locations. Respondents were located all over New Zealand, in small towns and big cities. In GW, some of the locations with over 5 respondents included Wellington City, Masterton, Upper Hutt, Lower Hutt, and Porirua. In the BP, areas included Tauranga, Te Puke, Katikati, Kawerau, and Whakatane. In the WK, areas included Taupo, Hamilton, Cambridge, Raglan, and Te Awamutu. For the rest of the NI, towns and cities included Gisborne, Wanganui, Kerikeri, Hastings, and Napier. On the SI, people came from all SI regions including a variety of large cities and small towns. Some of the locations with over 5 respondents included the cities of Christchurch, Dunedin, Blenheim, Invercargill, Greymouth, and Nelson. Overall, 30% of the respondents were from the GW, while each of the other regions encompassed between 16% and 18% of the respondents (Figure 2).

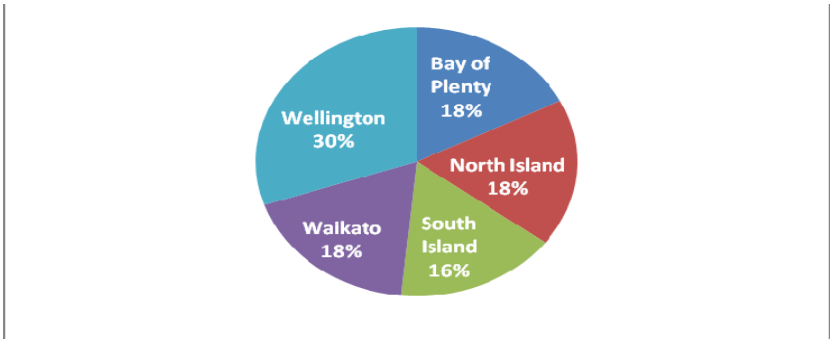

Figure 2. Survey respondent home locations by region

Our second question asked respondents to state whether they believed they lived in an urban or rural area. During the focus groups, it was suggested that definitions of these terms were not needed. Therefore, no definition was given in the mail survey. Overall, 68% of our respondents lived in an urban area, while 32% lived in a rural area. Our results compare very closely to the Statistics New Zealand (2005) data, stating that 67% of New Zealanders lived in an urban area (Figure 3).

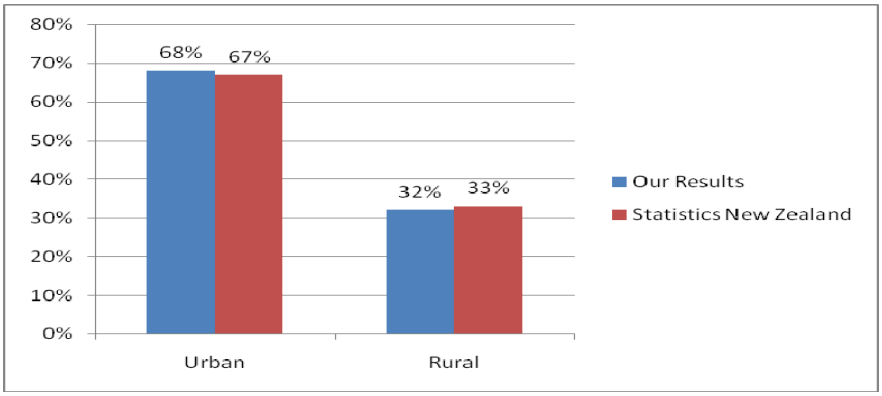

Figure 3. Rural/urban comparisons between our survey and Statistics New Zealand (2006)

When comparing the results by region, we found that GW had the greatest number of urban respondents (85%). This is most likely the case since a large majority of GW respondents were from Wellington City. The NI, not including the BP, WK, and GW, resulted in the greatest number of rural respondents (46%) (Figure 4).

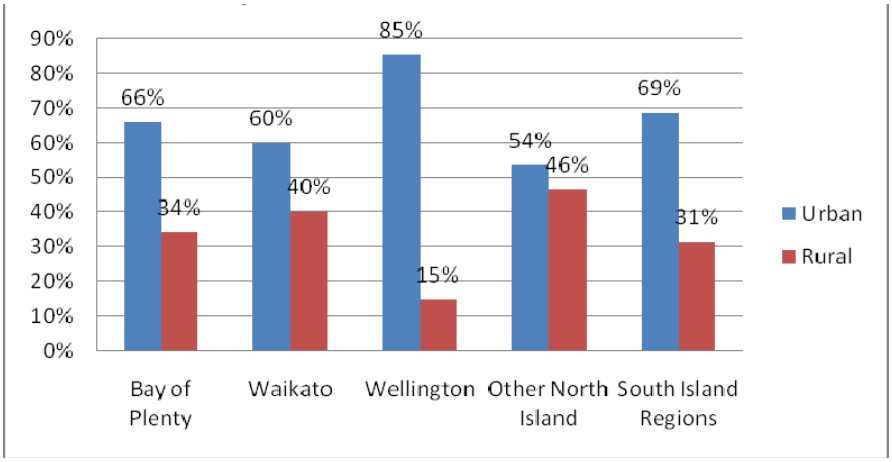

Figure 4. Respondent home locations

A multiple choice question was asked to determine what type of home respondents live in. Options to select included single dwelling, flat, shared unit, unit/ apartment, and other. There was a blank space to fill in if respondents ticked 'other.' The majority of respondents lived in a single dwelling home (87%), with only 3% living in shared dwellings, units/ apartments and other (Figure 5). Just 4% of respondents lived in a flat.

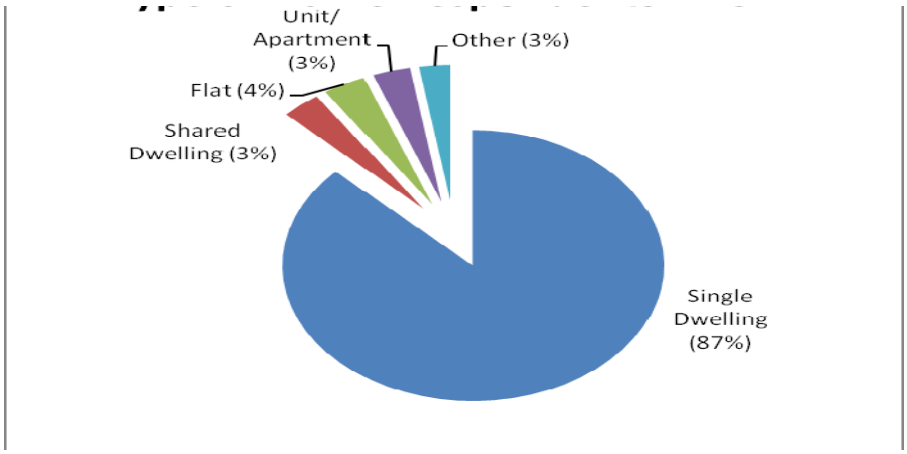

Figure 5. Home types of all respondents

Not too many differences are seen when dividing respondents by regions. Overall, over 80% of respondents lived in a single dwelling, with 91% of respondents from the BP living in single dwelling homes (Figure 6). As a large proportion of people from GW lived in an urban area, it was no surprise that a smaller proportion of people (82%) lived in single dwelling homes, while 15% of respondents lived in a flat, shared unit, or unit/apartment.

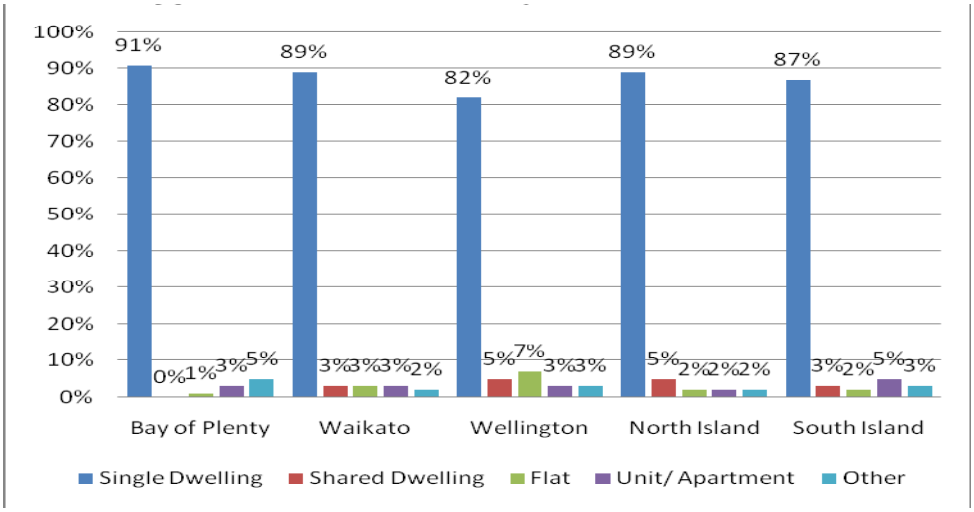

Figure 6. Respondent home types by region

The typical respondent lived at his/her property for approximately 10.6 years (Figure 7). However, the length of residence varied between survey regions, with GW having the longest average length of residency (about 12 years), while the BOP had the shortest (8.6 years).

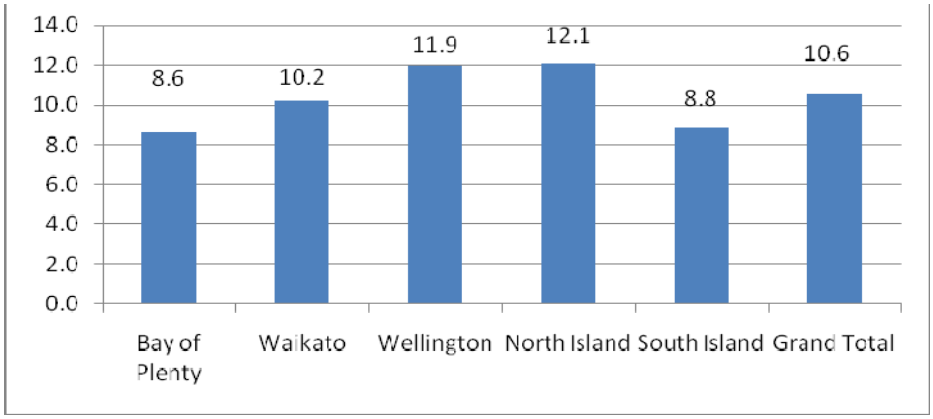

Figure 7. Average length (in years) the respondent lived at their current property

Respondent property sizes ranged from a small 30 square-meter flat in Auckland to a 820-hectare farm in the WK. On average, a respondent lived on a 19.3 hectare property (Figure 8). The smallest average property sizes were in the BP (7.8 hectares), while the largest were in the NI (33.0 hectares). However, the median property size was approximately 1,000 square meters, indicating that the distribution is skewed with a few observations pulling up the average.

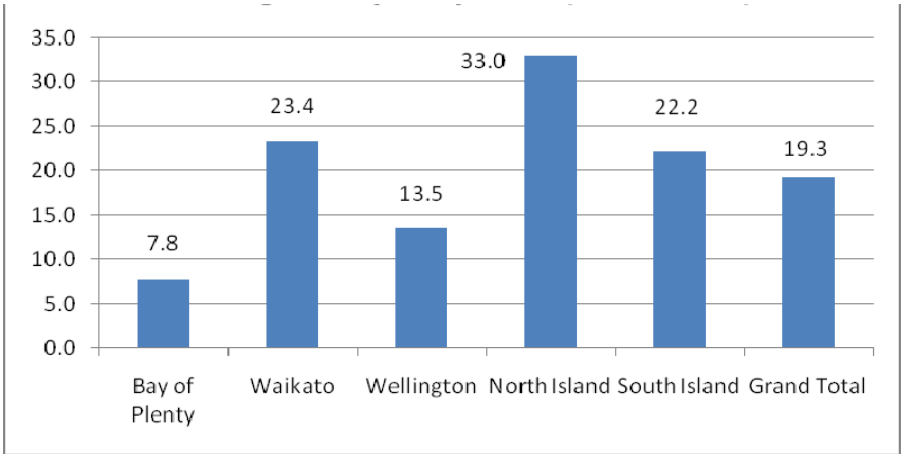

Figure 8. Average property size by hectares

We also asked respondents if they owned or rented their homes. Three options were given to this question: own, rent, and other (in which they would need to specify what 'other' was). As can be seen in Figure 9, between 79.5% and 87.3% of respondents in the different regions owned their own home. Less than 5% of respondents selected the 'other' response. When asked to specify what 'other' meant, answers included that the partner/spouse owned the home, their parents owned the home and that their work was providing them with this home.

Having indoor plants in a home offers several benefits to those people living in the home with plants. These benefits include cleaner air, stress reduction and aesthetic improvement. Figure 10 illustrates that all survey regions in the NI (i.e., GW, BP, WK, and the NI) had virtually the same proportion of respondents with plants inside their homes (between 71%

and 74%). By far, people living on the SI had the highest proportion of plants inside their home (83.9).

We then asked respondents who did have plants inside their home, what types of plants they had. There were over 1,000 responses to this question (as numerous respondents gave two or three answers). The top 20 plants named are listed in Table 2. The five most popular indoor plants were ferns (17.8%), lilies (14.2%), cacti (12.0%), herbs (8.5%), and African Violets (7.4%). Ferns included maiden-hair fern, rabbit's foot fern and stag fern. Indoor lilies consisted primarily of the peace lily. Cacti came in various forms which included the Christmas cactus and chain cactus. Some respondents specified the type of indoor palm they had, which included the kentia palm and ponytail palms.

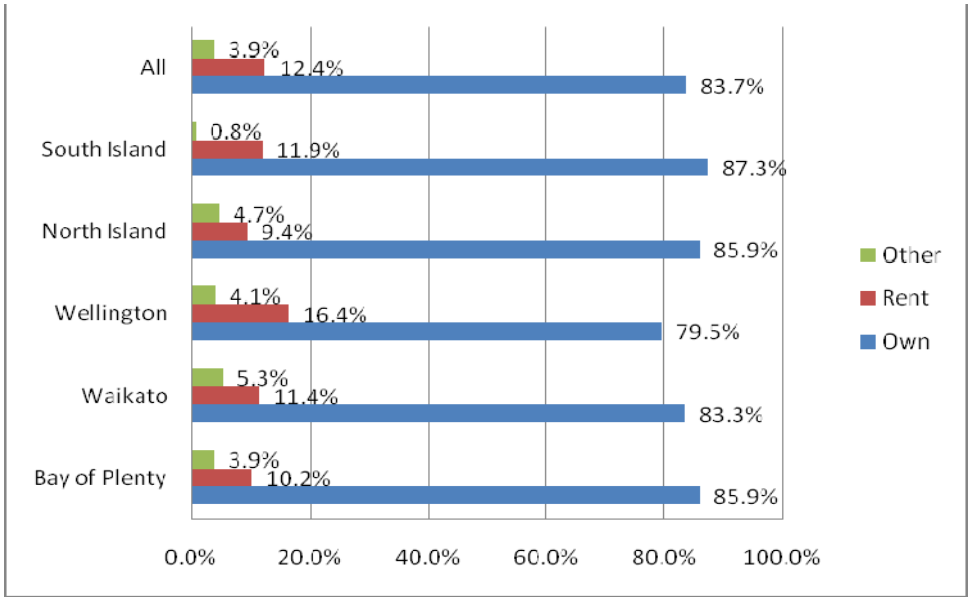

Figure 9. Property tenurial status of respondents by region

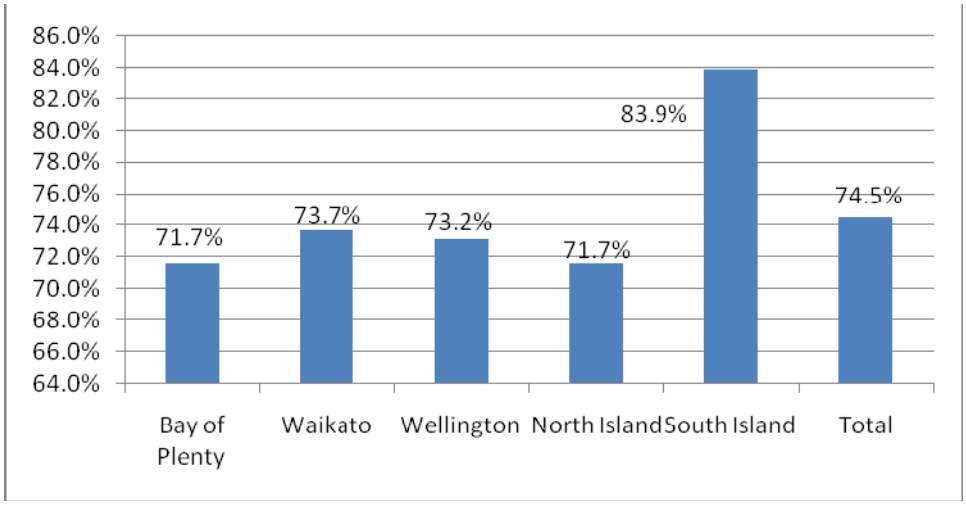

Figure 10. Do the respondents have house plants inside their home (% yes)

Table 2. List of the top 20 indoor plants in respondent homes

Name of Plant	Percentage of Respondents
Fern	17.8%
Lily	14.2%
Cactus	12.0%
Herbs (Basil, Coriander, Parsley, Thyme)	8.5%
African Violet	7.4%
Yucca	6.9%
Palm	6.4%
Begonia	4.5%
Orchid	4.1%
Rubber Plant	2.2%
Hoya	2.0%
Spider Plant	2.0%
Anthurium	1.7%
Poinsettia	1.7%
Aloe Vera	1.6%
Cyclamen	1.5%
Dracaena	1.5%
Ficus	1.5%
Mother-in-Laws tongue	1.5%
Bromeliads	1.1%

Plate 1 provides an example of indoor plants that a respondent may have. This picture was sent to us by one of the GW respondents. Indoor plants in the picture are those located at the bottom of the picture in pots.

Plate 1. A Greater Wellington respondent's home garden.
The plants in pots (lower portion of picture) are included in the survey's list of indoor plants. The actual copy of this scanned photo was sent to us by a respondent.

Recently, there have been a number of studies that have asked respondents questions about who is the 'decision maker' in the home. We also included a question like this. Our question was worded as such: 'If you have a partner and/or fellow household member in your home, and plans were made to plant a few trees, who would decide which trees to plant?' The possible responses were: You, Them, Both/ All, Landlord/ NA. We discovered that an overwhelming majority of respondents made a decision together (71.4%), while only 20.2% of the respondents made this type of decision themselves (Figure 11).

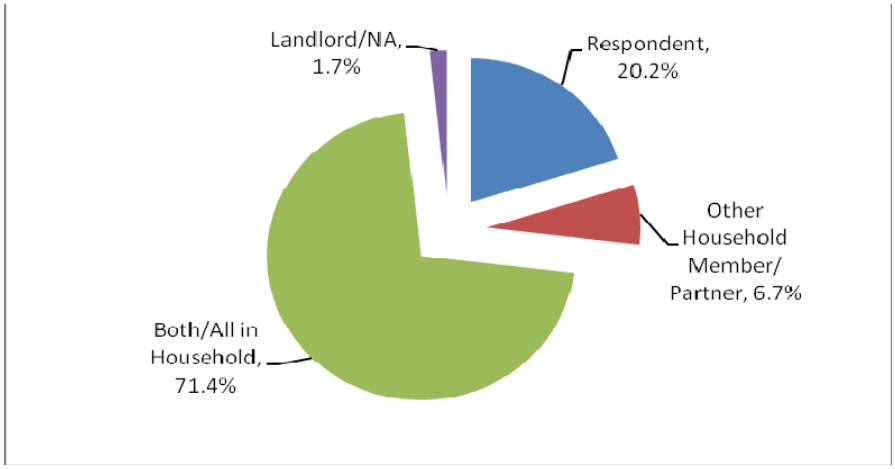

Figure 11. Who in your household decides what kind of trees to plant?

Since a large majority of this survey is aimed at determining the value of native plants, we asked respondents if they are aware of some common trees that grow around the country. Three of these trees were native (Tree Fern or Ponga, Kowhai, and Cabbage Tree), while three were introduced (Gum Tree, Norfolk Pine, and Japanese Maple). Of the six trees, 96% of respondents were familiar with the native trees and 85% were familiar with the introduced trees (Figure 12). The cabbage tree (97%) and tree fern (97%) were known best among the six listed trees. It was encouraging to learn that most of the respondents around the country were familiar with some of our native trees.

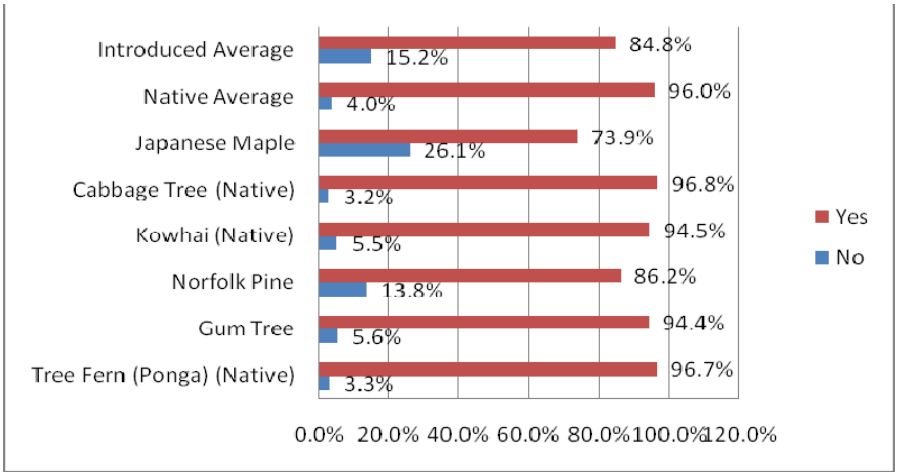

Figure 12. Which of these trees were respondents familiar with?

Next, we asked respondents whether their property had space for trees and shrubs. This was important, as there are properties, such as apartments, that do not have any ground to plant trees. It was interesting to see that 91.2% of respondents had space on their property for trees and/or shrubs (Figure 13). The SI had the highest proportion, with 95%, while the BP, the WK and the NI virtually had the same proportions (between 89% and 90%).

Figure 13. Does the respondents' property have space for trees or shrubs?

Fifty-three percent of the respondents intended to plant trees on their respective properties in the future (Figure 14). Among the regions, this answer did not seem to differ much, varying between 50% and 55%. Looking at this in further depth (although these statistics are not presented here), we have learned that respondents who have lived on their current property for over 7 years were less likely to plant trees in the future. However, people that have lived on their property for less than 7 years are more likely to plant trees in the future. We believe that people that have lived on their property for a long time have had enough time to get the property looking the way they would like, which includes the presence of trees and shrubs.

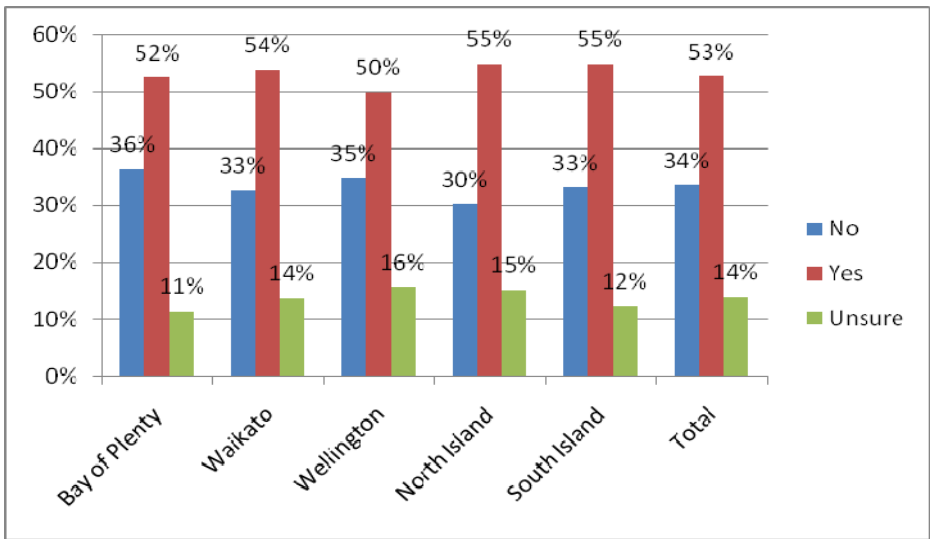

Figure 14. Are respondents intending to plant trees and/or shrubs on their properties?

Next, we asked those respondents who said they intend to plant a tree on their property in the future, what type of trees they would plant. Fruit trees were the most popular. Most people just said they would plant a fruit tree, while others stated specifically which fruit trees they intend to plant. Fruit tree types included lemons, plums, feijoas, apples, oranges, and several others (Figure 15). The top ten trees include: fruit, kowhai, natives (in general), cabbage tree, pohutukawa/ rata, pittosporum, ponga (tree fern), maple, hebe, and magnolia. Therefore, slightly over half of the top ten trees to be planted are natives, while a large majority of the others are non-native fruit trees.

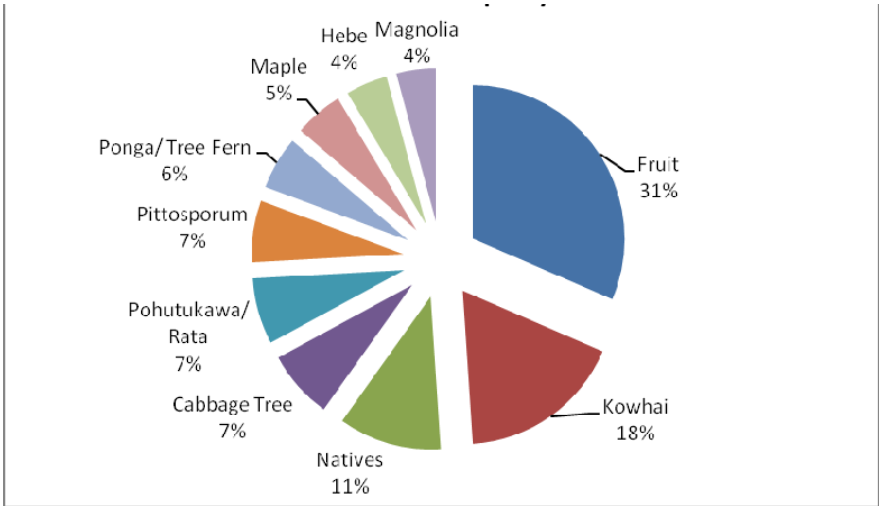

Figure **15. Top ten trees respondents intend to plant in the future on their property**

A respondent from the Lower Hutt in GW sent us a photo of a Kowhai tree on her property which provides food and shelter to several tui birds (Plate 2). A feature that the respondent liked about the Kowhai is that it gives them the opportunity to see tui right on their own property.

Plate 2. A kowhai tree on a property of a respondent in Lower Hutt (Greater Wellington) that provides food and shelter to several tui birds.

A more complete listing of trees that respondents will be planting in the future is found in Table 3. Here, all plants that were listed at least 5 times are represented. We subjected this table to those plants listed 5 or more times, as there were a large number of plants listed only one time, which we did not think is as beneficial to this report.

Table 3. List of some of the trees to be planted on the respondents' properties

Plant Type	Number of Respondents	% of respondents
Fruit	135	21.2%
Kowhai	75	11.8%
Natives	47	7.4%
Cabbage Tree	31	4.9%
Pohutukawa/ Rata	30	4.7%
Pittosporum	28	4.4%
Ponga/ Tree Fern	24	3.8%
Maple	22	3.5%
Hebe	19	3.0%
Magnolia	18	2.8%
Flax	15	2.4%
Pine	15	2.4%
Camellia	14	2.2%
Palm Tree	14	2.2%
Manuka/ Kanuka	12	1.9%
Oak	12	1.9%
Rhododendron	12	1.9%
Gum Tree	11	1.7%
Japanese Maple	8	1.3%
Kauri	8	1.3%
Poplars	8	1.3%
Silk tree	8	1.3%
Totara	8	1.3%
Willow	8	1.3%
Karaka	7	1.1%
Lancewood	7	1.1%
Puka	7	1.1%
Rimu	7	1.1%
Elm	6	0.9%
Nut	6	0.9%
Akeake (Dodonaea viscosa)	5	0.8%
Ferns	5	0.8%
Yucca	5	0.8%

Approximately 98% of respondents had trees or other plants on their properties. The other two percent who did not have plants were small properties in urban areas and, therefore, did not have a place to establish trees. The proportion of those who had trees on properties slightly varied between study areas. GW had the lowest proportion (96%) of those who had trees on the property (Figure 16). This can be attributed to the fact that, of the five study areas, GW had the highest proportion of urban respondents. All SI respondents had trees on their properties.

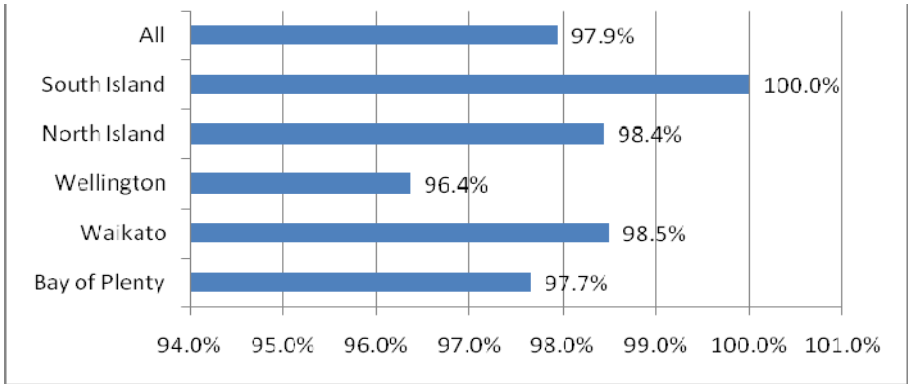

Figure 16. Distribution of respondents with trees/shrubs on their property by region

Respondents who reported to have trees and/or shrubs on their properties were asked what types of trees were there. Eighty-six percent of them reported that they had a mixture of native and non-native trees. Almost 7% strictly had introduced species, while only 2.7% of respondents strictly had native plants. Almost 5% of the respondents were not sure of the mix of their plants (Figure 17).

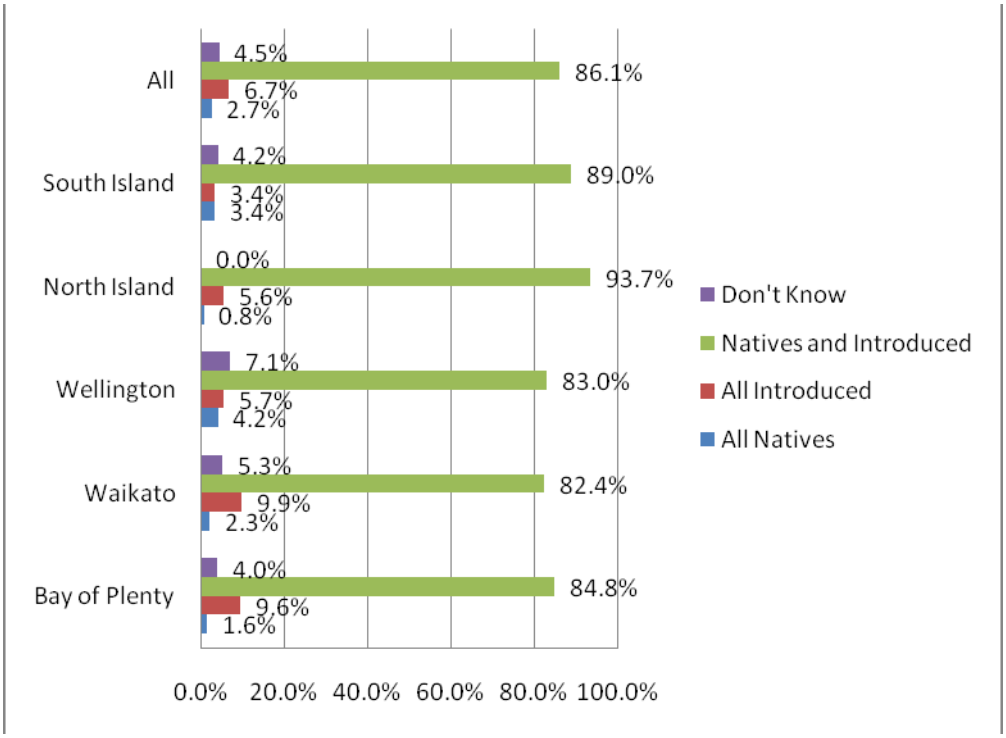

Figure 17. Types of plants on respondent properties by region

Respondents that do have trees and shrubs on their property were asked if they, or any of their household members, planted any of them (Figure 18). Overall, 80% of respondents had planted a tree or shrub on their current property. Regionally, GW had the least proportion of respondents who planted something on their property (76%), while BP had the greatest proportion (87%).

We then asked whether respondents had a creek/river and/or a lake/pond on/or adjacent to their property. About 76% of all respondents did not have a water body on their property (Figure 19). 12.3% percent either had a creek or river running along a section of their property. Almost 9% percent had their property situated adjacent to a lake or pond. It is interesting to note that 2.9% percent had properties that encompass at least a portion of a river/creek and a lake/pond. Only three respondents reported that they lived on a sea/beach, accounting for 0.4% of the survey sample.

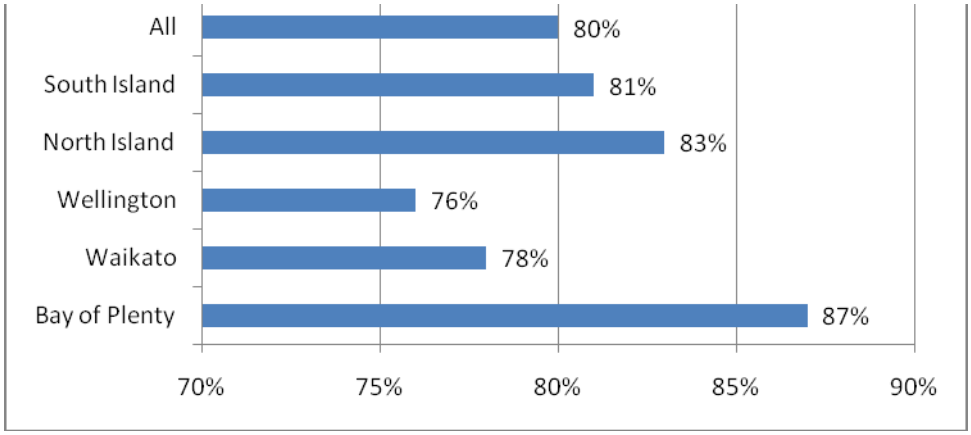

Figure 18. Percentage of respondents who planted a tree or shrub on their properties

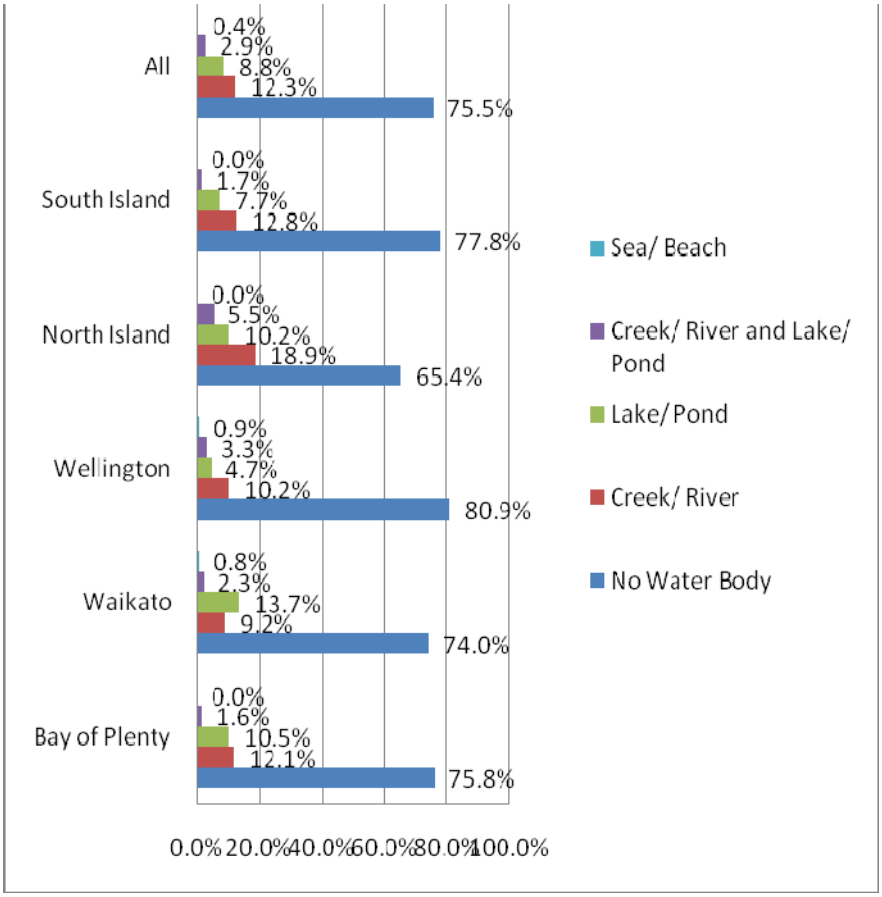

Figure 19. Type of water body on/or adjacent to respondent properties

Respondents were then asked whether their property borders a reserve or a gully. About 27% of them had properties bordering gullies or reserves. The proportions vary between regions, ranging from 25% in WK to 33% in BP (Figure 20). In the WK region, there is a government initiative which aims to enhance the awareness of Hamilton City residents of the importance of gully systems for restoring indigenous biodiversity (Wall and Clarkson, 2006). This initiative, which has been implemented in partnership with private landowners and community groups, is known as the Gully Restoration Programme.

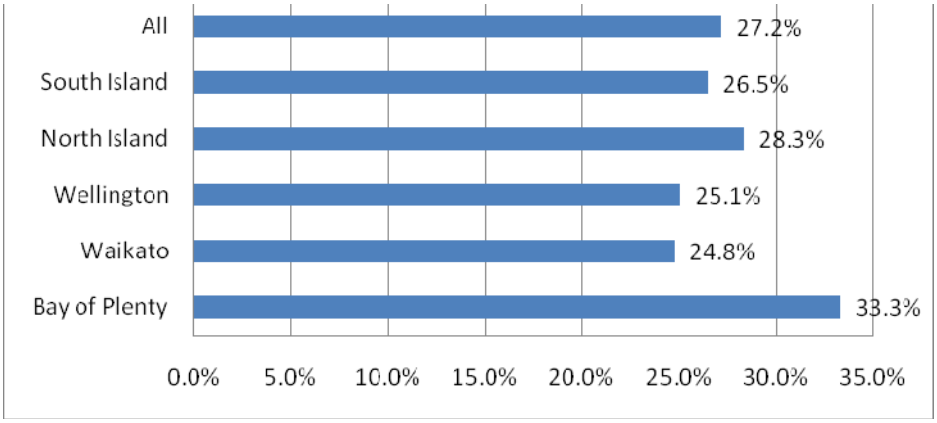

Figure 20. Percentage of respondents whose property borders a reserve or gully

Plants are important ecologically for many reasons. They use the carbon dioxide that we breathe out and turn it into oxygen that we can breathe in. They also provide food and shelter for native birds. While 98% of all respondents had trees on their property, 93% of them believed that trees are also important to be present on neighbouring properties. The proportion of respondents varies between survey regions, with the lowest of 87% in WK and highest of 96% on the SI (Figure 21).

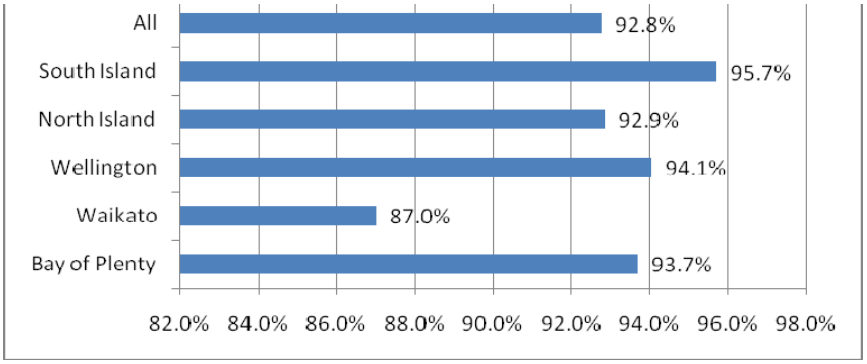

Figure 21. Percentage of respondents who believe that plants are important on neighbouring properties

While we learned in previous questions that respondents intended to plant mainly native trees, the type of trees that the majority of them would like to see on their neighbouring properties was a combination of natives and non-natives (60%) (Figure 22). The other 36% of respondents also preferred to have trees and shrubs, but it didn't really matter what they are. Five percent of the respondents preferred all natives. Only 3 respondents, in total (0.1%)

preferred neighbouring properties with solely non-native trees or introduced tree species. All three of these respondents were located in GW. This result somewhat shows a scenario that although majority of the respondents would like to have native trees, these natives should be supplemented or complemented, by exotics or introduced trees. A neighbouring property with either purely natives or non-natives was preferred by the least proportion of respondents.

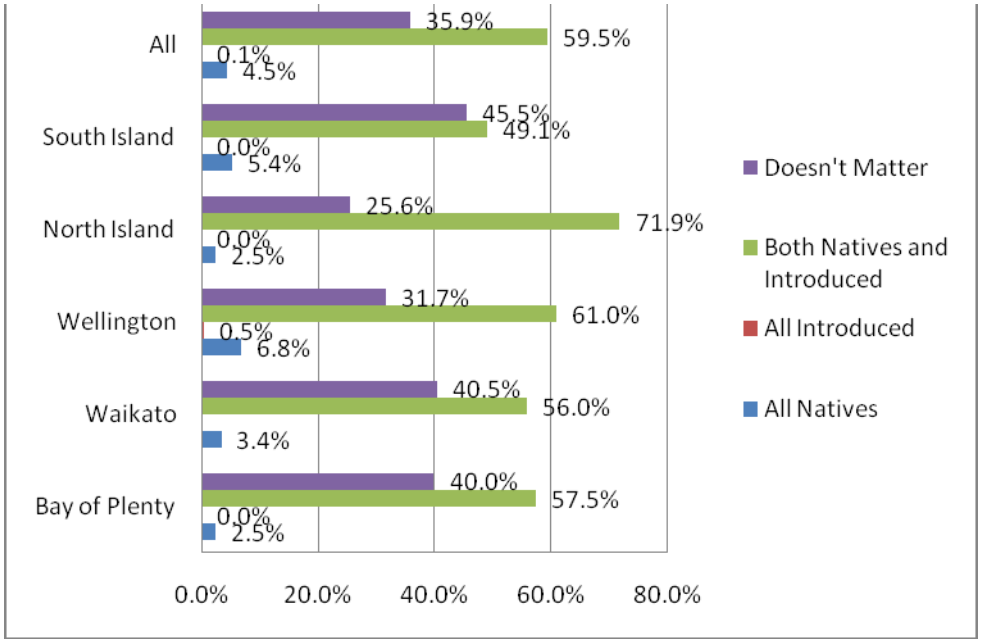

Figure 22. Do respondents believe their neighbours' trees should be of a specific type?

B. Survey Section 2: Questions About Respondents Views of Their Ideal Property

In our survey questionnaire, we asked respondents to imagine or visualize their 'ideal property'. This ideal property is the place they would ideally wish to reside. It did not matter whether they were living there now or hope to live there in the future (or had lived there in the past, in the case of some of the retired respondents). Respondents were then asked to rate 16 different features - determined during focus groups - of their 'ideal property' based on a Likert scale of 1 to 4 where 1=not important, 2=slightly important, 3=important, and 4=very important.

Of the 16 features listed, on average, all respondents considered the presence of trees, plants and shrubs on their ideal property to have the highest importance rating (with an average overall rating of 3.77) (Table 4). This feature had been consistently rated as the most important feature for all five regions, with BP having the highest rating of 3.85. A possible reason for recognizing the presence of trees being rated as the most important feature on private properties is the fact that 98% of the respondents had trees on their property. This may imply that trees are part of the everyday lives of most New Zealanders. The second most important feature was 'trees for shade and/or shelter' which were an average rating of 3.59. The third, fourth and fifth most important features were the existence of a lawn (3.56),

native birds (3.53) and birds[1] (3.46). If we put together the five most important features of an ideal property, we can come up with a scenario wherein an average respondent aspires for an ideal property wherein one could relax on a lawn, while enjoying a view of trees and/or shrubs which provide shelter for both native and non-native birds.

On the other hand, the three least important features of an ideal property were 'trees or plants with nice smelling flowers' (2.79), 'native lizards (e.g., geckos, skinks)' (2.41), and 'having a water source (e.g., river, stream, lake, pond) on or next to the property' (2.35). It is surprising to find that trees with nice smelling flowers were considered less important by respondents because one may expect that many people would appreciate a place with nice smelling flowers from trees. However, it is not very surprising that skinks and geckos were considered less important on properties, as they may be viewed as 'creepy crawlies,' such as snakes, that many people seem not to enjoy seeing. Perhaps a possible reason for considering a water body as the least important factor (among the 16 given features) on an ideal property is that it might attract some unwanted insects, such as mosquitoes and wasps.

Table 4. Average rating of the features of trees and plants on an 'ideal property' by region
(1=not important, 2=slightly important, 3=important, and 4=very important)

Rank	View About Ideal Property	Bay of Plenty	Waikato	Welling-ton	North Island	South Island	All
1	Having trees, shrubs, or plants	3.85	*3.72*	*3.73*	3.81	3.76	3.77
2	Trees for shade and/or shelter	3.53	*3.69*	3.52	3.61	3.66	3.59
3	A lawn (for relaxing or playing games)	3.54	3.55	3.54	3.62	3.55	3.56
4	Native Birds	3.59	3.55	3.52	3.52	3.51	3.53
5	Birds	3.48	3.48	3.44	3.48	3.43	3.46
6	A deck (e.g., to sit on, put a BBQ on)	3.49	3.38	3.25	3.36	3.26	3.34
7	Trees to Stabilize the Soil	3.30	3.39	3.40	3.44	3.09	3.33
8	Native trees and shrubs (e.g., pohutukawa, flax, hebe)	3.28	3.17	3.26	3.33	3.25	3.25
9	Trees or plants with attractive flowers	2.98	3.22	3.09	3.08	3.19	3.11
10	A place to work on projects (e.g., car repair, painting)	3.06	3.09	2.81	3.19	2.91	2.99
11	Fruit Trees and/ or berry plants	3.17	3.12	2.73	3.24	2.79	2.98
12	A vegetable garden	3.07	3.11	2.60	3.20	3.11	2.96
13	Plants for future owners of the property	2.95	2.98	2.84	3.12	2.88	2.94
14	Trees or plants with nice smelling flowers	2.67	2.94	2.64	2.80	3.01	2.79
15	Native lizards (e.g., geckos, skinks)	2.54	2.46	2.29	2.50	2.33	2.41
16	Having a water source (e.g., river, stream, lake, pong) on or next to the property	2.49	2.41	2.14	2.58	2.27	2.35

[1] This represents birds, in general. It did not specify whether they were native or non-native.

C. Survey Section 3: Questions About Respondents Views of Parks or Reserves in Their Local Area

In this section, respondents first were asked questions about their awareness and visits to public parks (Figure 23). Almost all (99%) respondents were aware of at least one park or reserve in their area. This proportion slightly varied between regions from 98% for NI and BP respondents to 100% for GW respondents.

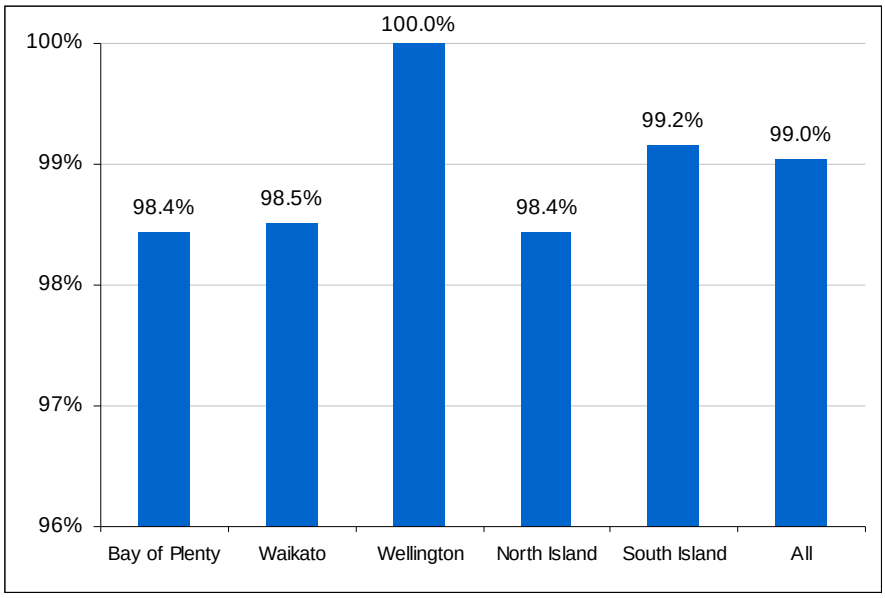

Figure 23. Proportion of respondents who knew of at least one park or reserve in their local area

Figure 24 shows that 98% of respondents visited at least one park or reserve. Regionally, while almost all GW respondents (99.5%) visited a park or reserve, respondents in other regions had at least 97% who visited a park or reserve. Therefore, we find that most New Zealanders are aware of and visit public parks.

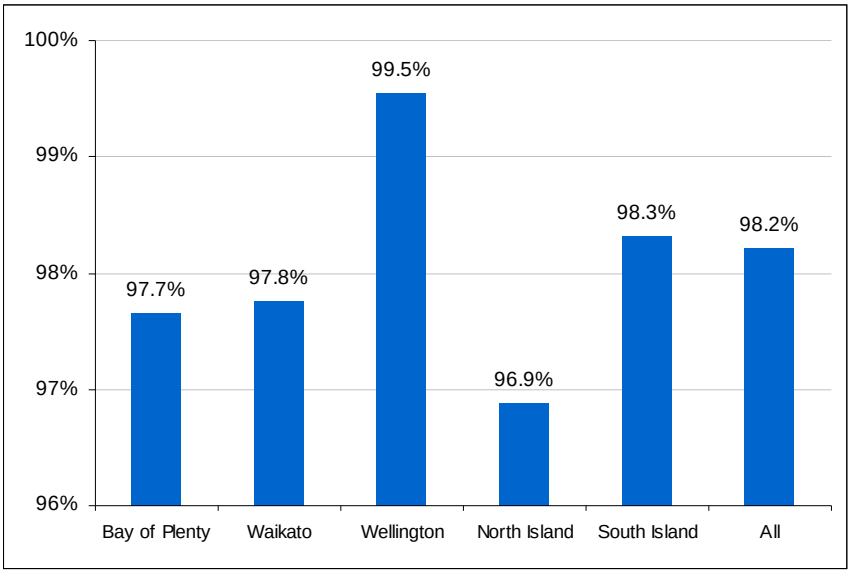

Figure 24. Proportion of respondents who visited at least one park or reserve in their local area

Respondents who visited parks/reserves were then asked which type/s of parks they have visited. The options - determined during the focus groups - included: (1) national park, (2) scenic/native reserve, (3) district council park, (4) city park, (5) children's playground, and (6) other. Figure 25 represents that, among the five types of parks listed, district council parks are the most visited (73%), while national parks are the least visited (27%). A possible reason for the low visits to national parks is because they are few and far between and that people would not necessarily have a national park in their local area. SI had the highest proportion who visited national parks (33%), while WK had the least (23%). Among the five regions, NI had the highest proportion who visited district council parks (79%), while SI had the least (66%). The GW had the highest proportion who visited scenic/native reserves (75%) while slightly behind is the GW proportion of those who visited district council parks (72%). Children's playgrounds and city parks were visited by 40% to 59% of the overall respondents. A smaller proportion (9%) of the overall respondents reported visiting other types of parks which were not included in the six types that we listed in the questionnaire. Other park types specified included botanical gardens, bird sanctuaries, beach fronts/reserves, walkways, stream reserves and forest parks.

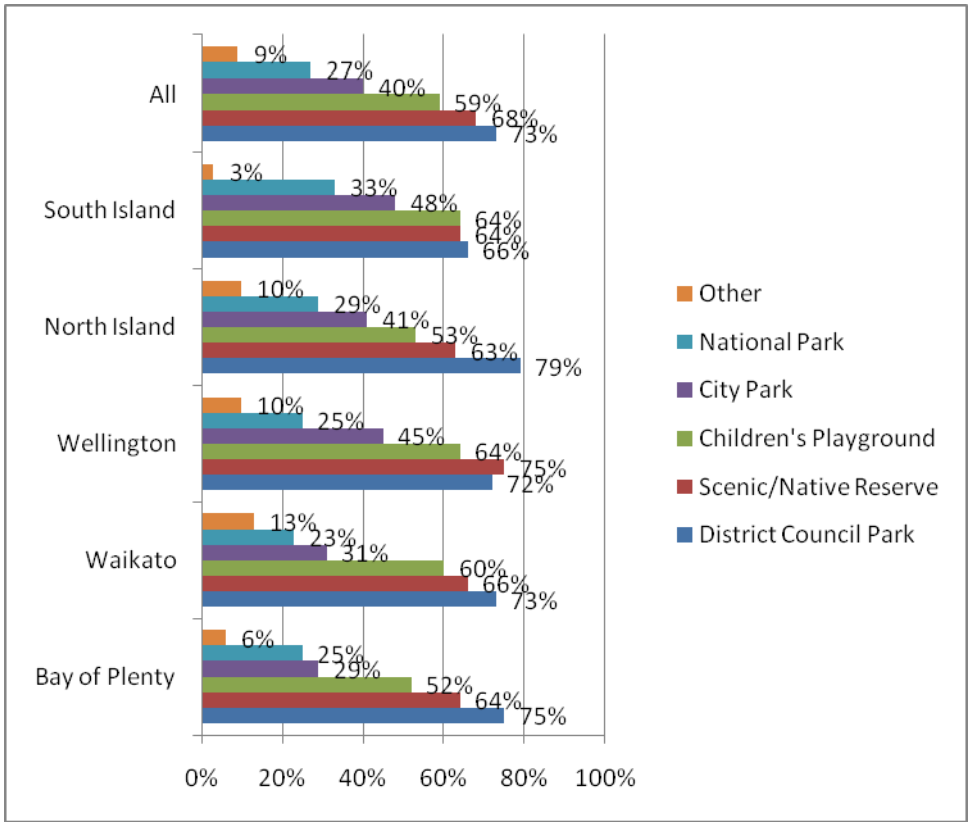

Figure 25. Types of parks or reserves visited by respondents by region

Visits to public parks usually entail participating in some form of recreational activity. Of the several activities listed, walking was the most popular activity, wherein 91% of respondents participated (Figure 26). GW had the highest proportion (96%) of walkers, while for the rest of the regions; at least 86% participated in walking. Picnicking was the

second most popular activity, where 53% of all respondents picnicked in parks. SI had the highest proportion of picnickers at 62% while BP had the least proportion at 49%. Nature observation or viewing (30%) and bird watching (23%) ranked as the third and fourth most popular activities. Photography, camping, fishing, cycling and jogging were participated in by at least 11% of all respondents. Fifteen percent of the overall respondents specified other activities they did in parks and reserves. Other activities included bringing kids to public parks to play, horseback riding, dog walking, relaxing and hunting. GW had the highest proportion (19%) who specified other activities, while SI had the least (8%).

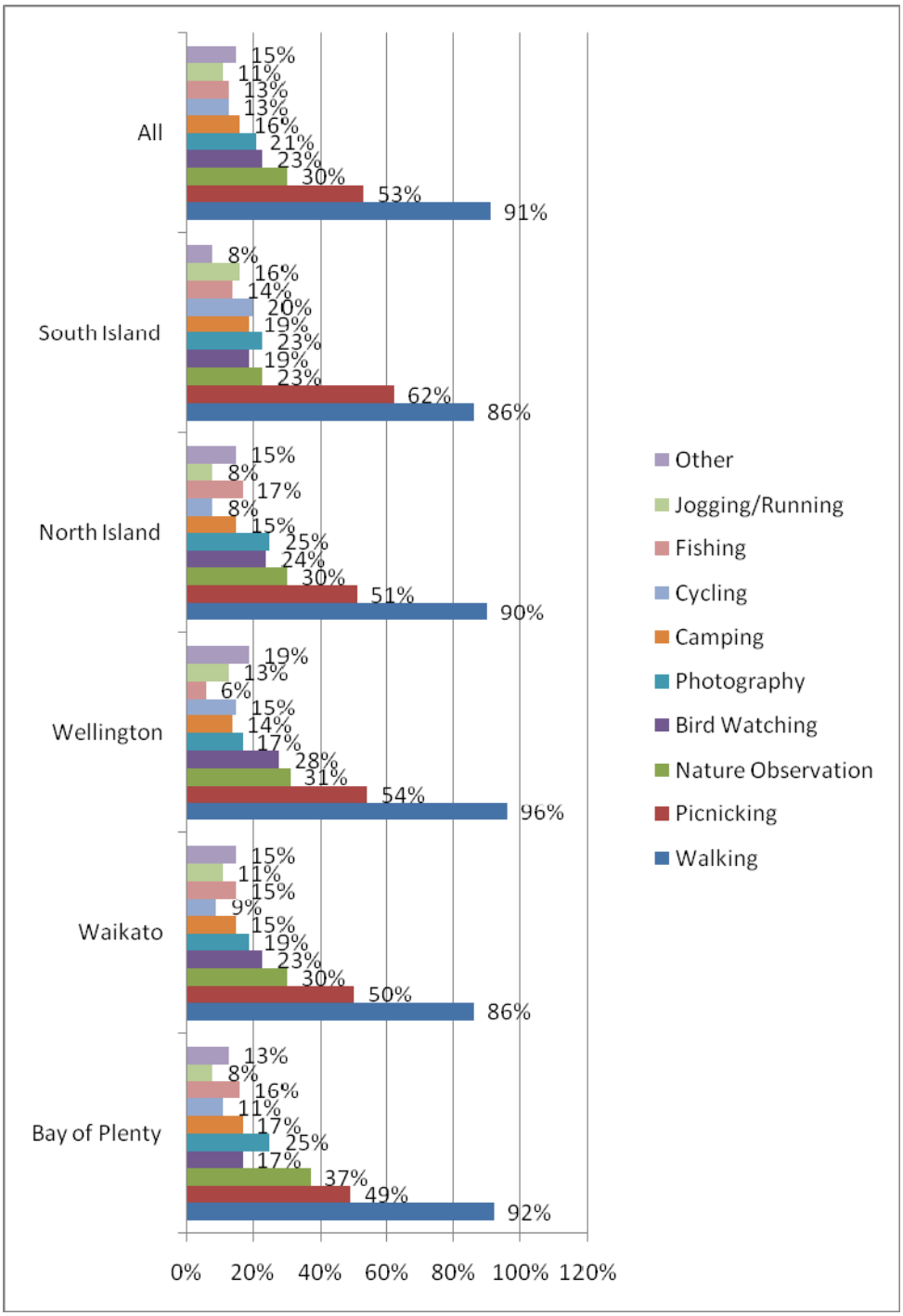

Figure 26. Activities on public parks/reserves that respondents participate

Respondents were then asked to rate 16 important features of trees and shrubs on public lands (determined during the focus groups). Similar to rating the importance of plants on their ideal property, respondents, on average, placed the highest importance on trees and shrubs on public parks (Table 5). However, the difference between these two land types is that the presence of trees and shrubs on public land (3.85) is valued higher than trees on private land (3.77). Testing the difference between the two average ratings using a t-test, at the 99.9% confidence level, the value of trees on public parks were found to be significantly greater than on ideal properties.

Table 5. Average rating of the features of trees and plants on parks and reserves in the respondents local area, by region

(1=not important, 2=slightly important, 3=important, and 4=very important)

Rank	Feature	Bay of Plenty	Waikato	Wellington	North Island	South Island	All
1	Trees, shrubs, and plants	3.94	3.84	3.84	3.81	3.85	3.85
2	Having plants and trees for park visitors fifty years from now	3.79	3.71	3.74	3.83	3.76	3.76
3	Trees for shade and/or shelter	3.84	3.79	3.65	3.76	3.81	3.75
4	Native birds	3.83	3.66	3.71	3.72	3.71	3.72
5	Walking tracks	3.70	3.65	3.62	3.48	3.69	3.63
6	Birds	3.60	3.54	3.58	3.61	3.61	3.59
7	Native trees and shrubs (e.g., pohutukawa, flax, hebe)	3.61	3.51	3.57	3.54	3.56	3.56
8	Picnic benches	3.21	3.22	3.03	3.15	3.26	3.16
9	Playgrounds	3.20	3.18	3.19	2.97	3.19	3.15
10	Trees or shrubs with attractive flowers	3.11	3.24	3.06	3.16	3.24	3.15
11	Having a water source (e.g., river, stream, lake, pond, ocean) on or next to the park	3.33	3.07	3.11	3.17	3.08	3.15
12	Providing natural homes for native fish	3.14	3.14	3.01	3.09	3.03	3.07
13	Sports fields (e.g., touch rugby, soccer)	2.95	2.70	2.74	2.78	2.84	2.79
14	Native lizards (e.g., geckos, skinks)	2.90	2.75	2.66	2.72	2.78	2.75
15	Fishing	2.51	2.45	2.01	2.32	2.35	2.29
16	Barbeque grills	2.44	2.33	2.14	2.17	2.27	2.26

The next five important features on public parks were ‘having plants and trees for park visitors fifty years from now’ (3.76), ‘trees for shade and/or shelter’ (3.75), ‘native birds’ (3.72), ‘walking tracks’ (3.63), and ‘birds’ (3.59). It appears that respondent’s value the importance of both native and non-native birds on public land (with native birds being valued slightly higher than non-native birds). They would also like these rich biodiversity features to be experienced by future generations (3.76), indicating a strong bequest value.

The four least important public park features were 'sports fields' (2.79), 'native lizards' (2.75), 'fishing' (2.29) and 'barbeque grills' (2.26). Perhaps respondents would like to have these features elsewhere (e.g., do barbeque parties on their deck, fishing at the Rakaia river, or play rugby at school/university fields). There might also be respondents who were not aware that native lizards, such as some species of skinks and geckos, are included on the list of endangered species (Ministry for the Environment, 2007; Craig, et al., 2000).

D. Survey Section 4: Willingness-to-Pay Questions

In this section of the survey, respondents were presented with a hypothetical situation wherein they could contribute to planting programmes for biodiversity enhancement on private and public lands. In the questionnaire, respondents were asked how much they would be willing to contribute annually through their rates. To determine this, we designed a single-bounded dichotomous choice contingent valuation (CV) question (Mitchell and Carson, 1989; Habb and McConnell, 2003). This type of valuation question is also referred to as a 'take it or leave it' question and can simply be answered with a 'yes' or a 'no'. Different respondents were asked the same two questions, but with different sets of willingness-to-pay (WTP) values. Each respondent was given two CV questions which were both assigned the same WTP value. For instance, if a respondent is asked if he/she would be WTP $30 to support a tree planting initiative on private land, the next CV question asked if he/she would be WTP $30 to support a similar initiative on public land. The next respondent, however, would be asked if they were WTP $40 for both questions.

Figure 27 illustrates the 'yes' vote pattern over the various private land WTP values. Starting with the lowest bid of $1, we see almost all respondents (93%) would be WTP to support biodiversity enhancement of private lands. We then see a direct pattern in that as the bid gets higher, not as many respondents are WTP. At a bid of $10, 74% are WTP. At a bid of $20, 64% of respondents that were asked this question were WTP. We find that at the bid of $40, half of the respondents were WTP. So in general, less than half of the respondents are WTP at bids greater than $40, while more than half are WTP less than $40.

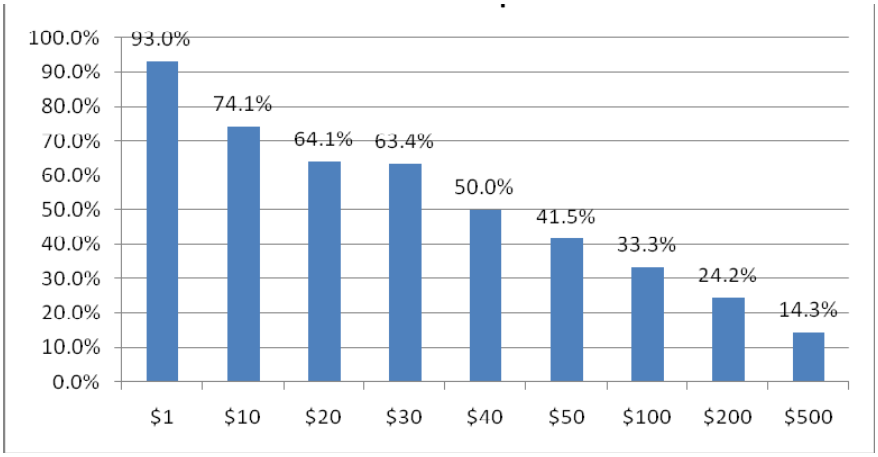

Figure 27. Percentage of respondents who were willing-to-pay an annual rate increase For a planting programme on private lands at a specified rate

When we divide the respondents by regions, we find a similar, but more detailed, pattern: as the bid amount gets lower, more people are WTP for the programme. Here, we find that in the BP and the GW, all respondents were WTP for the programme on private lands at the $1 bid amount (Figure 28). For the BP, over half of the respondents were WTP for amounts of $30 or less. For the WK, over half of the respondents were WTP for amounts of $1, $10, $30 and $40. However, over half of the WK respondetns were not WTP at the $20 level. For the GW, over half of the respondents were WTP for amounts of $100 or less. In the rest of the NI, we find over half WTP for $30 or less. And finally, for the SI, over half of the respondents were WTP for levels of $20 or less. Without doing any further analysis on the data (a more detailed analysis will be conducted in future work), we find that GW respondents have the highest WTP of the five regions. The next highest WTP by region are BP, WK, and NI. Finally, the lowest WTP was seen on the SI .

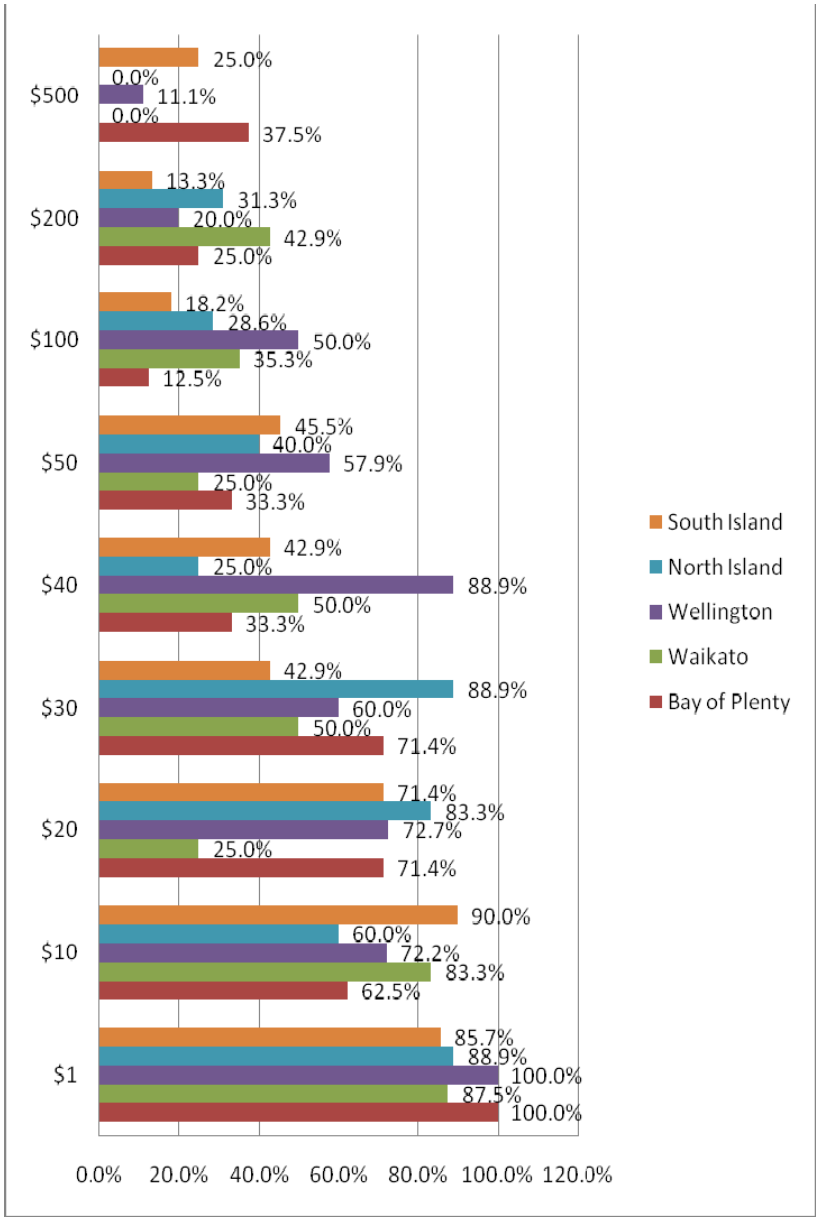

Figure 28. Percentage of respondents who were willing-to-pay an annual rate increase for a planting programme on private lands at a specified rate, by region

Our second WTP question was directly related to the first, except that it asked respondents for their WTP for biodiversity enhancement on public lands (the first focused on private lands). Here, at $1, only 91% of respondents were WTP (this is 2% less than on private land) (Figure 29). At $10, 83% are WTP (compared to 74% on private lands) and at $20, 67% are WTP (compared to 64% on private lands). This same pattern follows throughout, in that the percentages of WTP for programmes on public lands are all higher (except at the $1 level) than the percentages on private lands. This indicates that respondents were WTP more for projects on public lands than they were on private lands.

Figure 29. Percentage of respondents who were willing-to-pay an annual rate increase for plant programmes on public lands at a specified rate

We then separated the data by region to see if we could find out any more information. For public lands, there were 100% yes bids for the GW for bids of $1 and $30, as well as the NI at $1 and BP at $10 (Figure 30). At least 50% of BP respondents said yes to all bids of $50 and under. The WK results seemed to fluctuate, with at least 50% of respondents saying yes at $1, $10, $30, and $40. However, this was not true for WK at $20. GW and the NI exhibited values over 50% for all values of $50 and under. SI exhibited values over 50% for all values of $50 and under, but this was also true for values of $500. This overview represents that people on the SI are much more WTP for projects on public lands than they are on private lands. In this case, the SI had the highest WTP values overall. However, all other regions also had higher values for public lands than for private. In general, we find that respondents all over New Zealand place a higher value on biodiversity on public lands than they do on private lands.

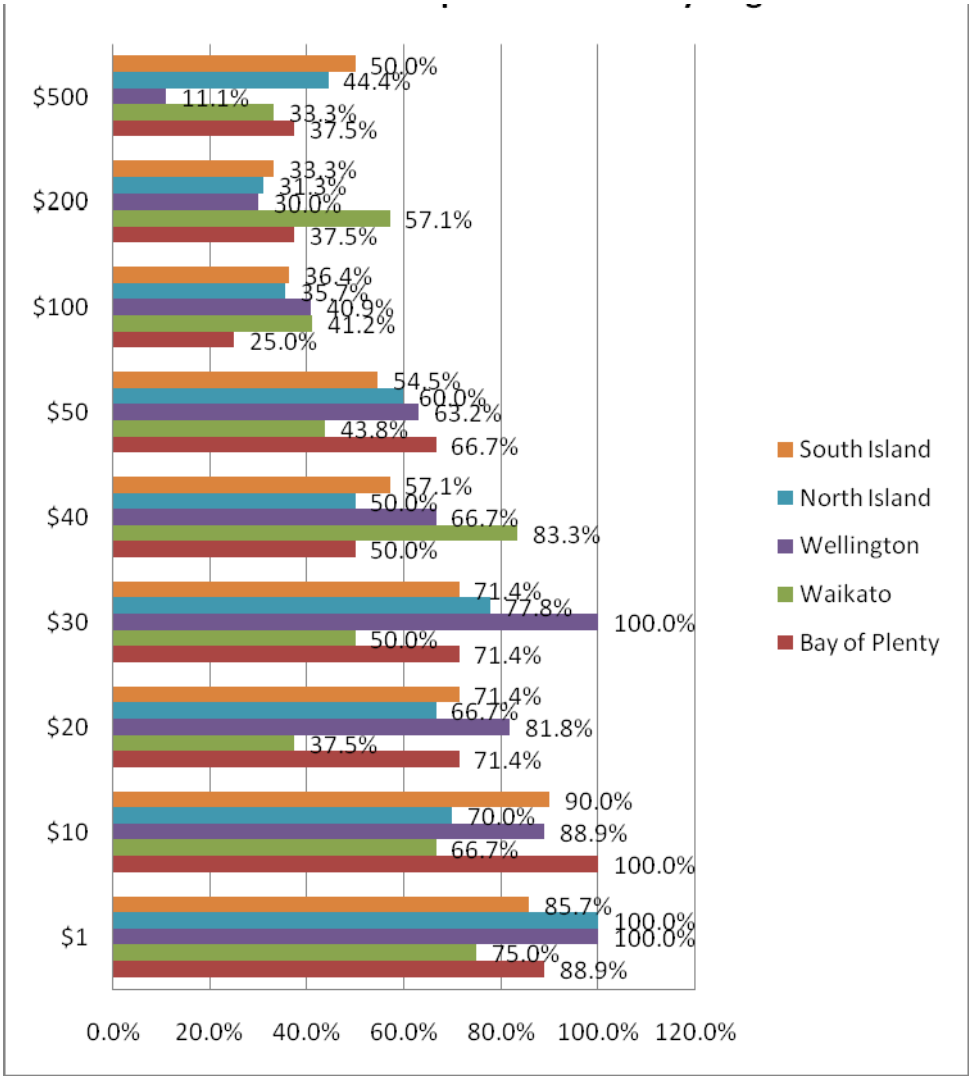

Figure 30. Percentage of respondents who were willing-to-pay an annual rate increase for plant programmes on public lands at a specified rate by region

E. Survey Section 5: Choice Modelling Questions

To determine some of the most preferred attributes of biodiversity enhancement programmes, we included a choice modelling (CM) question in the survey.[2] CM is derived from the notion that a good can be described according to its features or attributes (Bateman, et al., 2002). For instance, a private property or dwelling place may be described by its location, size and design quality. Changes in any of these attributes would likely result in a change in value.

Here we evaluate hypothetical council supported tree planting programmes. The three major attributes were the type of trees/shrubs to be planted (native, non-native or both), type of tree provision (provided free by council, tree purchase rebates, no tree provided) and value of the trees and/or advice (between $30 and $145). These attributes were presented in a tabular form where respondents were given four different options to choose from. The

[2] Choice modelling is an economic valuation technique which is also known as conjoint analysis.

features and the four options comprised what we call the 'choice sets'. An example of one of the choice sets is presented in Figure 31. Our questionnaire had three main versions which we call CM Version 1 (CM1), CM Version 2 (CM2) and CM Version 3 (CM3). The values of trees and shrubs, as well as the value of advice, varied for each version to capture the preferences of respondents given different values.[3] Each respondent was given a choice set composed of four different tree planting incentive programmes undertaken by the council. Options 1, 2 and 3 represent incentives offering subsidized tree or shrub planting programmes on private property. These three options vary between different versions of choice sets. On the other hand, Option 4 represents the situation where only free advice is given. In this option, the council offers free technical advice on the planting of trees or shrubs, but no free trees. The value of this technical advice varied between different sets of surveys. Option 4 represents the cheapest option, costing the councils between $30 to $65 per household, while Options 1, 2 and 3 would cost between $95 and $145 per household.

Overall, responses to the CM questions are summarised in Table 6. CM Version 1 has a total of 277 responses, while CM 2 and 3 had 282 and 268 responses, respectively. For CM 1, a respondent had four different options to choose from, plus the option of not selecting any of the four options. This allowed each respondent five different options and these were: (1) no option selected, (2) non-native plants from councils, (3) native plants from councils, (4) native plants you purchase, and (5) no trees, only advice. For CM1, the highest proportion (43%) chose **'native plants you purchase'**.

When asked why they chose the option they did, many reasons were provided. Some of the reasons for choosing that option included the flexibility to choose the desired size and type of native plants for their property and the provision of rebates of purchased native trees. For CM 2, the highest proportion of respondents (31%) chose **'native and non-native plants you purchase'**. Some of the reasons for choosing this option include that it offers the flexibility of buying the desired selection of native and non-native trees and being able to reimburse tree purchase costs later. For CM Version 3, the largest proportion also voted for the option of having **'native and non-native plants you purchase'** (47%). These results represent a scenario where respondents most prefer the option in which they have the freedom to choose which plant types. They also prefer a mixture of natives and non-natives.

[3] The values assigned to particular trees and/or shrubs as well as values of advice varied. This was accomplished to capture the preferences of individual respondents through econometric analyses.

Plants on private land: what do you prefer?

Native Trees and Shrubs | **Non-Native Trees and Shrubs**

Flax

Camellia

Hebe

Cabbage Tree

Rosemary

Silver Birch

21a. 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.

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

Figure 31. Choice set for Choice Modelling Question, Version 1[4]

[4] **Sources of Tree and Shrub Photos:** Photo of New Zealand Flax or Harakeke taken at the University of Waikato Campus on 30 October 2006 by Richard Yao. Hebe Photo from www.joycreek.com. Photo of Cabbage Tree taken at the University of Waikato Campus on 30 October 2006 by Richard Yao. Photo of Camellia from http://www.themagnolias.co.uk/images/mar2003/camellia-x-williamsii-cv.jpg. Rosemary Photo from http://www.plantsourceintl.com/availability/varietyphotos/index.php?dmi_pindex=11. Photo of Silver Birch from duo.irational.org/food_for_free/organisms/10020.jpg.

Table 6. Summary of choice modelling data – all respondents

	Question Version 1 (CM1)		Question Version 2 (CM2)		Question Version 3 (CM3)	
	N	%	N	%	N	%
Did Not Select An Option	22	(8%)	26	(9%)	15	(6%)
Native and Non-Native Plants from Councils	-	-	82	(29%)	-	-
Native and Non-Native Plants you Purchase	-	-	87	(31%)	125	(47%)
Native Plants from Councils	91	(33%)	57	(20%)	-	-
Native Plants you Purchase	119	(43%)	-	-	79	(29%)
No Trees only Advice	26	(9%)	30	(11%)	31	(12%)
Non-Native Plants from Councils	19	(7%)	-	-	18	(7%)
TOTAL	277	(100%)	282	(100%)	268	(100%)

Note 1: '--' means no data.
Note 2: Figures before parentheses represent number of respondents.

Table 7 represents the regional responses for CM1 for the five regions. The highest proportion of respondents preferred '**native plants you purchase**' while the second most preferred was '**native plants from councils**'. Only a small percentage (16% or less) of respondents in the regions preferred '**non-native plants from councils**'. This represents a scenario that, on average, natives are preferred vis-à-vis non-native plants in relation to council assistance.

Table 7. Choice modelling responses for question version 1 (CM1) by region

Option	Bay of Plenty	Waikato	Wellin -gton	North Island	South Island	All
Number of respondents	44	52	91	45	45	277
Native Plants you Purchase	**41%**	**37%**	**46%**	**44%**	**44%**	**43%**
Native Plants from Councils	36%	33%	34%	31%	29%	33%
No Trees only Advice	9%	17%	7%	11%	4%	9%
Did Not Select An Option	5%	10%	9%	9%	7%	8%
Non-Native Plants from Councils	9%	4%	4%	4%	16%	7%

Note: % figures in boldface font indicate the option preferred by the highest proportion of respondents in the region.

For CM2, the highest proportions of respondents in the BP (32%) and the WK (42%) regions preferred '**native trees and plants you purchase**' (Table 8). On the other hand, the highest proportions of respondents in GW, NI and SI preferred '**native trees and plants you purchase**'. This scenario may indicate that in BP and WK, trees to be planted on property, if freely chosen by the landowners themselves, would be preferred by more people. For GW, NI and SI, these trees are preferred to be provided by councils. Table 8 also represents a scenario that the mixture of natives and non-natives is more preferred than purely native trees.

Table 8. Choice modelling responses for question version 2 (CM2) by region

Option	Bay of Plenty	Waikato	Welling-ton	North Island	South Island	All
Number of respondents	47	50	90	51	44	282
Native and Non-Native Plants you Purchase	**32%**	**42%**	28%	25%	30%	**31%**
Native and Non-Native Plants from Councils	19%	22%	**32%**	**29%**	**41%**	29%
Native Plants from Councils	26%	14%	27%	22%	7%	20%
No Trees only Advice	19%	16%	6%	10%	7%	11%
Did Not Select An Option	4%	6%	8%	14%	16%	9%

Note: % figure in boldface font indicates the option preferred by the highest proportion of respondents in the region.

In the case of CM3, for all five regions, the most preferred option was '**native and non-native plants you purchase**' (Table 9). The second most preferred was '**native plants you purchase**'. Again, this represents a scenario that the combination of native and non-native plants was more preferred than purely native plants. From Table 9, we can see a pattern that natives were more preferred than non-natives.

Table 9. Choice modelling responses for question version 3 (CM3) by region

Option	Bay of Plenty	Waikato	Wellington	North Island	South Island	All
Number of respondents	47	45	89	44	43	268
Native and Non-Native Plants you Purchase	**40%**	**42%**	**52%**	**41%**	**53%**	**47%**
Native Plants you Purchase	30%	29%	26%	34%	33%	29%
No Trees only Advice	17%	13%	7%	20%	5%	12%
Non-Native Plants from Councils	9%	7%	10%	--	5%	7%
Did Not Select An Option	4%	9%	6%	5%	5%	6%

Note: % figure in boldface font indicates the option preferred by the highest proportion of respondents in the region.

When asked if respondents would still plant trees without government incentives (i.e., no free trees, no rebates), a large majority (87%) of overall respondents would still be willing (Figure 32). This is a significant result for a council that does not have a lot of money to fund a project such as this. Regionally, BP had the highest proportion (92%) who would still plant trees even without this incentive. NI and SI closely follow with 91% and 89%, respectively. Of the five regions, GW had the lowest proportion at 83%.

The next question we asked was the open-ended question 'What feature/s attracted you most to choose the above option?' This question was answered by 75% of the respondents. Many respondents listed more than one feature. This allowed us to compile a total of 818 responses from the 546 respondents who answered the question. Table 10 represents a summary of these responses. The highest proportion of respondents (20%) pointed out that 'freedom to choose or purchase trees or shrubs' as the most attractive feature. This implies that many respondents would like to be given the flexibility to choose the types of trees or

shrubs to be planted on their properties. Regionally, the WK region had the highest proportion (24%) that was attracted to this feature, while NI had the least (18%).

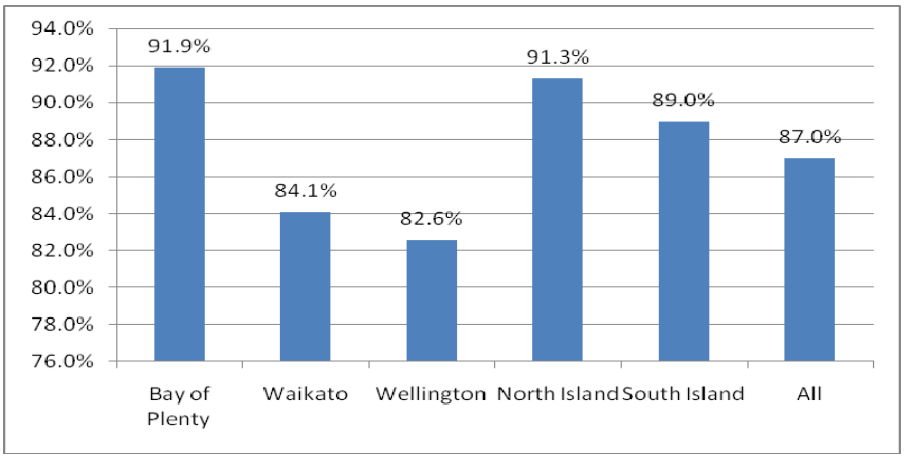

Figure 32. Would they still plant trees even without incentives, by region (% yes)

The second most attractive feature was 'native trees and/or shrubs' suggested by 18% of respondents (Figure 33). This indicates that a large percentage of respondents were aware of the importance of planting native trees and shrubs in New Zealand. Regionally, GW had the highest proportion (19%) that were attracted to native plants, while NI had the least (15%). The third most attractive feature is the 'mixture of natives and non-natives' which was reported by 14% of all respondents. This might indicate that a significant proportion of respondents would like to complement or supplement the additional native trees on their property with non-natives. The combination of both types of plants reported to somewhat balance the natives with exotics, while others stated that it is better to have more plant varieties on their properties.

Other features which attracted respondents include 'free trees and/or shrubs' (9%), 'free expert advice' (6%) 'trees are good for the environment' (6%) and 'rebate from purchase of trees'. Many respondents reported that tree seedlings are expensive and if there will be free trees or shrubs available, those would be very helpful. Several respondents mentioned that guidance or expert's advice would also be important for the planting of trees on their properties. A handful of respondents stated that trees are good for the environment, as well as for future generations. These scenarios enticed them to like the planting of trees on their properties and elsewhere.

Although we asked for features that attracted respondents to select that particular option, some respondents who did not select an option or simply selected only free advice with no free trees, justified why they did not select any option or reasoned out why they selected the cheapest option. 1% of these respondents reported that rates were already high. These respondents were thinking that if there will be a tree planting programme, their rates would go up. Another 1% mentioned that councils should not intervene in the planting. A few respondents were reluctant to receive any help from councils. The other 1% reported that

nothing is free from their council and this thinking somewhat influences them not to choose the option with more planting provisions from councils.

Table 10. Features that attracted respondents to choose a particular choice modelling option

Feature	BP	WK	GW	NI	SI	All
	n=150	n=136	n=266	n=143	n=123	N=818
Freedom to choose/purchase trees and/or shrubs	20.7%	23.5%	19.2%	18.2%	18.7%	19.9%
Native trees and/or shrubs	18.0%	18.4%	19.2%	14.7%	18.7%	18.0%
Mixture of natives and non-natives	11.3%	14.7%	12.8%	15.4%	18.7%	14.2%
Free trees and/or shrubs	10.0%	8.1%	9.8%	3.5%	12.2%	8.8%
Free expert advice	10.0%	2.9%	6.0%	7.0%	5.7%	6.4%
Trees are good for the environment	5.3%	5.1%	7.1%	6.3%	5.7%	6.1%
Rebates from purchase of trees	7.3%	2.9%	4.1%	11.2%	5.7%	6.0%
Council support/initiative/provision	2.7%	2.9%	4.5%	2.8%	2.4%	3.3%
Lack of space/time/capital	4.0%	4.4%	0.8%	4.2%	0.0%	2.4%
Attract/provide food/shelter for birds	1.3%	0.7%	3.8%	2.1%	0.0%	2.0%
Appropriateness to the area	1.3%	2.2%	1.9%	0.7%	2.4%	1.7%
Attract native birds and other native animals	2.7%	2.2%	0.0%	0.7%	0.8%	1.6%
Beneficiaries should be accountable/responsible	1.3%	2.2%	1.5%	2.1%	0.8%	1.6%
Aesthetic benefits from more trees	0.7%	0.0%	2.3%	2.1%	1.6%	1.5%
Councils should not pay for trees/should not intervene	1.3%	1.5%	0.8%	2.1%	1.6%	1.3%
Rates already high	0.0%	2.2%	1.1%	2.8%	0.8%	1.3%
Already have plants on property	0.0%	1.5%	2.3%	1.4%	0.0%	0.7%
Independence/no cost/obligation	0.7%	0.7%	1.5%	0.0%	0.0%	0.7%
Non-native trees and/or shrubs	0.0%	1.5%	0.0%	0.7%	2.4%	0.7%
Nothing from council is free/no Council	1.3%	0.7%	1.1%	0.0%	0.0%	0.7%
Have space for trees	0.0%	0.7%	0.0%	1.4%	1.6%	0.6%
Proactive scheme/cannot be abused	0.0%	0.7%	0.4%	0.0%	0.0%	0.2%
Rebates could take ages	0.0%	0.0%	0.0%	0.7%	0.0%	0.1%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

We also asked respondents 'Is there an option you would prefer that is not listed here?'. 245 out of the 729 respondents answered this question, accounting for 33% of the total respondents. Of the 245 who responded, 58% of them answered 'no'. A few of those who said no mentioned that the options they were thinking were already covered in the choice modeling sets provided. The other 42% who responded created numerous options. Five options that were listed include:

1. 'Extreme garden makeover TV program' - the council comes in gives your garden a makeover
2. 'Free native trees for sensitive ecological areas - e.g. stream banks, or to regenerate wetland areas.'
3. 'A mix of native/non-native - say 60:40 - with natives free and non-natives subsidised. Non-native to be chosen from a list of food/bird friendly trees/plants.'

4. ‘Council should provide free assistance with pest control, e.g. possums and stoats. At present, we pay rural pest control rates, but are in a ‘non-operation’ area, i.e., we get nothing from them.’
5. ‘Access money not from councils (our rates are high enough) but from another source such as lotto’

These five options were taken directly from the respondents’ responses. In case there will be a related survey in the future, we suggest incorporating the above mentioned options into the survey.

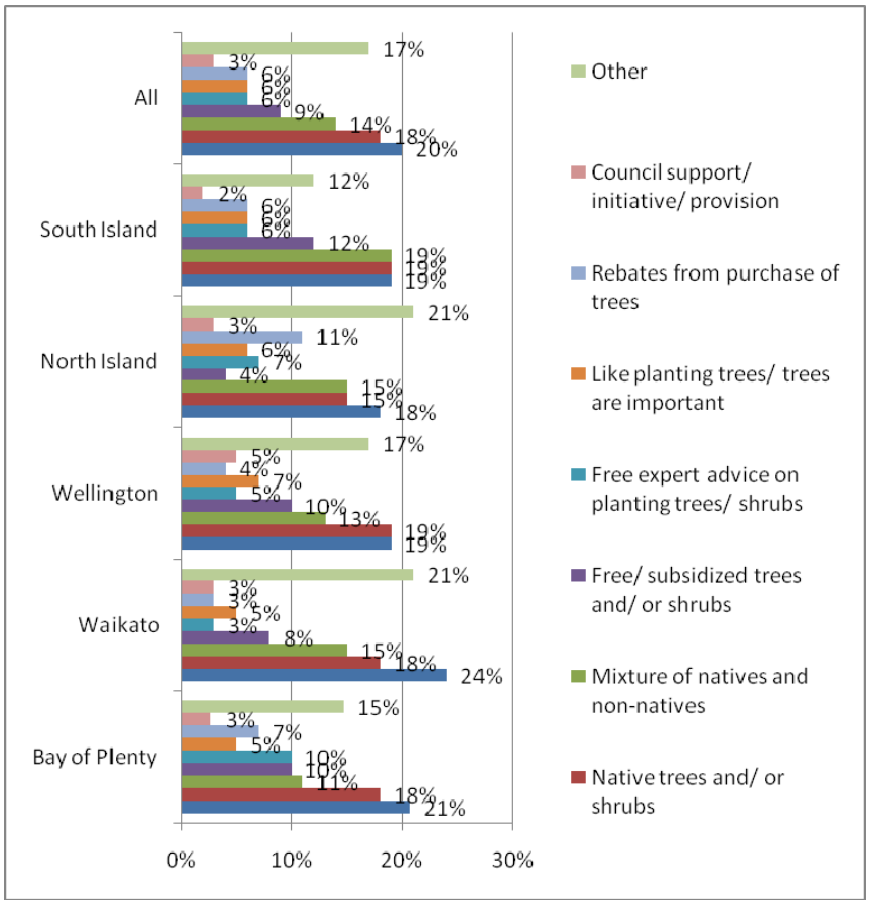

Figure 33. Features which attracted respondents to choose a particular choice modelling option

F. Survey Section 6: Well-Being Questions

The well-being questions examine whether the life satisfaction of respondents would change if there were more native plants and animals in their immediate area and if there were more natives on nearby public parks or reserves. A respondent was initially asked to rate his/her current satisfaction level on a 0 to 10 scale where ‘0’ represents the lowest life satisfaction or unhappiest condition and ‘10’ represents the highest life satisfaction level or happiest condition. This respondent would base this rating on current living conditions, which included the current location of the property, whether it was situated close to work, or near a gully. Two follow up questions were asked (again rated from 0 and 10). The first asked to rate the life satisfaction rating given a hypothetical increase in native plants and animals in their area. The second asked for the life satisfaction rating given a hypothetical increase in native plants and animal on the parks and reserves closest to their location.

Figure 34 represents that, on average, respondents would be less satisfied with their life if there were more natives in their area. This is exhibited by the decrease in the average current satisfaction rating from 8.13 to 8.08. The average rating further decreased to 8.02 if there were more natives on public parks. This indicates that more native plants and animals would result in lower well-being levels of a typical respondent.

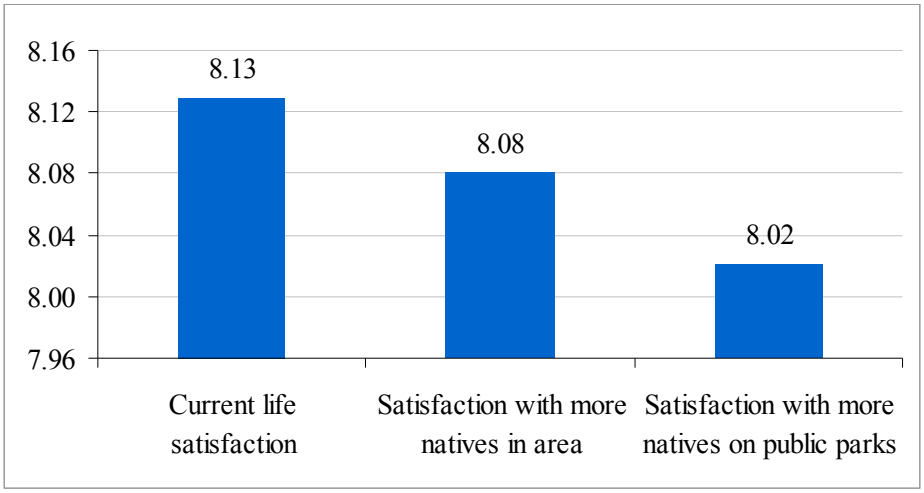

Figure 34. Life satisfaction ratings for current life situation, more natives in area and more natives on the closest public parks

Looking at the regional sample, BP, SI and WK demonstrate lower well-being with more natives (Figure 35). Only GW, on average, appears to perceive relatively higher well-being levels with more natives. While more natives on public parks appear to contribute to higher well-being, the increase in natives in their areas appears to contribute more to improving well-being. In the case of the NI, more natives in the area results in a slightly higher perceived well-being, while more natives on public parks appears to lower perceived well-being.

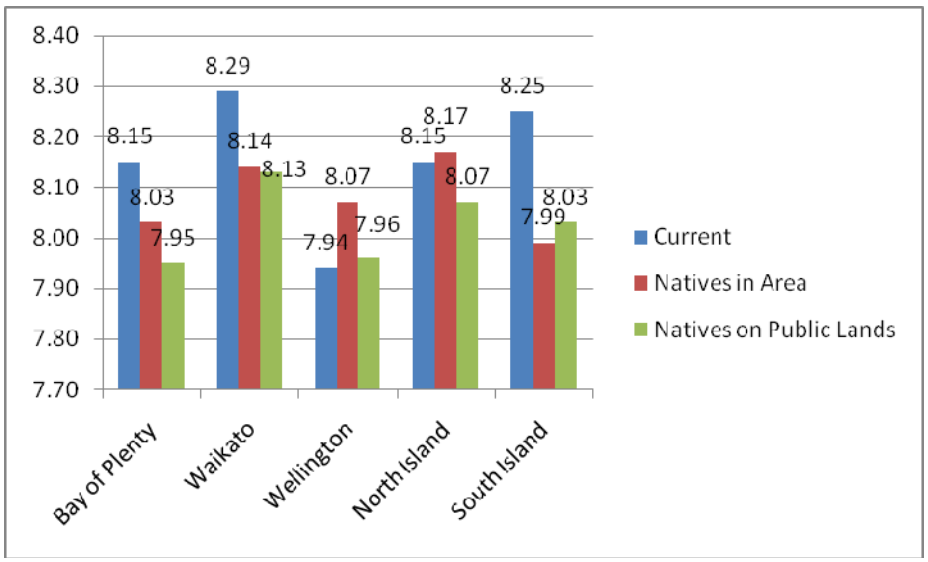

Figure 35. Regional life satisfaction ratings for current life situation, more natives in area and more natives on the closest public parks.

We were surprised by these results, especially after most people were WTP for native plant projects on both private property and public lands. When we pre-tested this question during the focus groups, respondents understood it. We wonder that without us there to discuss the questions afterwards, that maybe people did not really understand the question.

However, we included a follow up question soliciting comments from respondents about how they felt about answering the questions. Out of the 712 respondents who reported their life satisfaction rating, 231 provided comments. Figure 36 represents that out of the 231 comments, 57% of them were indicating their areas being '**already surrounded by native (trees and shrubs)**'. This might indicate that more than half of the respondents were already saturated with native plants and animals and adding more might decrease well-being. Some of the respondents who reported their properties were surrounded with trees stated that they were living in a paradise of natives which made them very happy. Regionally, GW had the highest proportion (64%) of respondents '**already surrounded by natives**' while BP had the lowest proportion (36%). On the other hand, only 16% of the respondents who provided comments reported they would like to have more native plants and animals in their area. This may indicate that they would like their residence or property to be surrounded by more natives in the future. Some of these respondents reported that more natives would increase their life satisfaction. Regionally, BP had the highest proportion (29%) of respondents who aspired to have more natives, while NI had the least (11%). This result represents that BP had the least proportion of those surrounded by natives and this may imply that they want more natives in their area.

Out of the 231 comments, 20 of them indicated that '**more native trees is not the only important aspect of life.** These aspects might include good health and good friends. Regionally, NI had the highest proportion of respondents (11%) who pointed out that '**more natives does not make your life**' while WK had the least (2%).

Other comments include '**natives not suitable in area**' (7%), '**response not relevant (to the question given)**' (6%), '**other response**' (4%) and '**suggestion to improve the set of questions**' (2%). Some respondents commented that native plants and animals are more appropriate on public parks and reserves than in their area. Some respondents reported that more natives can interfere with their farming operations. One respondent, whose property is situated on an estuary, stated that more trees would block their view of the nearby coastal waters. Some respondents gave comments which were unrelated or irrelevant to the questions. Others commented that the questions can be improved by using different set of words. Two respondents did not like how the questions were constructed.

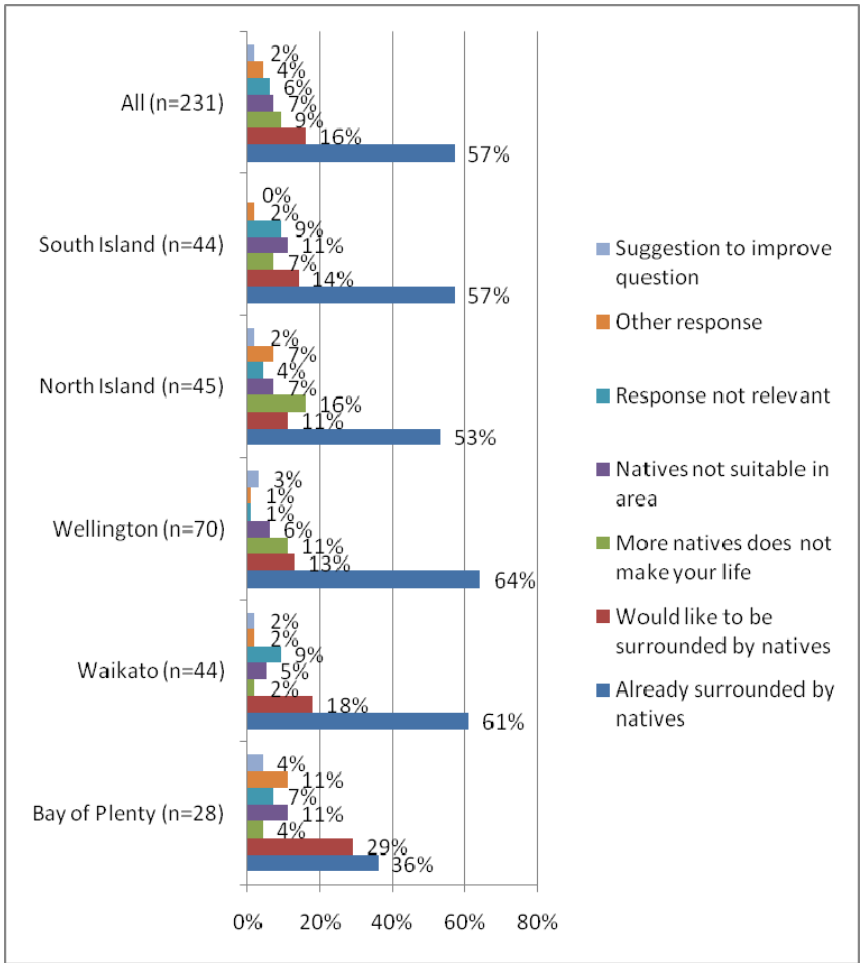

Figure 36. Comments on the questions on life satisfaction ratings by region

G. Survey Section 7: Demographic Questions

Our final section of the questionnaire included demographic questions. Responses to our question on gender show that 66% of the 727 respondents were female. The WK and NI had the largest proportion of females with 71% and 70%, respectively. BP had the smallest with 59% (Figure 37).

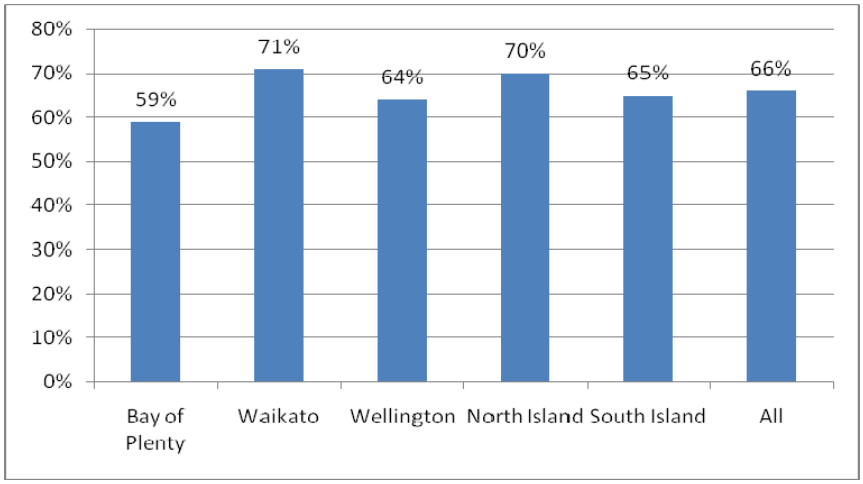

Figure 37. Proportion of female respondents by region

Overall, 85% of the 714 respondents were born in New Zealand (NZ). The WK region had the largest proportion of NZ born (88%), while GW and BP had the smallest proportions at 83% (Figure 38).

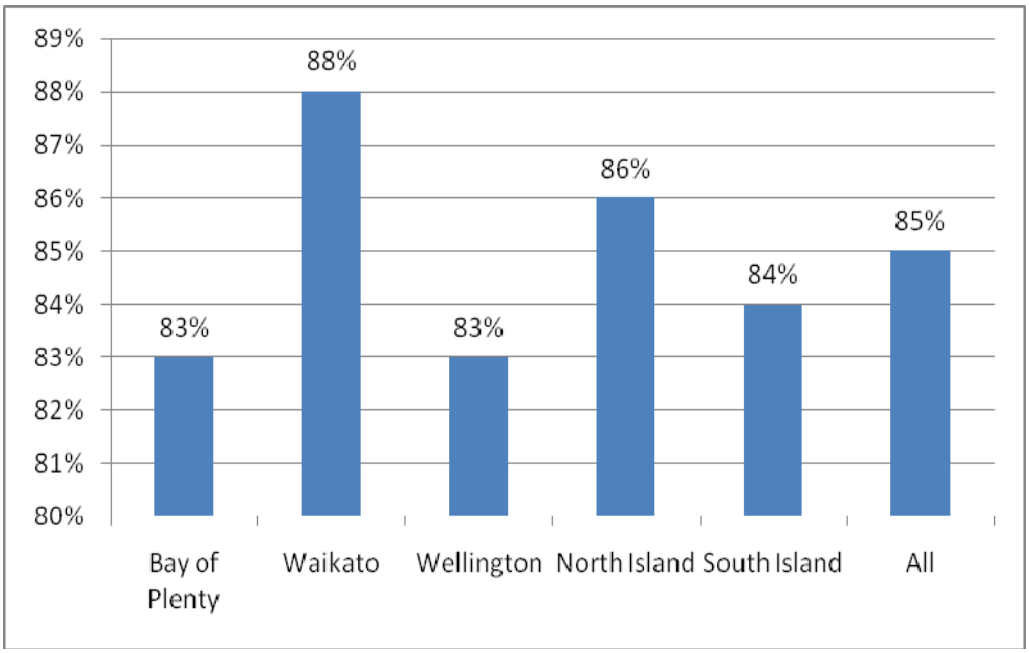

Figure 38. Proportion of New Zealand born respondents by region

Figure 39 represents the distribution of the age of respondents over seven age categories. In the overall sample, the highest proportion (22%) belonged to the 55 to 64 year old category. The youngest group, under 25 years of age, accounted for only 5% of the respondents. The oldest group, 75 years old and above, accounted for 8% of the total respondents. The distribution of respondents by age group varies across regions. The largest proportion of WK and NI were between 55 and 64 years old, while GW had the largest proportion belonging to the 35 to 44 age bracket. BP's largest proportion belonged to the 65 to 74 age bracket and the SI tied between 35-44 and 45-54 year old age brackets.

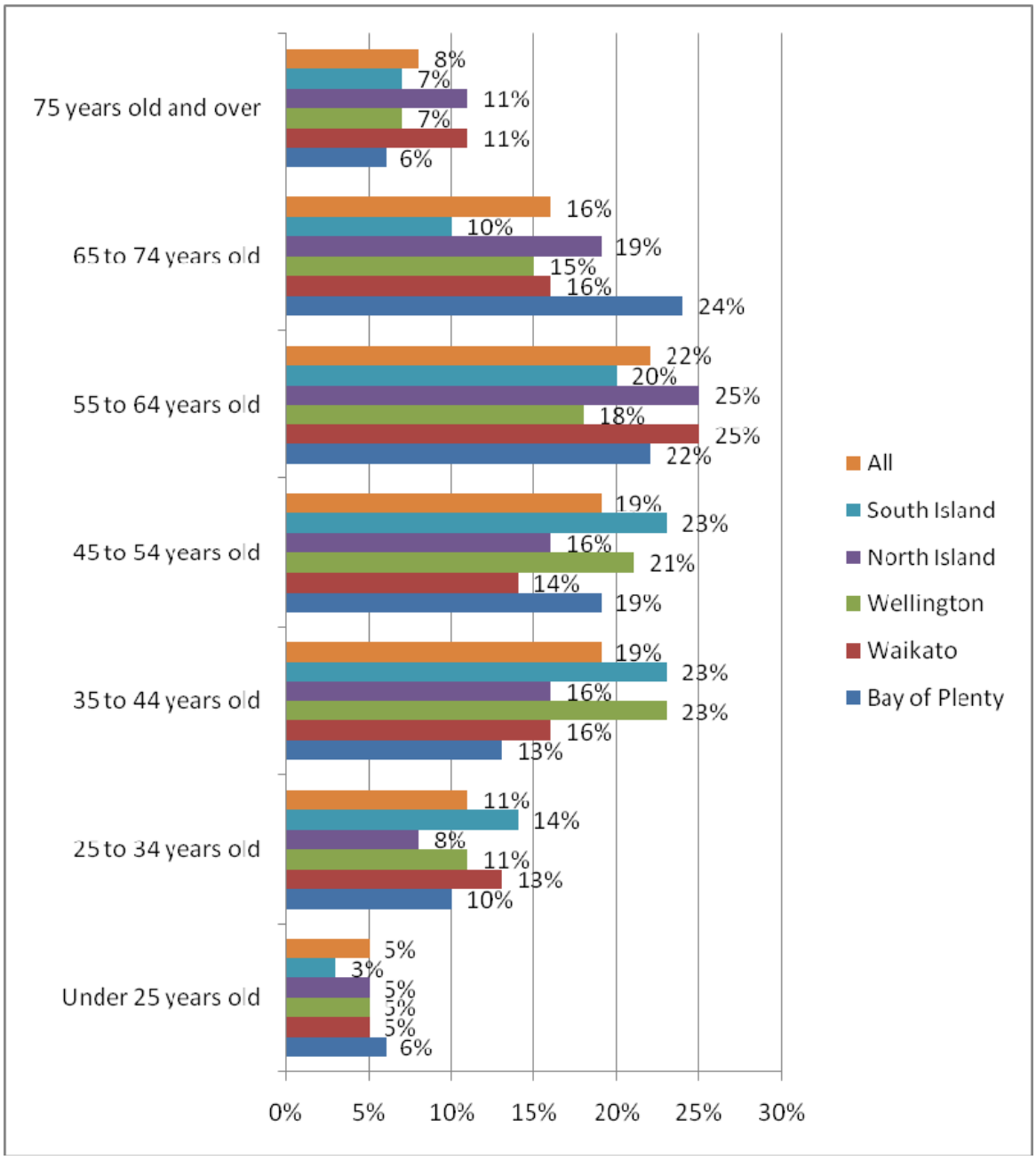

Figure 39. Distribution of the age of respondents by region

For the overall sample, the average household size was 2.72 people (Figure 40). The SI respondents had the largest average household size of 2.88, while the NI had the lowest of 2.50. GW had the greatest number of adults (2.12), while the SI had the greatest number of children (0.81).

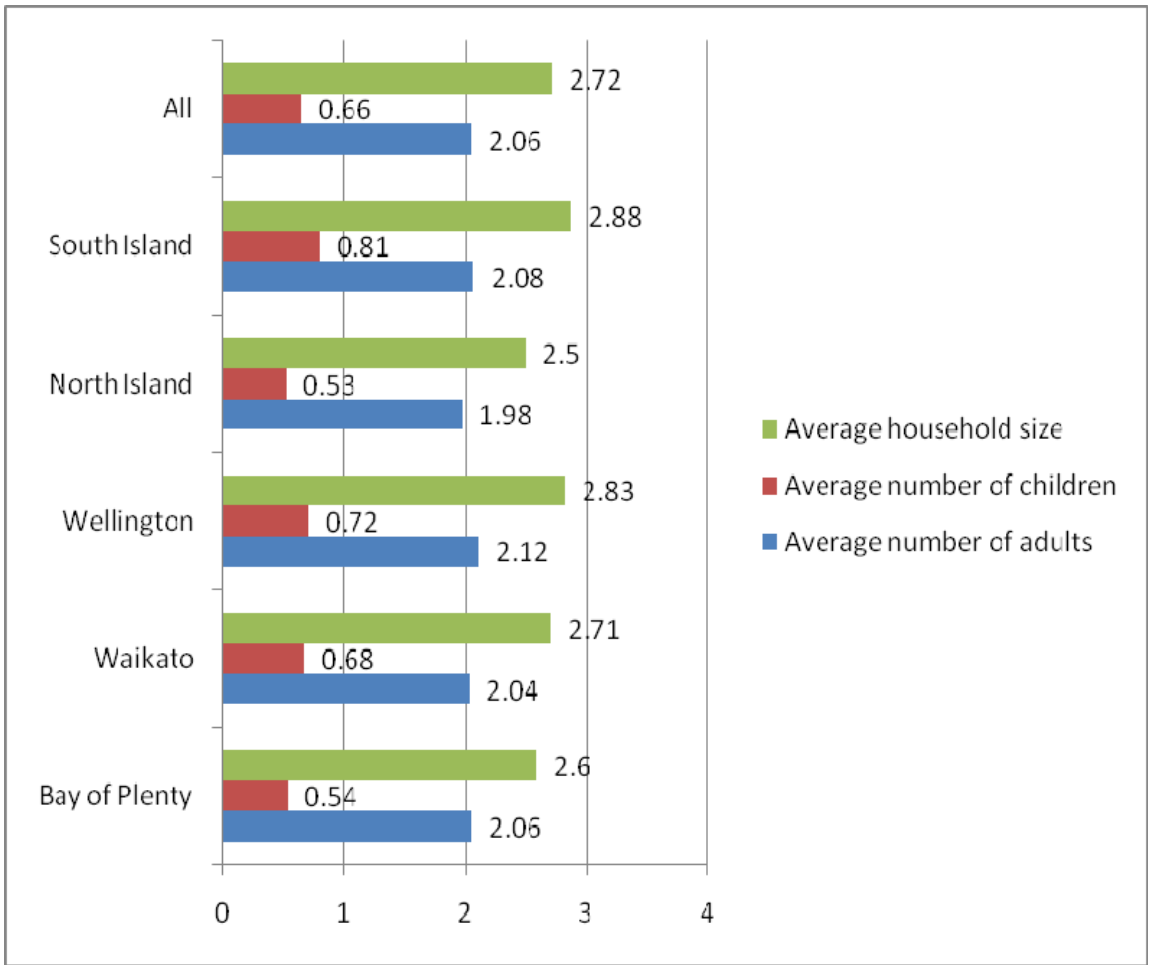

Figure 40. Number of persons in respondents' homes by region

The number of household members, overall, ranged between one and eight. The largest proportions of respondents (46%) were two-person households. There was only one eight-person household respondent out of the 719 respondents (Figure 41). For all regions, two-person households accounted for the largest proportion. BP had the highest proportion of two-person households at 58%, while GW had the least proportion at 39%. For the overall sample, one-person households account for 12%. Regionally, NI had the most one-person households at 19%, while SI had the least with 8% .

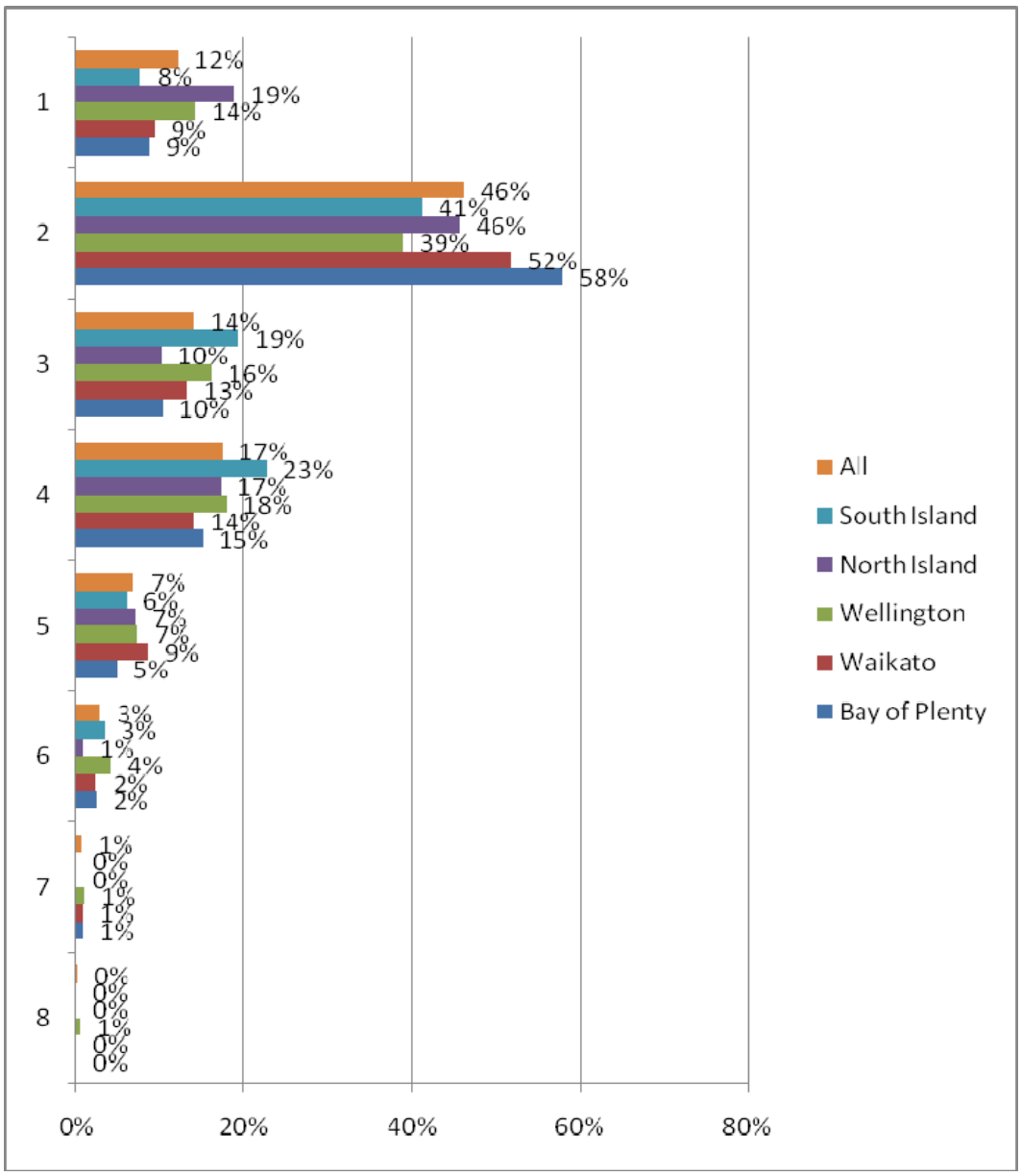

Figure 41. Number of persons in respondents' homes percentage by region

All respondents had, as a minimum, some formal schooling. The largest proportion (56%) had secondary schooling as their highest level of education (Figure 42). The second largest proportion had tertiary schooling at 34%. Seven percent had a graduate education, while only 2% had primary schooling. The proportion of respondents' educational levels varied a lot between regions. GW had the largest proportion (11%) with post graduate degrees, while the SI had the largest proportion (45%) with tertiary degrees. It is interesting to note that there were no SI respondents who had primary education as their highest educational attainment.

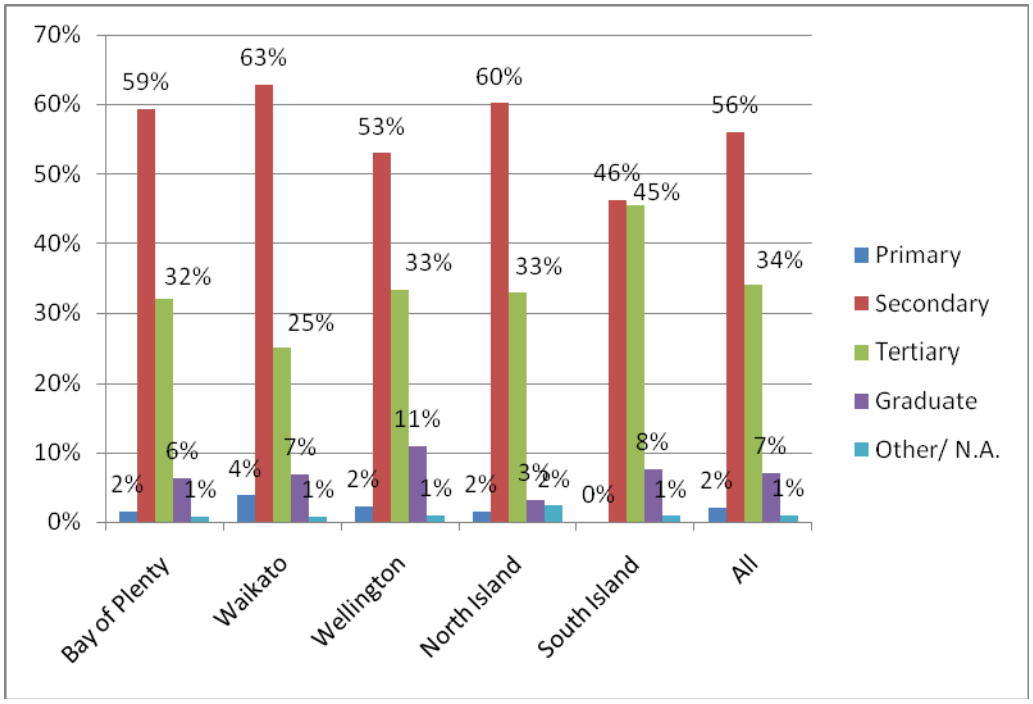

Figure 42. Distribution of respondents by highest educational attainment

In terms of occupation, 48% of the overall sample earned a living through salaries and wages, 30% through self-employment. While 24% were retired (Figure 43). GW had the largest proportion (56%) of wage earners, while the NI had the largest proportion (39%) of self employed respondents. BP had the largest proportion of retired people (34%).

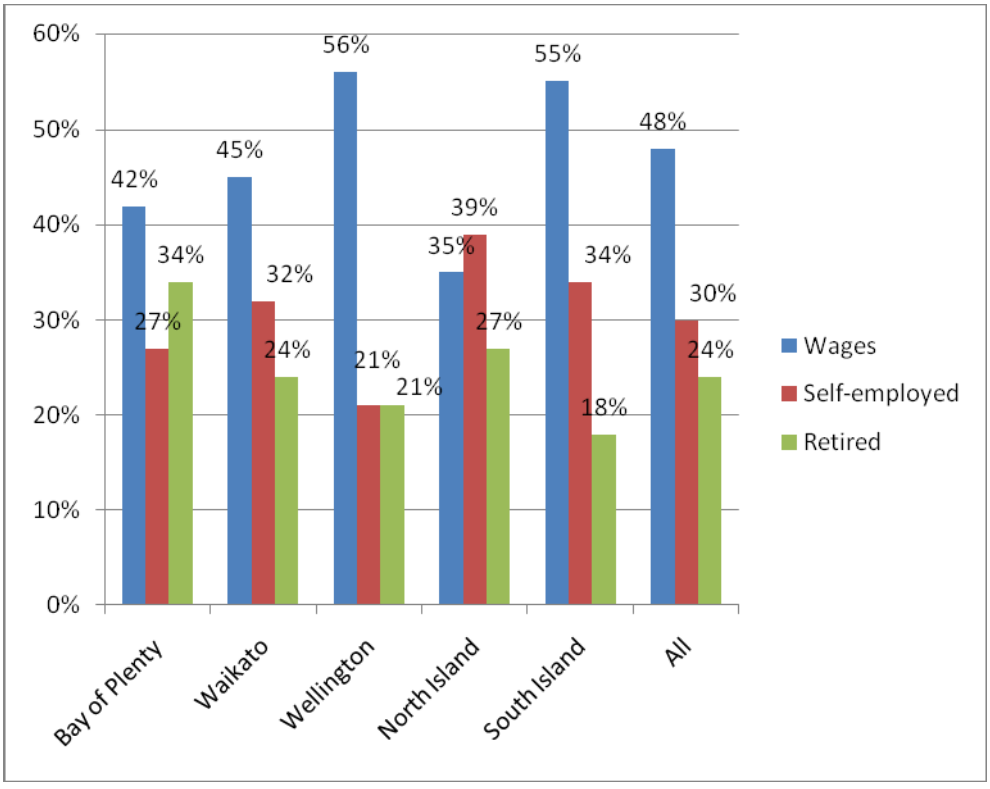

Figure 43. Type of occupation of respondents by region

We learned that approximately 66% of the respondents had been actively employed. Table 11 represents the top three employment categories: **administrative/managerial** (15%), **professional work** (14%) and **trade, maintenance and labour profession** (11%). These three categories include 40% of the overall respondents. The administrative/managerial type of work include respondents who reported they were managers or involved in assisting managers (e.g., secretarial work). The SI had the highest proportion (17%) conducting administrative/ managerial work, while WK had the least (14%). Professionals included accountants, engineers, architects, information technologists, artists and consultants. Regionally, GW had the highest proportion of professional (25%), while the SI had the least (8%). The job type which we classified as trade, maintenance and labour, covers a broad range of jobs which include tradesmen, maintenance labourers, builders and automotive mechanics. SI had the highest proportion (19%) of this type of occupation, while GW had the least (7%). Other types of employment include agriculture and fisheries (7%), academe (4%) and business (4%). Respondents from other regions in the NI had the highest proportion (10%) engaged in farming and fisheries, while GW had the least (4%). Only 3% and 2% of the respondents were students and government workers, respectively. Respondents, who were not formally employed, accounted for 44% of the total respondents. These respondents were composed of retirees (24%), homemakers (9%), or unemployed/invalid (1%).

Table 11. Occupation of respondents by region

Occupation	Bay of Plenty	Wai-kato	Wel-lington	North Island	South Island	All
	n=123	n=129	n=215	n=125	n=117	N=709
Retired	33.3%	23.3%	21.9%	25.6%	17.9%	24.1%
Administrative/Managerial	13.8%	12.4%	14.4%	16.0%	17.1%	14.7%
Professional work (accountant, architect, engineer, information technologist, artist, consultant)	9.8%	10.1%	25.1%	11.2%	8.5%	14.5%
Trade, maintenance and labour	10.6%	13.2%	7.4%	8.0%	18.8%	11.0%
Homemaker	6.5%	14.0%	6.5%	9.6%	7.7%	8.6%
Agriculture/Fisheries/Hort/Forestry	9.8%	7.8%	3.7%	10.4%	5.1%	6.9%
Academe	1.6%	7.0%	4.2%	0.0%	9.4%	4.4%
Business	3.3%	4.7%	3.3%	5.6%	5.1%	4.2%
Marketing/Sales/Brokerage	5.7%	2.3%	3.3%	4.8%	1.7%	3.5%
Healthcare	1.6%	2.3%	4.7%	2.4%	2.6%	3.0%
Student	3.3%	2.3%	1.9%	4.0%	2.6%	2.7%
Government agency officer/worker	0.8%	0.8%	2.8%	0.8%	1.7%	1.6%
Invalid	0.0%	0.0%	0.0%	1.6%	0.9%	0.4%
Unemployed	0.0%	0.0%	0.9%	0.0%	0.9%	0.4%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

We asked respondents whether they participated in a community organization and 722 of our 729 respondents answered this question. A slight majority (50.6%) of our respondents belonged to at least one community organization, while 49.4% of respondents did not. Of

those that belonged to a community organization, 32.8% belonged to one organization, 11.5% belonged to two, 3.9% belonged to 3, 1.4% belonged to 4, 0.6% belonged to five and 0.4% belonged to 6 organizations (Figure 44).

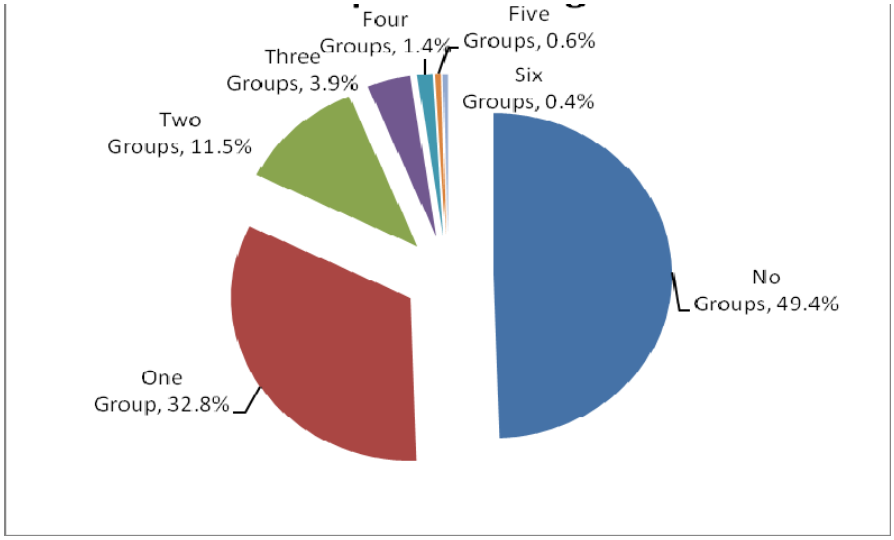

Figure 44. Number of community organizations participated in by respondents

Of the reported community organizations, sports, hunting and fishing clubs experienced the greatest participation (24%) (Figure 45). The second greatest participated was church groups (16%). In third and fourth places were 'Playgroup, Kindergarten, or Kohanga Reo' (10%) and 'Professional Organizations' (9%). In fifth and sixth places were 'Family and Recreation Groups' (7%) and 'Service Clubs (e.g., Lions, Rotary)' (5%).

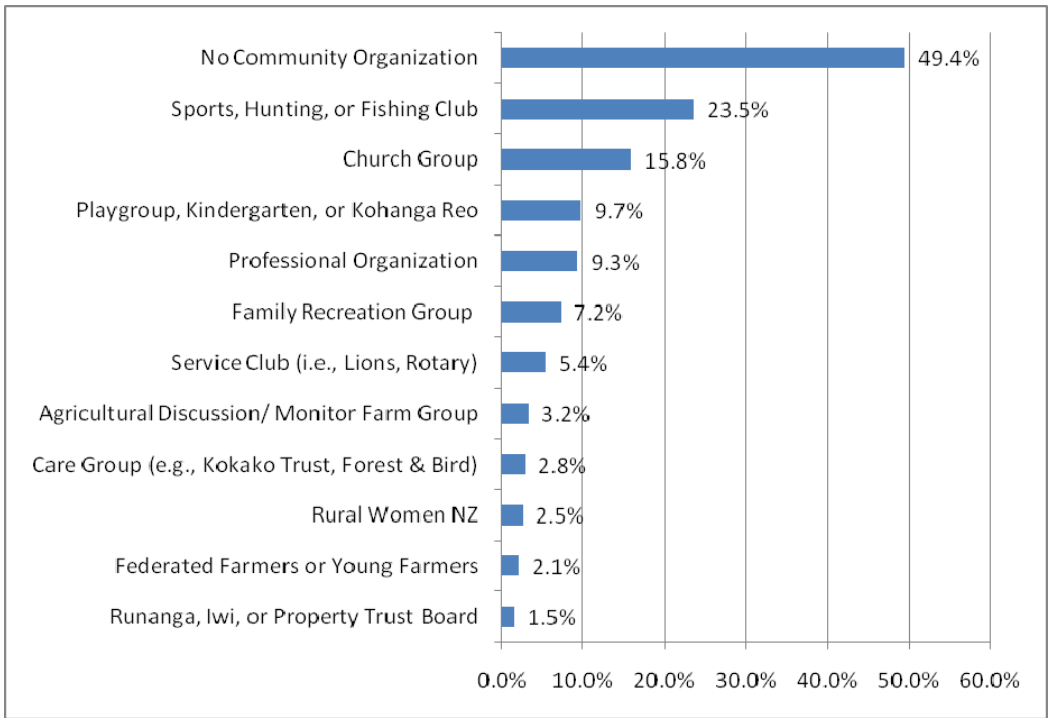

Figure 45. In which community groups do the respondents participate?

In Figure 46, we have presented the breakdown of the community organizations by region. We found that BP had the greatest number of non-participants (51.6%). However, they also have the highest for sports clubs (33.3%). The WK has the greatest participation in church groups (18.9%) and the SI had the greatest participation in playgroups, kingergartens, and kohanga reos (12.6%).

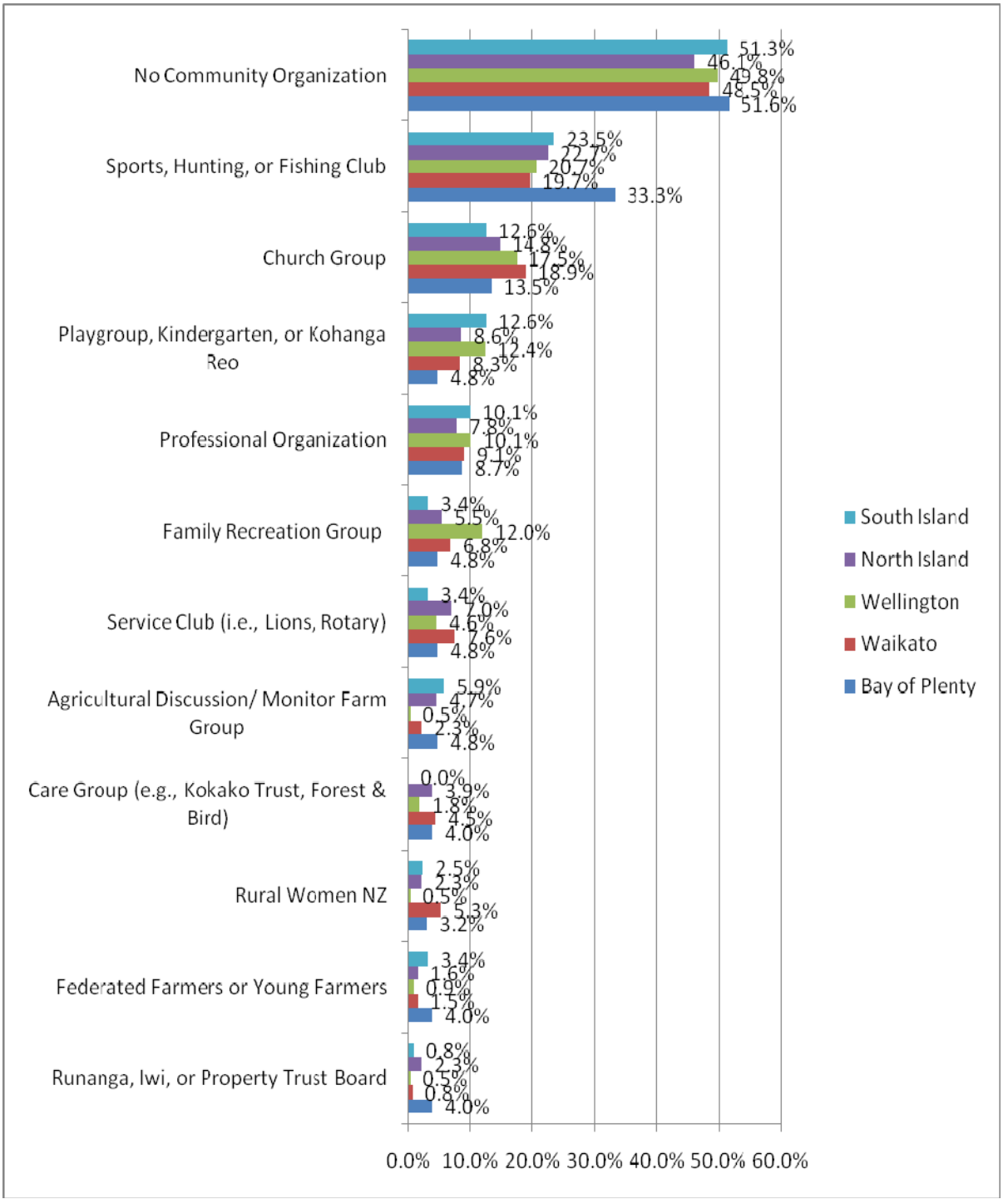

Figure 46. Which community groups do the respondents participate in, by region?

In this study, respondent attitudes towards biodiversity enhancement was also examined. We asked the question '***Would you be willing to volunteer to plant trees in your neighborhood?***'. Overall, 60% of them answered yes (Figure 47). The proportion varies between regions, wherein the SI had the largest proportion at 65%, while the WK had the smallest (56%). However, it is interesting to note that more than half of the respondents would be willing to volunteer to plant on neighbourhood properties for all regions.

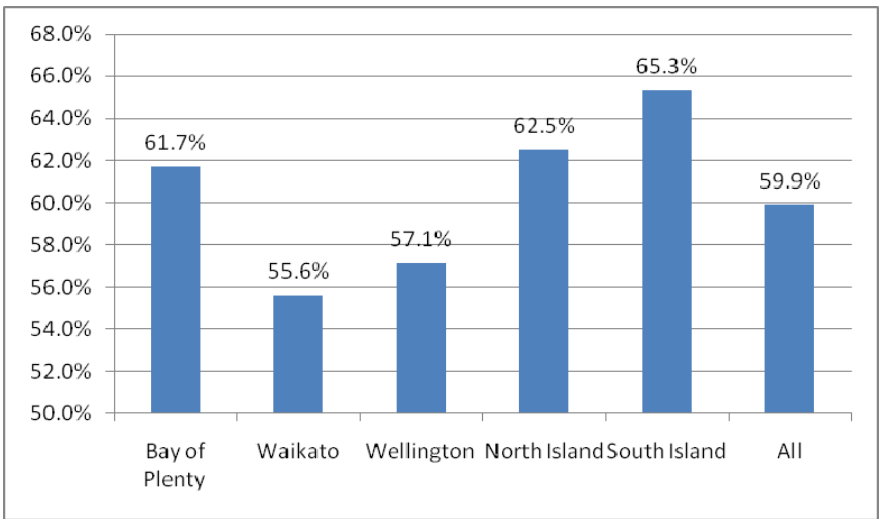

Figure 47. Proportion of respondents who would be willing to volunteer to plant natives on the public lands in their neigbourhood by region

We then asked '***Would you be willing to volunteer to plant trees on your property?***'. Comparing to neighbourhood public properties such as district council parks and scenic native reserves, a higher proportion of respondents would be willing to volunteer to plant trees on their own property (73%) (Figure 48). This makes intuitive sense, since while people would like to see more natives on neighbourhood properties, they would like to first see or plant more natives on their respective properties. The proportion of yes votes varies between regions with the GW region having the highest propoertion (76%) while BP having the lowest (70%).

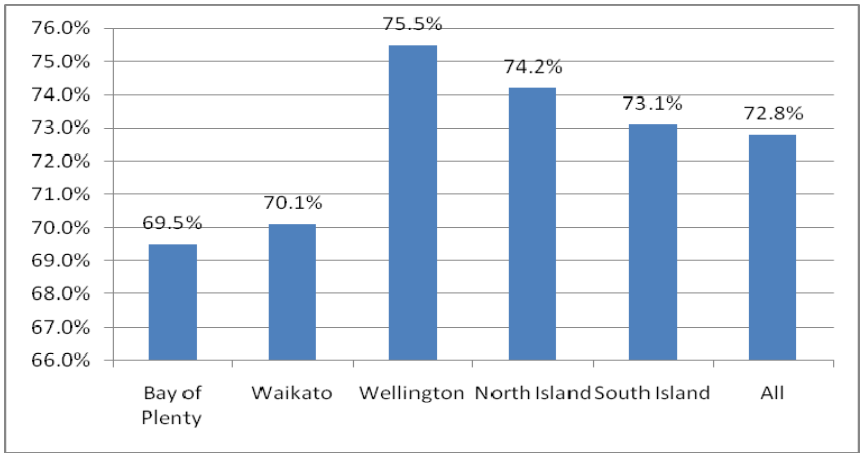

Figure 48. Proportion of respondents who would be willing to volunteer to plant natives on their property by region

Overall, respondents were primarily New Zealand European (84%) (Figure 49). About 4% were Māori, 3% were a mixture of NZ European and Maori, and 3% were Europeans. Two percent did not specify their ethnic origin and simply reported they were New Zealanders. Other ethnic origins included Asian, Australian, African, Samoan, Tongan, American and Cook Islander. Ethnicity slightly varies across regions. GW had the largest proportion of NZ Europeans, while BP had the lowest. BP had the highest proportion of Maori, NZ European-Maori Mix, and Asian. BP is the only region with respondents who were migrants from America.

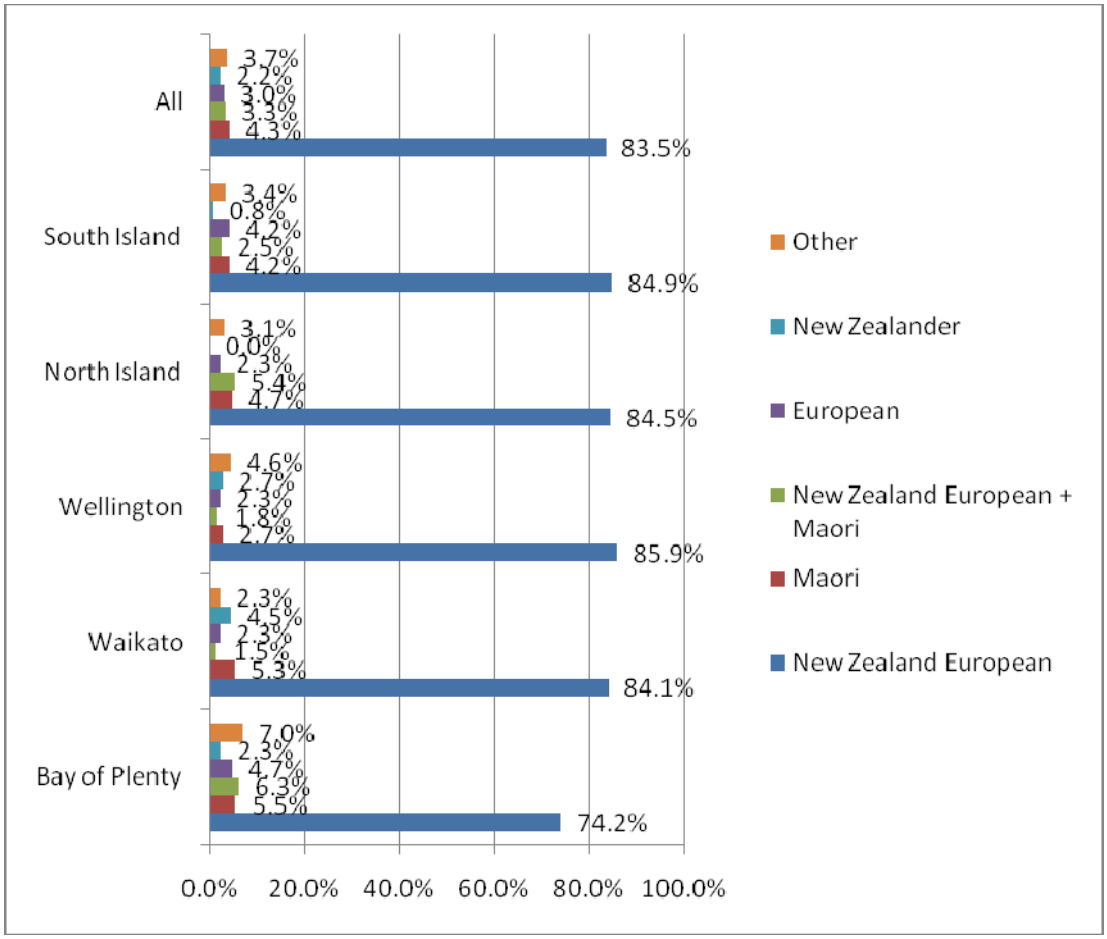

Figure 49. Ethnicity of respondents (% of respondents)

Overall, the largest proportion of respondents (26%) had a household income between $25,000 to $50,000, while the smallest proportion (7%) earned between $100,001 and $125,000 (Figure 50). Income distribution varied between survey regions. GW appears to have the greatest evenly distributed income among respondents with two-digit percentage point different between each income level. GW also appears to have the largest proportion of high income earners, where 35% of the respondents earned more than $75,000 per year. On the other hand, BP had the highest proportion of lowest income respondents, where 21% reported earning less than $25,000 a year.

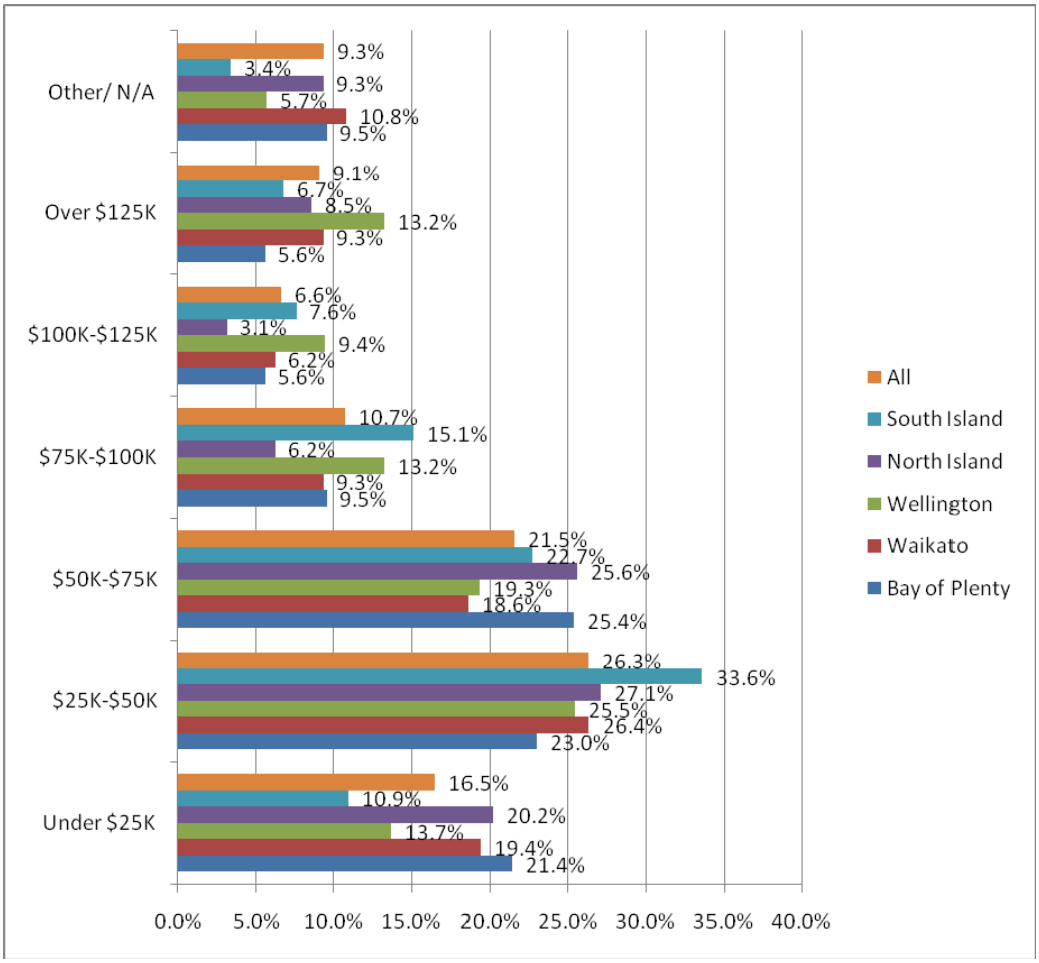

Figure 50. Total gross annual household income of respondents by region

Conclusions

The aim of this study was to examine the economic value of biodiversity in New Zealand. To achieve our goal, we collected surveys from 729 respondents throughout the country. Respondents were categorized into five regions: Greater Wellington, Greater Bay of Plenty, Greater Waikato, the rest of the North Island, and the South Island. We believe that our respondents were familiar with their properties and the native plants and animals in their areas, as they had lived at their current property an average of 11 years. Over 50% of our respondents planned to plant trees on their property in the future. Some respondents intend to plant non-native trees, primarily in the form of fruit trees, but many intend to plant native trees. Several respondents stated that one reason to plant native trees is to attract native birds. We also learned that over 90% of our respondents were willing-to-pay an additional amount in their rates each year to contribute to a native tree planting programme. Therefore, our investigation has revealed that our respondents value native trees and native birds highly. We believe that these results will be useful to councils that are considering a revision of their biodiversity policies.

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