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Non Market Valuation in New Zealand: 1974 through 2005

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Abstract

Non-market valuation (NMV) is recognized as an essential tool in policy decision making worldwide. In this paper, we investigate the history of NMV, specifically in relation to New Zealand (NZ), by compiling and analyzing all available published studies. Results show a significant increase in the number of studies, specifically those requested by government agencies, following the passage of the NZ Resource Management Act of 1991. Studies were found to be concentrated in three major areas: outdoor recreation, environmental conservation/management, and travel time savings. These three areas covered eight environmental commodities, the value of which totaled NZ$72 billion, or 50% of NZ GDP, with the highest valued commodity being biodiversity services. While our analysis yielded many positive results, we did discover, however, a severe lack of studies in many areas including pest control, water resources and outdoor recreation.

Keywords

Non-market valuation
New Zealand
Consumer surplus
Resource Management Act

JEL Classification

B4, Q2, Q26

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Introduction

Non-market valuation (NMV) is the process of placing a monetary value on goods and services that do not have out-of-pocket costs (Bateman, et al. 2002). The estimated monetary values from NMV studies are used in cost-benefit analyses to calculate the value of changes in environmental quality (Boardman, et al. 2006; Bockstael and Freeman 2005). Over the years, NMV has been used in both developed and less developed countries to calculate *more realistic* estimates of the values of environmental goods and services (Kahn 2005; Navrud and Pruckner 1997; Smith 1993)

Over the last five decades, NMV methods have been useful for environmental policy decision making, particularly for project evaluation, environmental impact assessments, regulatory review and environmental accounting (Adamowicz 2004; Navrud and Pruckner 1997; Freeman 2003; Kahn 2005; Carson, et al. 1994; Smith 1984; Harris and Meister, 1981). The most widely used NMV methods, to date, are the contingent valuation method (CVM), travel cost method (TCM), choice modeling method (CM), benefit transfer method (BT), and hedonic pricing method (HPM) (Rolfe and Bennett 2006; Carson and Hanemann 2005; Adamowicz 2004; Champ, et al. 2003; Hanley, et al. 2003). While most NMV studies focus on using one methodology, some attempt to value environmental commodities using a combination of NMV methods in the same study, i.e., CVM and TCM (e.g., Adamowicz, et al. 1998; Kling 1997; Grandstaff and Dixon 1986). Some of these studies have also compared resulting estimates between different NMV techniques (e.g. Scarpa and Willis 2006; Mogas, et al. 2006; Boxall, et al. 1996).

The concept of NMV originated in the United States in the mid 1800s when non-market values of environmental goods (i.e. wilderness) were discussed by non-economists such as Henry David Thoreau (1854; 1864) and John Muir (1912; 1901). In 1915, an economist named Clark argued that these values relating to the environment and environmental quality should be taken into account, even though they are not captured in market transactions. He suggested that if these values were estimated, they could be used in economic analysis to capture a more “true” value estimate of a good or service (Clark 1915a; Clark 1915b; Carson and Hanemann 2005).

In 1947, two NMV theories were independently proposed in the US. Firstly, Ciriacy-Wantrup (1947) raised the issue that there are other benefits and costs from the establishment of soil conservation measures that are yet to be valued. He called these “extra-market” values and believed that data for these values could be calculated. This served as the foundation of the NMV technique known today as CVM. The second theory, proposed by Harold Hotelling, began with his two-paged letter to the US National Park Service in 1947. In this letter, he proposed a method for measuring the benefits provided at outdoor recreation sites by calculating what people spent to travel there. This NMV technique is known today as the TCM (Hotelling 1947).

By the late 1950s, Wood and Trice (1958) and Clawson (1959) published their applications of Hotelling's theory to value the benefits of water-based recreation. These studies are regarded as the first applications of TCM. In 1961, Robert Davis, who was not aware of the theory behind CVM, applied his own variation of CVM to his PhD thesis at Harvard. This study valued the benefits from recreational deer hunting in Maine and became known as the first CVM application (Davis 1963).

Even though studies were being conducted, NMV studies were not commonly applied until many significant environmental tragedies occurred, which, in turn, led to new environmental laws. In the US, environmental laws such as the Clean Air Act of 1970, the Clean Water Act of 1972, and the Oil Pollution Act of 1990, facilitated an increase in NMV research (Kahn 2005). The Clean Air Act spurred the application of the HPM, because these studies allow for the decomposition of prices of market goods; prices which facilitate the estimation of embedded values for particular environmental attributes (Kahn 2005). Using relevant data on property values, HPM enables an analyst to elicit willingness-to-pay values of individuals to avoid the negative effects on health and aesthetic aspects from air pollution. The Clean Water Act, in turn, resulted in an increase in TCM studies. This is because they are used mainly for measuring the demand for recreational activities, many of which were based on water resources (Kahn 2005).

The significant increase in CVM research in the US in the early 1990s can be attributed mainly to three factors: the passage of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) of 1980, the Exxon-Valdez oil spill in Alaska in 1989, and the passage of the Oil Pollution Act (OPA) of 1990 (see Portney 1994: 6-7). During that time, CVM was regarded as the only technique that measured both *use* and *passive use* values (Kahn 2005).[1] Use and passive use values were ordered to be given equal treatment in natural resource damage assessments, by a US federal court of appeals (Portney 1994). Passive use values, which can be larger than use values, are recognized as a major component in the natural resource damage assessment (NRDA) for the determination of compensable values (Carson, et al. 2003; Loomis 2006).[2] The Exxon Valdez oil spill was the first legal case where CVM surveys were used in a quantitative assessment of damages.

[1] Passive use value refers to the belief that an environmental commodity is valuable even if they never make active use of it (e.g., existence of the Amazon River). In contrast, use value refers to the direct consumption or direct use of a particular environmental commodity (e.g., visit to a beach). While CVM can estimate passive use values, HPM and TCM cannot

[2] Under the provisions of CERCLA, government agencies who were trustees to natural resources (e.g., bay, forest) can sue firms or individuals who damage these resources as a consequence of the

Here, damages to the Alaskan coastline, which were mostly passive use value losses, were calculated (Carson and Hanemann 2005; Carson, et al. 2003; Carson, et al. 1998).

To explain in more detail about the reason for the recommendations from NOAA, we must go back in time. In the early 1990's, the reliability of estimates from CVM studies for damage assessments had been questioned. It was recommended that CVM be excluded from NRDA (Diamond and Hausman 1994; Niewijk 1992). In response to these criticisms, the NOAA panel, chaired by Nobel laureates Kenneth Arrow and Robert Solow, was organized to review the validity of estimates of CVM studies. The results of the review suggested that CVM estimates would be useful, in fact, for NRDA, given that the administration of related CVM studies adhere to the panel's recommendations (Arrow, et al. 1993). These recommendations shaped the NOAA regulations, which, once published, resulted in wide debates in the academic arena regarding the use of CVM (Carson, et al. 2003). The academic and policy debates, spurred by the NOAA regulations, led to a large demand for CVM research, resulting in over one thousand journal articles (Adamowicz 2004). Most likely, because of the extensive exposure it has received over the years, CVM has become the most commonly applied NMV methodology (Bateman 2002; Carson 2000).

Not only has NMV been applied in the North America's, but as early as the 1970s, NMV began being applied in Australasia. We believe that the first NMV study in Australasia was a project in New Zealand (NZ) by Gluck. In 1972, Gluck (1974) applied both CVM and TCM to assess the recreational benefits of the Rakaia fisheries on the South Island. The second NMV work was conducted by Woodfield and Cowie (1977), again in NZ, who estimated the recreational benefits of the Milford Walking Track using TCM. In Australia, the first CVM study took place in 1979. In this project, Bennett used the responses from a sample of adult residents in Canberra Australia to estimate the existence value of the Nadgee Nature Reserve (Bennett 1981; Bennett 1984).

Since several environmental laws facilitated the increase in NMV research in the US, our first hypotheses for this paper is that this would also be the case in NZ. Most notably, we propose that the passage of NZ's comprehensive environmental law, the Resource Management Act (RMA) of 1991, might have facilitated an increase in NMV studies. This is because the need for the use of NMV methods has been mentioned in two sections of the RMA: Section 32 and Section 88 (Kerr 2002). Section 32 states that: "…an evaluation [of an environmental resource] must take into account the 'benefits and costs' of policies, rules, or other methods;" where "'benefits and costs' includes benefits and costs of any kind, whether monetary or non-monetary". Section 88, on the other hand, mentions that: "…an assessment of environmental effects in such detail as corresponds with the scale and

release of hazardous substances (Portney 1994; Kahn 2005). The estimated monetary amount from damages represents the compensable value.

significance of the effects that the activity may have on the environment." With the inclusion of the phrases "benefits and costs", "whether monetary or non-monetary", and "environmental effects in such detail", we could see the need for NMV in the enforcement of this policy. To examine this conjecture, we compile a detailed database of all NMV studies available in NZ. From this compilation, in addition to studying whether the RMA had an effect on the number of NMV studies, we also present an overview of the NMV studies. In addition, we use the results from these studies, specifically the average consumer surplus non-market values of different environmental commodities, to estimate the value of non-market benefits in NZ.

Data

An extensive search of published NZ NMV studies, in printed and electronic form, was conducted in NZ between December 2006 and June 2007. Firstly, several libraries were visited, including the Hamilton City Libraries, University of Waikato's Central Library and other Hamilton government libraries. Next, on-line NZ university libraries and web sites of relevant journal publishers were searched. Finally, an on-line NZ NMV database created at Lincoln University[3] was referred to. From this search exercise, we were able to compile 92 NMV studies whose results were published between 1974 and 2005 (Appendix A). While we took every effort to follow every lead we received, with the aim of obtaining every NMV study ever conducted in NZ, many of our leads lead us to dead ends. Overall, however, we believe that the 92 studies we compiled, account for over 90 percent of the NMV studies ever conducted in NZ[4].

The 92 NMV studies were published as project reports (57%), postgraduate theses (24%), and refereed journal articles (18%). Publications in report form were classified into six types: conference papers, commissioned reports, discussion papers, policy papers, bulletins and technical papers. Postgraduate theses included several Master's thesis and one PhD Thesis. Refereed articles were published in a variety of journals including: Australian Journal of Agricultural and Resource Economics, Land Economics, New Zealand Economic Papers, New Zealand Geographer and New Zealand Hydrology. Twenty-three percent of the NMV studies were published in two or more formats presenting virtually the same results. Therefore, in our count of 92 studies, if a thesis and a journal article presented the same results, we count this as one study, not two.

Results

Overall, three decades of NMV studies from NZ has resulted in a compilation of data from 92 studies. After recording our findings into an extensive database, our first task was to test our first hypothesis. To see if there was an increase in NMV studies occurring after the passage

[3] Accessed at http://oldlearn.lincoln.ac.nz/markval/.

[4] To date.

of the 1991 RMA, studies were categorized as to whether they were conducted before 1991 or after.[5] Out of the 92 NMV studies, 86 of them clearly reported their valuation year or the year of data collection implementation, which can sometimes be different than a year a study is published. Sixty-seven percent of these studies were conducted during or after 1991. In addition, we find that before 1991, only 7% of the NMV studies were submitted as commissioned reports to government agencies (Table 1). Most of these pre-1991 studies were conducted for academic purposes, mainly in the form of technical academic reports. From 1991 onwards, the proportion of government commissioned NMV studies increased to 35%. Using a statistical test of difference between the two proportions, we found that the proportion of commissioned reports post RMA to be significantly higher at the 95% confidence level. Our results present a scenario wherein the NMV application transformed from mainly an academic exercise, prior to 1991, into a government decision support tool for policy decision making, afterwards. Therefore, we conclude that the RMA did have an effect, not only on the number of studies conducted, but also on who was interested in the studies.

Table 1. NMV methods used in New Zealand (1974-2005)

Item	Before 1991	1991 onwards	All
Total Number of NMV studies by output year	31 (34%)	61 (66%)	92 (100%)
Number of studies commissioned by the Government	6 (7%)	32 (35%)	38 (42%)

Next, we categorized the 92 NMV studies by their methodologies. Here, we discovered that the most popular NMV method employed was CVM (66%). CVM was typically used as a standalone valuation tool (58%), but in a few instances, it was used in conjunction with other NMV methods (Table 2). Overall, nine studies used a combination of methodologies: six used CVM and TCM, one used CVM and CM, one used CVM and HP, and one used CM and BT. The next most popular methods were TCM and CM, respectively accounting for 17% and 10% of the studies. All studies that applied TCM valued outdoor recreational goods, such as hunting, tramping/ walking on the Milford Track, and forest park recreation. Studies which used CM, however, concentrated on valuing the benefits from transportation safety and travel time savings.

Six studies used the BT method: five of them used BT as a standalone valuation tool, while one used BT in conjunction with CM. BT is recognized as the cheapest NMV method, since it uses data from previous NMV studies and transfers the data to a new study location.

5 We believe this was appropriate, as studies were conducted for approximately the same number of years before and after 1991.

However, BT requires that previous studies be conducted to obtain the data from. This is not always available, probably resulting in the low number of NZ BT studies. The first BT study in NZ was conducted in 1995 by Ball et al (1997a; 1997b) and focused on estimating the recreation values of Auckland regional parks by using CS estimates from previous NMV studies. This was followed in 1999 by two related reports valuing the non-market benefits of land-based biodiversity for all of NZ and ecosystems services specific to the Waikato region (Patterson and Cole 1999a; Patterson and Cole 1999b). Two separate BT studies followed which valued the recreational benefits of two areas in the North Island: Te Kouma Park and the Maungatautari Ecological Island (Kaval et al. 2004; Kaval 2004). The most recent BT study was conducted by Sharp and Kerr (2005) and valued recreational fishing at the Waitaki catchment. Here, BT was applied with the CM technique which resulted to numerous estimates of CS values.

Table 2. NMV methods used in New Zealand (1974-2005)

NMV Method/s	Number of Studies	Percent
Contingent Valuation Method	53	58%
Travel Cost Method	10	11%
Choice Modelling/Conjoint Analysis	7	8%
Hedonic Pricing Method	6	7%
Contingent Valuation and Travel Cost	6	7%
Benefit Transfer	5	5%
Contingent Valuation and Choice Modelling	1	1%
Contingent Valuation and Hedonic Pricing	1	1%
Choice Modelling and Benefit Transfer	1	1%
Game Theory	1	1%
Expert Opinion	1	1%
TOTAL	**92**	**100%**

Moyle's (1995) NMV study was the only one in NZ to apply game theory. Here, a game theory framework was setup to understand the endangered species problem from the point of view of a species manager. Another NMV method applied only once in NZ was conducted by the Works Consultancy Services (1995) that used expert opinion to estimate the value of the benefits that could be derived from the construction of a seven-kilometer highway, called the Stoke bypass, in Nelson. This South Island project would ultimately cost over 25 million dollars to construct (Transit New Zealand 2000).

While most of the 92 studies valued only one environmental good, a few used CVM to either value two different environmental goods or two different types of values of an environmental good. Fahy and Kerr (1991) valued research efforts for the conservation of the Royal Albatross and willingness-to-pay to increase the number of life-saving patrols on Christchurch beaches. The study by Kirkland (1988), estimated both preservation values and recreational benefits of Whangamarino wetlands. Kerr and Manfredo (1988), estimated the recreation values for the use of National Park Visitor Centres and did a separate set of estimates for the recreation benefits from enjoying Tararua Forest Park road end camping.

When distributing NMV studies by the environmental commodities they valued, we find ten commodity categorizations. Overall, these studies appear to be concentrated in three major areas: outdoor recreation (38%), environmental conservation/management (23%) and travel time savings (17%) (Figure 1). Environmental management studies were primarily water quality improvement studies (80%). Other NMV studies dealt with valuing risk reduction (5%), public/academic/health services (4%), pest control (i.e., possum, weeds) (3%), land quality (2%), food quality/labeling (2%), biodiversity and ecosystem services (2%), human life (2%), and aesthetics (2%).

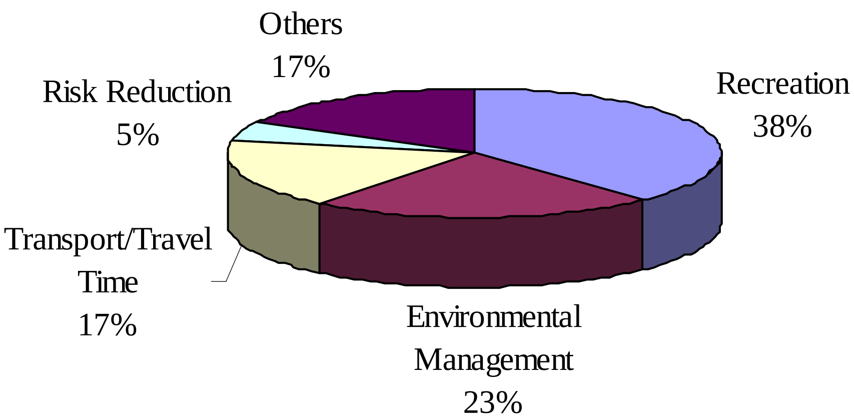

Figure 1. Distribution of NZ NMV studies by type of environmental commodity valued

The primary output variable from a majority of the NMV studies was to estimate consumer surplus (CS) values. The CS value is an amount that a consumer is prepared to pay for a commodity, over and above its market price. To calculate CS, we determine the difference between the price that consumers would be willing-to-pay (WTP) for an environmental commodity and the commodity's actual price in the market For example, if a consumer would be WTP $25 for a tour at a wildlife sanctuary, but the cost of the tour was only $10, they would have a positive CS value. The difference between the two prices, $15, represents this CS value.

Many studies reported more than one CS value (for example, one study may report WTP for picnic areas and WTP for camping on Stewart Island). In all, 167 CS values were obtained from the studies. For ease of comparison, these CS values were converted to 2007 NZ$/person/day. We found the lowest CS value to be $0.02/person/day; this represented the benefit of pest control. The highest CS of $622.41/person/day represented the value of a tramping day on the Milford Track (Table 3).

CS was estimated for eight commodities: biodiversity services, travel time saving, water resource improvement, recreation, health/life risk reduction, transport safety and efficiency, land quality improvement and pest control. For six of the eight commodities: biodiversity services, water resource improvement, transportation safety and efficiency, health/life risk reduction, land quality and pest control, we calculated CS by using the following formula: we multiplied the average CS/person/day by 365 (days) and the NZ population (4,233,149 as of 21 August 2007). This is accurate because we believe that all people in NZ benefit from these commodities. However, we do realize that these numbers are most likely an underestimate, as there are many non-residents that come to NZ every year and also benefit from these commodities.

Table 3. Mean and Total CS Value of Environmental Commodities (2007 NZ$)

Commodity	No. of observations (% of observations)	Mean CS Value ($)	Std Dev ($)	Min CS Value ($)	Max CS Value ($)	Coeff. of Variation	Total CS Value ($)
Biodiversity Services[6]	1 (1%)	35.21	--	35.21	35.21	--	54,410,016,972
Travel Time Saving	7 (4%)	95.85	39.40	43.62	171.18	0.41	6,920,665,538
Water Resource Improvement	41 (25%)	2.96	10.46	0.04	54.08	3.53	4,579,961,966
Recreation	88 (53%)	56.63	98.22	0.38	622.41	1.73	4,077,323,280
Health/Life Risk Reduction	6 (4%)	0.58	1.28	0.03	3.19	2.20	897,960,929
Transport Safety and Efficiency	3 (2%)	0.41	0.23	0.15	0.59	0.56	637,490,083
Land Quality Improvement	3 (2%)	0.21	0.06	0.16	0.27	0.28	317,277,506
Pest Control	18 (11%)	0.37	0.50	0.02	1.62	1.34	577,867,044
TOTAL	**167**	**34.87**	**74.03**	**0.02**	**622.41**	**2.40**	**72,418,563,318**

Overall, we found that biodiversity services provide the highest value ($54 billion annually). Biodiversity is an extremely important commodity, not only for humans, but for all organisms in NZ and the world. Therefore, it is not surprising that biodiversity services had such a high value. However, caution should be observed when referring to this specific amount, since this CS estimate came only from one study. This study was, however, a benefit transfer study that used valuation information from a variety of sources. Even so, we

[6] Biodiversity services are also known as ecosystem services.

believe more work should be accomplished in this area to measure the accuracy of the original estimates. In addition, the authors of this study warned about the possibility of overestimation of the CS value due to the use of a partial equilibrium approach (Patterson and Cole 1999a: 69).

Of the 167 observed CS estimates, 25% valued the importance of water resource improvement. These studies concentrated on valuing the improvement of water quality of rivers and/ or lakes, as well as, an improvement in the quality of groundwater and drinking water resources. About two-thirds of these water resource studies were conducted after 1991, when the RMA was legislated. This might indicate that the RMA facilitated an increase in NMV research for water resources improvement.

The average CS value for water resources improvement was about $3/person/day with a coefficient of variation (COV) of 3.53. This commodity has the highest COV among the eight commodities, indicating that it exhibits the widest variation in its estimates.[7] This variation can be attributed to the fact that the average CS value came from 41 observed CS values. For the 41 observed CS values, namely direct, option and preservation, values were $0.85, $7.65, and $3.01, respectively. This shows that, on average, the non-use value of water resources is about three times higher than the use value (i.e., direct use value). This scenario is consistent with the previous empirical results in the US showing that non-use values of water resources are higher than their counterpart use values (e.g., Sutherland and Walsh 1985; Loomis 2006).

In NZ, just like anywhere else, water resources improvement would most likely affect or 'benefit' the everyday life of all its residents. Taking the average CS value of $3/person/day, the total CS for this commodity is estimated to be around $4.6 billion annually (Table 3). This is the third most valuable among the eight commodities.

Lock (1992a) and Kerr and Cullen (1995) have suggested that people that benefit most from the control of pests (e.g., possums, invasive plants) are mainly farmers and rural people. We disagree with this assumption, since we can argue that all people in NZ consume farm products such as meat, vegetables and fruits, and therefore all residents in NZ benefit from pest control 365 days annually. Not only this, but pest control is related to native NZ biodiversity, which we have already established as the most important NMV commodity. Taking this into account, the benefits from pest control for NZ residents would total NZ$578 million annually.

[7] It is interesting to note that the coefficient of variation for water resource management, with 41 observations, is higher than the recreation commodity, which has 88 observations. The smaller variation of the CS value estimates for recreation can be attributed to the fact that all recreation values fall under only one type of value, use values. The commodity water resources improvement, on the other hand, consisted of three types of values, namely: use, preservation and option.

Other commodities believed to have an everyday impact on a typical NZ resident are risk reduction, transport safety and land quality improvement. It seems that people found these commodities to be less important than biodiversity services or water resource management and therefore, they have relatively lower CS estimates. These three commodities exhibit a combined benefit value of $1.5 billion annually.

Two environmental commodities would not likely benefit or affect all people in NZ year round, namely: recreation and travel time saving. Not all people participate in recreation, and of those, few engaged in outdoor recreation activities 365 days a year. Tourism New Zealand (2007a; 2007b) reported that 72.1 million recreation days annually were spent on the country's outdoor recreational amenities. Taking this into account and multiplying it by the average 2007 dollar value of a recreational day of $56.63, we get a total CS value of about $4.1 billion (Table 3). Outdoor recreation ranked fourth among the eight commodities.

Observed recreational CS values ranged between $0.38 and $622.41/ person/ recreation day. This illustrates a wide variation in the value of recreational amenities. Of the 88 observed recreation CS values, 50% of them occurred on the South Island, 40% on the North Island, and only 10% on both islands. At the 95% confidence level, the average CS value on the South Island ($131) is significantly higher than the average CS value on the North Island ($28). This might imply that outdoor recreation on the South Island has a higher value, but this may also be due to a location bias. It seems that popular amenities like the Milford Walking Track and mountain climbing at Mt. Cook were amenities valued on the South Island, while on the North Island; only causal activities like picnicking were valued, therefore producing a location bias (Kaval and Yao 2007).

Estimation of the total CS value of travel time saving for all New Zealanders is difficult to calculate. Murphy and Satherley (2000) calculate that a typical employee in NZ takes 44 minutes/day to travel to and from work. As of June 2007, there were approximately 2,158,000 workers in NZ, accounting for about 51% of the population (Statistics New Zealand 2007). During weekends or non-working days, people also travel: perhaps less for work, but more for activities like visiting relatives, relaxation and shopping. Therefore, we make the assumption that people travel 44 minutes/day on non-working days. Since these studies represent a savings in travel time, we also assume that whatever method a person uses to travel: car, bicycle, walking, etc, will take the same amount of time. Multiplying 44 minutes/day by the number of NZ employees and then by 365 days and by the CS value of $95.85/day (or approximately $0.20/minute), we get a total CS value for travel time savings of $6.9 billion annually. We believe this calculation may represent an underestimation of the value of travel time since non-workers do travel on working days; however, we did not have figures for the non-workers and therefore needed to make an assumption.

CS values were calculated from the studies for eight environmental commodities. If it is true that the eight environmental commodities in Table 3 are mutually exclusive, their total consumer surplus value is approximately $72 billion annually. This amount is a significant component of the national economy, representing approximately 50% of the 2006 NZ GDP. Therefore, including NMV results in GDP would most likely result in a significant increase in the country's total GDP.

Discussion and Conclusions

In this paper, we present a brief history of NMV, focusing on applications in NZ. In all, 92 NMV studies were conducted in NZ between 1974 and 2005. It was discovered that NMV became more popular and more commonly used in NZ policy decision making after the passage of the RMA in 1991. Of the NMV methods used in NZ, CVM was the most popular. It was also revealed that biodiversity is the most highly valued NMV commodity in NZ. This may be because it is not only important to people but also to all ecosystem functions.

Based on the above discoveries, it appears that NMV studies in NZ followed similar patterns to that in the US. Firstly, both countries legislated policies that created avenues to conduct NMV studies for environmental policy decision making. This, we believe, is important, because NMV calculations combined with the market values results in more holistic estimates of benefits and costs. In addition, both the US and NZ used the CVM technique more than any of the others (Adamowicz 2004; Kerr 2007; Kaval 2007). The wide application of CVM in both countries can be attributed to its flexibility to elicit WTP values for almost any environmental commodity of interest (Portney 1994; Mitchell and Carson 1989; Carson et al., 2003). In addition, CVM facilitates the estimation of both use and non-use values while methods like TCM and HP cannot (Bateman, et al. 2002). Furthermore, numerous research undertakings have been conducted to examine or improve the reliability of estimates from CVM studies (e.g., Carson, et al. 1997; Dupont 2004).

The rate of increase in the number of NMV studies in the US, however, was several folds higher than in NZ (Adamowicz 2004; Kerr 2007). One reason for this might be related to the extreme environmental destruction caused by the Exxon Valdez oil spill disaster in 1989. Whereas in NZ, there have been no similar environmental disasters.

NMV studies have played an important role in NZ, to a limited extent. However, given the proven usefulness of NMV studies for policy decision making in the US and in Australia, study numbers and study areas in NZ seem to be deficient (Bennett 2002; Carson, et al. 2001; Kerr 2002). Areas that are lacking include pest protection and studies on the newest and fastest growing outdoor recreational activities (e.g., black water rafting, extreme mountain biking, surfing). These study areas represent only a few of the many areas where we believe NMV studies could aid in future environmental policy decisions.

References (Note: Database references preceded by '***** ')

Adamowicz, W. 2004. What's it Worth?: An Examination of Historical Trends and Future Directions in Environmental Valuation. *Australian Journal of Agricultural and Resource Economics*, 48(3):419-443.

Adamowicz, W., Boxall, P., Williams, M. and Louviere, J. 1998. Stated Preference Approaches for Measuring Passive Use Values: Choice Experiments and Contingent Valuation. *American Journal of Agricultural Economics,* 80: 64–75.

Arrow, K., Solow, R., Portney, P.R., Leamer, E.E., Radner, R. and Schuman. H. 1993. Report of the NOAA Panel on Contingent Valuation. *Federal Register,* 58(10): 4601–4614.

* Awatere, S. 1997. *Natural Resource Taonga: Investigating the Cultural Sensitivity of the Contingent Valuation Method*. Master of Management Studies Thesis. University of Waikato, Hamilton.

* Awatere, S. and Scrimgeour, F. 1998. Treasures and Taonga: A Contingent Valuation Study Involving New Zealand Maori. Paper Presented to World Congress of Resource Economists, Venice.

* Ball, R., Saunders, C. and Cullen, R. 1997a. *Assessment of Benefits and Expenditure Recovery Options*. Report for Regional Parks Service. Auckland Regional Council.

* Ball, R., Saunders, C. and Cullen, R. 1997b. *Unit Day Values: An Application to Auckland Regional Parks*. Paper Presented to New Zealand Association of Economists Conference, University of Canterbury, Christchurch.

Bateman, I.J., Carson, R.T., Day, B., Hanemann, M., Hanley, N., et al. 2002. *Economic Valuation with Stated Preference Techniques: A Manual*. Edward Elgar Publishing Ltd.

* Beanland, R. A. 1992. Implementation of Sustainable Resource Management: A Process for Environmental Evaluation Aorangi Awarua Case Study, Unpublished Thesis for Master of Resource and Environmental Planning, Massey University, Palmerston North.

* Beca Carter Hollings and Ferner Ltd. 1999. *Economic Assessment of the Strategic Value of State Highway 3 Between Taranaki and Waikato*. Report prepared for Taranaki Regional Council. Beca Carter Hollings and Ferner Ltd, Auckland.

* Beca Carter Hollings and Ferner Ltd and Malcolm Hunt Associates. 1997. *Monetary Valuation of Intangibles*. Transfund New Zealand Research Report No. 98. Transfund New Zealand, Wellington.

* Beca Carter Hollings and Ferner Ltd., Steer Davies Gleave, Forsyte Research, Brown Copeland & Co. 2002. *Project Evaluation Benefit Parameter Values*. Report prepared for Transfund New Zealand (April).

Bennett, J.W. 2002. *Non-market Valuation Scoping Study.* A Report Prepared for the Murray Darling Basin Commission, Australia.

Bennett, J.W. 1984. Using Direct Questioning to Value the Existence Benefits of Preserved Natural Areas. *Australian Journal of Agricultural Economics*, 28(2,3): 136-152.

Bennett, J.W. 1981. *Evaluation and the Benefits of Natural Ecosystem Preservation with Special Reference to Existence Values*. Ph.D. Thesis, Australian National University, Canberra, Australia.

Boardman, A.E., Greenberg, D.H., Vining, A.R. and Weiner, D.L. 2006. *Cost-Benefit Analysis: Concepts and Practice* (3rd ed). Pearson-Prentice Hall, New Jersey.

Bockstael, N. and Freeman, A.M. 2005. Welfare Theory and Valuation. In: Mäler, K.G. and Vincent, J.R. (eds.) *Handbook of Environmental Economics: Valuing Environmental Changes* (Vol. 2) . Elsevier-North-Holland Inc., San Diego:

* Bond, S. and Hopkins, J. 2000. The Impact of Transmission Lines on Residential Property Values: Results of a Case Study in a Suburb of Wellington, NZ. *Pacific Rim Property Research Journal*, 6(2): 52–60.

* Booz-Allen & Hamilton. 2000. *Valuation of Travel Time Savings - Market Research*. Report to Transfund New Zealand, November 2000.

Boxall, P., Adamowicz, W., Swait, J., Williams, M., and Louviere, J. 1996. A Comparison of Stated Preference Techniques for Environmental Valuation. *Ecological Economics*, 18: 243–253.

* Brouwer, R., Bateman, I.J., Saunders, C. and Langford, I.H. 1999. *Perception and Valuation of Risk Reduction as a Public and Private Good: Investigating Methodological * Issues in Contingent Valuation of UV risks in New Zealand*. CSERGE Working Paper GEC 99-06, University of East Anglia, Norwich.

* Cairns, N.D. 1985. *Assessment of the Kaikoura Amateur Fishery for Rock Lobsters*. Unpublished MS Thesis. Centre for Resource Management, University of Canterbury and Lincoln College, Canterbury.

Carson, R.T. 2000. Contingent Valuation: A User's Guide. *Environmental Science andTechnology*, 34(8): 1413–1418.

Carson, R.T., Flores, N.E., and Hanemann, W.M. 1998. Sequencing and Valuing Public Goods. *Journal of Environmental Economics and Management*, 36: 314–323.

Carson R.T., Flores, N.E. and Meade, N.F. 2001. Contingent Valuation: Controversies and Evidence, *Environmental and Resource Economics*, 19, 173– 210.

Carson, R. T. and Hanemann, W. M. 2005. Contingent Valuation. In: Mäler, K.G. and Vincent, J.R. (eds.) *Handbook of Environmental Economics: Valuing Environmental Changes*. Vol. 2, , Elsevier-North-Holland Inc., San Diego: 821-936.

Carson, R.T., Hanemann, W.M., Kopp, R.J., Krosnick, J.A., Mitchell, R.C., Presser, S., Rudd, P., Smith, V.K., Conaway, M., and Martin, K. 1997. Temporal Reliability of Estimates from Contingent Valuation. *Land Economics*, 73 (2): 151–163.

Carson, R.T., Mitchell, R.C., Hanemann, W.M., Kopp, R. J., Presser, S. and Ruud, P.A. 2003. Contingent Valuation and Lost Passive Use: Damages from the Exxon Valdez Oil Spill. *Environmental and Resource Economics*, 25: 257–286.

Carson, R.T., Wilks, L. and Imber, D. 1994. Valuing the Preservation of Australia's Kakadu Conservation Zone. *Oxford Economic Papers*, 46: 727–749.

Champ, P., Boyle, K., and Brown, T.C. 2003. *A Primer on Nonmarket Valuation*, Kluwer Academic Publishers.

Ciriacy-Wantrup, S. V. 1947. Capital Returns from Soil Conservation Practices. *Journal of Farm Economics*, 29: 1181–1196.

Clark, J. M. 1915a. The Concept of Value. *The Quarterly Journal of Economics, 29*(4): 663–673.

Clark, J. M. 1915b. The Concept of Value: A Rejoinder. *The Quarterly Journal of Economics, 29*(4): 709–723.

Clawson, M. 1959. *Methods of Measuring the Demand for and the Value of Outdoor Recreation*. Reprint No. 10, Resources for the Future, Washington, D.C.

* Clough, P.W.J. and Meister, A. 1991. Allowing for Multiple-site Visitors in Travel Cost Analysis. *Journal of Environmental Management*, 32: 115–125.

* Cocklin, C., Fraser, I., and Harte, M. 1994. The Recreational Value of In-Stream Flows: The Upper Wanganui and Whakapapa Rivers. *New Zealand Geographer*, 50(1): 20–29.

* Cole, A. and Patterson, M. 1997. *The Economic Value of New Zealand's Biodiversity*. Unpublished report for the Ministry for the Environment and Department of Conservation, Wellington.

* Craig, J. and Vesely, E.T. 2003. *Perceived Value of a Quantitative Change in the Urban Tree Estate of New Zealand*. Report Prepared for the Ministry of Agriculture and Forestry, School of Geography and Environmental Science, University of Auckland.

* Cribbett, P.F. 1985. Estimating a Hedonic Price Equation with Christchurch Real Estate Sales Data. MA Dissertation, Department of Economics, University of Canterbury, Christchurch.

Davis, R. K. 1963. *The Value of Outdoor Recreation: An Economic Study of the Maine Woods*. PhD Thesis, Harvard University, Boston, MA.

Diamond, P. and Hausman, J. 1994. Contingent Valuation: Is Some Number Better than No Number?. *Journal of Economic Perspectives*, 8(4), 45–64.

Dupont, D.P. 2004. CVM Embedding Effects When There Are Active, Potentially Active and Passive Users of Environmental Goods. *Journal of Environmental and Resource Economics*, 25 (3): 319-341.

* Everitt, A.S. 1983. A Valuation of Recreational Benefits. *New Zealand Journal of Forestry*, 28(2):176–183.

* Fahy, A.E.C. and Kerr, G.N. 1991. *Valuing Non-Market Goods*, Unpublished report for the Ministry for the Environment, Centre for Resource Management, Lincoln University, Canterbury.

Freeman, M. 2003. *The Measurement of Environmental and Resource Values: Theory and Methods.* (2nd ed) RFF Press, Washington DC.

* Gan, C. and Zwart, T. 1994. *Hedonic Analysis of Waterfowl Hunting Lease Attributes: An Evaluation of Owner-Provided Services*. Discussion Paper No. 2, Department of Economics and Marketing, Lincoln University, Canterbury.

* Gluck, R. J. 1974. *An Economic Evaluation of the Rakaia Fishery as a Recreation Resource*. MS Thesis in Agricultural Science, University of Canterbury (Lincoln College), Christchurch.

Grandstaff, S. and Dixon, J.A. 1986. Evaluation of Lumpinee Public Park in Bangkok, Thailand. In: Dixon, J. A. and Hufschmidt, M. M. (eds.) *Economic Valuation Techniques for the Environment: A Case Study Workbook*. Johns Hopkins University Press, Baltimore.

* Greer, G. 2001. *The Value of the Rangitata River to its Angling Community*. Agribusiness and Economics Research Unit, Lincoln University, Canterbury.

* Greer, G. and Sheppard, R.L. 1990. *An Economic Evaluation of the Benefits of Research into Biological Control of Clematis vitalba*, Research Report No. 203, Agribusiness and Economics Research Unit, PO Box 84, Lincoln University, Canterbury.

* Guria, J., Jones-Lee, M. and Loomes, G. 1998. *The Value of Statistical Life and Injuries: Willingness to Pay and Accept*. Draft report to the Land Transport Safety Authority, Wellington.

* Guria, J. and Miller, T. 1991. *The Value of Statistical Life in New Zealand: Market Research on Road Safety*. Land Transport Division, Ministry of Transport, Wellington.

Hanley, N., Shaw, W.D. and Wright, R.E. 2003. *The New Economics of Outdoor Recreation.* Edward Elgar, Cheltenham.

* Harris, B.S. 1984. Contingent Valuation of Water Pollution. *Journal of Environmental Management*, 19: 199–208.

* Harris, B.S. 1983. Valuation of Non-Market Goods: An Application of Contingent Valuation to Water Pollution Control in the Waikato Basin, Technical Publication No. 27, Waikato Valley Authority.

* Harris, B.S. 1981. Application of a Travel Cost Demand Model to Recreation Analysis in New Zealand: An Evaluation of Lake Tutira. M.Ag.Sci Thesis, Massey University, Palmerston North.

* Harris, B.S., and Meister, A.D. 1981. *A Report on the Use of a Travel Cost Demand Model for Recreation Analysis in New Zealand: An Evaluation of Lake Tutira*. Discussion Paper in Natural Resource Economics No. 4, Department of Agricultural Economics and Farm Management, Massey University, Palmerston North.

* Heylen Research Centre and Accent Marketing Research. 1993. *Auckland Transport Models Project Stated Preference Mode Choice Survey - Final Report.* Report prepared for Auckland Regional Council. Heylen Research Centre and Accent Marketing Research.

Hotelling, H. 1947. *Letter to the Director of the US National Park Service*. The University of North Carolina, 2 p.

Kahn, J.R. 2005. *The Economic Approach to Environmental and Natural Resources*. Mason, South-Western.

* Kane, S. J. 1991. *Use Values of the Hollyford Valley Track: with specific reference to the Proposed Haast - Hollyford Tourist Road.* Unpublished MA Thesis in Geography, University of Otago.

* Kask, S.B. and Maani, S.A. 1992. Uncertainty, Information and Hedonic Pricing. *Land Economics*, 68(2): 170-184.

* Kask, S.B. and Maani, S.A. 1989. Uncertainty, Information and Hedonic Pricing, Working Papers in Economics No. 55, Department of Economics, The University of Auckland.

Kaval, P. 2007. Recreation Values of U.S. Parks. Department of Economics Working Paper Series #07/12. Waikato University School of Management, Hamilton, New Zealand.

* Kaval, P. 2004. *The Maungatautari Ecological Island Trust: An Economic Analysis.* A Report Prepared for the Environment Waikato, Department of Economics, University of Waikato Management School, Hamilton, New Zealand.

* Kaval, P., Hughes, W. and Scrimgeour, F. 2004. *Te Kouma Farm Park: An Economic Analysis.* A Report Prepared for Environment Waikato, Department of Economics, University of Waikato Management School, Hamilton, New Zealand.

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

* Kaye-Blake, W., Bicknell, K. and Lamb, C. 2003. *Willingness to Pay for Genetically Modified Food Labelling in New Zealand*. Paper presented at the 6th International Consortium on Agricultural Biotechnology Research (ICABR) conference

Kerr, G. 2007. New Zealand Non-Market Valuation Database. Online at http://oldlearn.lincoln.ac.nz/markval/ (accessed 3 September 2007).

Kerr, G. 2002. *Valuation of Instream Issues: Non-Market Values and Water Management*. Paper presented to the Conference on Water: The Lifeblood of New Zealand on 22 August 2002, Wellington.

* Kerr, G.N. 2001. Waitakere City Water Management: Contingent Valuation Analysis and Results. Report to Resource and Environmental Management Ltd.

* Kerr, G.N. 2000a. *Contingent Valuation Payment Cards: How Many Cells?*. Commerce Division Discussion Paper No.87, Lincoln University, Canterbury.

* Kerr, G.N. 2000b. Dichotomous Choice Contingent Valuation Probability Distributions. *Australian Journal of Agriculture and Resource Economics*, 44(2): 233–252.

* Kerr, G.N. 2000c. *Rangitata River Anglers' Contingent Valuation Results.* Report to Agribusiness and Economics Research Unit, Lincoln University, Canterbury.

* Kerr, G.N. 1996a. *Economic Valuation of Wellington Regional Parks, Report to Wellington Regional Council*, Department of Resource Management, Lincoln University, Canterbury (July).

* Kerr, G.N. 1996b. Recreation Values and Kai Tahu Management: The Greenstone and Caples Valleys. *New Zealand Economic Papers*, 30(1): 19–38.

* Kerr, G.N. 1989a. *The Demand for Mountain Climbing at Mount Cook National Park*. Unpublished paper. Centre for Resource Management, Lincoln College, Canterbury.

* Kerr, G.N. 1989b. Willingness to Pay for Flood Protection. In: *Public perceptions of risk from the Waimakariri River*. Report to the North Canterbury Catchment Board and Regional Water Board, Christchurch.

* Kerr, G.N. 1987. Changes in Kawarau Gorge Values with Hydro Development. In: Kerr, G.N. and B.M.H. Sharp (eds) *Valuing the Environment: Economic Theory and Applications.* Studies in Resource Management No. 2, Centre for Resource Management, Lincoln College and University of Canterbury.

* Kerr, G.N. and Cullen, R. 1995. Public Preferences and Efficient Allocation of a Possum-control Budget. *Journal of Environmental Management*, 43: 1–15.

* Kerr, G. N., Cullen, R. and Hughey, K. F. D. 2003. *Environmental Budget Allocation: Public Preferences*. Discussion Paper No.98, Commerce Division, Lincoln University, Canterbury.

* Kerr, G.N. and Greer, G. 2004. New Zealand River Management: Economic Values of Rangitata River Fishery Protection. *Australasian Journal of Environmental Management*, 11: 139–149.

* Kerr, G.N., Hughey, K.F.D. and Cullen, R. 2003. *Marine Recreational Fishing Perceptions and Contingent Behaviour*. Discussion Paper No. 99, Commerce Division, Lincoln University, Canterbury.

* Kerr, G.N. and Manfredo, M.J. 1991. An Attitudinal Based Model of Pricing for Recreation Services. *Journal of Leisure Research*, 23(1): 37–50.

* Kerr, G.N. and Manfredo, M.J. 1988. *Cost Recovery on the Department of Conservation Estate*. Report to Departments of Conservation and Tourism and Publicity.

* Kerr, G.N. and Sharp, B.M.H. 2003. *Community Mitigation Preferences: A Choice Modelling Study of Auckland Streams*. Research Report No. 256, Agribusiness and Economics Research Unit, Lincoln University, Canterbury.

* Kerr, G.N., Sharp, B.M.H., and Gough, J.D. 1986. *Economic Benefits of Mt. Cook National Park*. Centre for Resource Management, University of Canterbury and Lincoln College, Canterbury.

* Kerr, G.N., Sharp, B.M.H. and Leathers, K.L. 2004. Instream Water Values: Canterbury’s Rakaia and Waimakariri Rivers, Research Report No. 272, Agribusiness and Economics Research Unit, Lincoln University, Canterbury.

* Kerr, G.N., Sharp, B.M.N. and White, P. 2003. The Economics of Augmenting Christchurch's Water Supply. *Journal of Hydrology (NZ)*, 42(2): 113–124.

* Kerr, G.N., Sharp, B.M.H. and White, P. 2001. *Non-marketed Impacts of Ground Water Extraction*. Paper presented to the Australian Agricultural and Resource Economics Society conference, Adelaide (January).

* Kerr, J. 2005. *Hedonic Price Modelling of Residential Land Values in New Zealand*. Unpublished Thesis in Master of Management Studies, University of Waikato, Hamilton.

* Killerby, P.S. 1992. *Local Socio-Economic Consequences of a Western King Country Protected Landscape*. Unpublished Master of Management Thesis, University of Waikato, Hamilton.

* Killerby, P.S. and Scrimgeour, F. 1992. *Local Socio-Economic Consequences of a Kawhia-Awakino Conservation Park*. Draft report submitted to the Department of Conservation, Department of Economics, University of Waikato, Hamilton.

* Kirkland, W.T. 1989. *Ewen Bridge Gateway Study: An Environmental Evaluation*. Report prepared for the Lower Hutt City Council and the Wellington Regional Council, Envirotech Consultants.

* Kirkland, W.T. 1988. *Preserving the Whangamarino Wetland - An Application of the Contingent Valuation Method*. Unpublished Thesis in Master of Agriculture Science at Massey University, Palmerston North.

Kling, C.L. 1997. The gains from combining travel cost and contingent valuation data to value nonmarket goods. *Land Economics*, 73(3): 428–39.

* Koorey, G.F., Mitchell, T.J., Farrelly, P.M. and Wong-Toi, D. 1998. *New Zealand Research Into Assessing Passing Opportunities*. Paper presented to the 19th Australian Road Research Board (ARRB) Road Research Conference, Sydney.

* Lambert, R., Saunders, L., and Williams, T. 1992. *Cultural Sensitivity of the Contingent Valuation Method*. Information Paper No. 41, Centre for Resource Management, Lincoln University, Canterbury.

* Lee, B.M. 2001. *An Application of Contingent Valuation to Assess the Sustainability of Oyster Farming in the Whangaroa Harbour*. Unpublished MS Thesis, Department of Environmental and Marine Science, University of Auckland.

* Lock, G.M. 1992a. *The Possum Problem in the Manawatu-Wanganui Region*, Unpublished Thesis in Masters of Agricultural Science in Resource Economics, Massey University, Palmerston North.

* Lock. G.M. 1992b. *The Possum Problem: A Case Study of the Manawatu-Wanganui Region*. Paper presented to New Zealand Association of Economists Conference, University of Waikato, Hamilton.

Loomis, J. 2006. Importance of Including Use and Passive Use Values of River and Lake Restoration. *Journal of Contemporary Water Research & Education*, 134: 4–8.

* Lynch, R.J. and Weber, J.A. 1992. *Valuing Water of the Ashburton River: In-Stream Flows Versus Irrigation*. Ministry of Agriculture and Fisheries (MAF) Policy Technical Paper 92/13, Wellington.

* Maani, S.A. and Kask, S.B. 1989. *Risk and Information: A Hedonic Price Study in the New Zealand Housing Market*. Working Papers in Economics No. 61, Department of Economics, The University of Auckland.

* Maani, S.A. and Kask, S.B. 1991. Risk and Information: A Hedonic Price Study in the New Zealand Housing Market. *The Economic Record*, 67(198): 227–236.

* McBeth, R. 1997. *The Recreational Value of Angling on the Tongariro River: Non-market Valuation Using the Travel Cost Method and Contingent Valuation Method*. Unpublished MA Thesis, Department of Geography, University of Auckland.

* McDermott Fairgray Group and Valuation Technologies. 1996. *Te Puke Internal By-Pass: Environmental and Social Benefits Study*. Draft report prepared for Works Consultancy Services.

* McDermott Fairgray Group Ltd. 1997. *Costs, Benefits and Impacts of the Mobil Wellington Street Race*. Report to Wellington City Council (March).

* McDermott Miller. 2002. *Kerikeri Heritage Bypass Study: Intangible Benefits*. Report to Far North District Council, McDermott Miller Ltd, Wellington.

* McDermott Miller. 1999. *Transmission Gully Community Survey: Report on Household Survey of Regional Residents*. Report to Wellington Regional Council and Transit NZ, McDermott Miller Ltd, Wellington.

* Regional Council. McDermott Miller Ltd, Wellington (December).

* McDermott Miller. 1996. Wellington Regional Land Transport Strategy - Willingness to Pay Research: Stated Preferences of Commuters, Report to Wellington Regional Council.

* McKinney, H. 1999. *A Study Using Contingent Valuation Methodology to Assess Willingness to Pay for Light Rail Passenger Transport*. Master of Applied Science Thesis, Lincoln University.

* Melsom, I. 2003. *Review of the Benefit Parameters Used in Transfund New Zealand's Project Evaluation Procedures*. Transfund New Zealand, Wellington.

* Melsom, I. and Collins, K. 2001. *Review of Transfund's Project Evaluation Benefit Parameter Values*. Paper for 14th IRF World Road Congress, Paris, 11-15 June 2001. Transfund New Zealand, Wellington.

* Meyer, F. 1994. *The Dichotomous Choice Approach to the Contingent Valuation Method*. Unpublished Thesis for Master of Commerce and Management, Lincoln University, Canterbury.

Mitchell, R.C. and Carson, R.T. 1989. *Using Surveys to Value Public Goods: The Contingent Valuation Method*. Resources for the Future, Washington D.C.

Mogas, J., Riera, P. and Bennett, J. 2006. A Comparison of Contingent Valuation and Choice Modelling with Second Order Interactions. *Journal Forest Economics*, 12(1): 5–30.

* Montgomery Watson. 1999.. Recreational Lake Demand and Economic Benefit Analysis. Report to Palmerston North City Council (September).

* Moore, R. 1999. Valuing the Benefits of a Small Community Sewerage System in the Coastal Environment, Master of Applied Economics Thesis. Massey University, Palmerston North.

* Mortimer. R.J. 1993. *An Application of Contingent Valuation: Little Barrier Island (Hauturu): A Case Study*. MSc thesis, Environmental Science and Zoology, University of Auckland.

* Mortimer, R.J., Sharp, B.M.H. and Craig, J. 1996. Assessing the Conservation Value of New Zealand's Offshore Islands. *Conservation Biology*, 10(1): 25–29.

* Moyle, B.J. 1995. *Valuation of Endangered Species: Towards a New Approach*. Unpublished PhD Thesis, University of Waikato, Hamilton.

Muir, J., 1912. *Hetch Hetchy Valley*. In: *The Yosemite*. Online at http://www.sierraclub.org/john_muir_exhibit/frameindex.html?http://www.sierraclub.org/john_Muir_exhibit/writings/the_yosemite/chapter_16.html (accessed 4 September 2007).

Muir, J., 1901. Our National Parks. Online at http://www.sierraclub.org/john_muir_exhibit/frameindex.html?http://www.sierraclub.org/john_muir_exhibit/writings/our_national_parks/ (accessed 4 September 2007).

Murphy, B. and Satherley, P. 2000. *Key Statistics – April 2000: New Zealand Time Use*. Social Policy Division, Statistics New Zealand.

Navrud, S. and Pruckner, G. 1997. Environmental Valuation - To Use or Not to Use? A Comparative Study of the United States and Europe. *Environmental and Resource Economics*, 10: 1–26.

* Nelson, G. 1998. *The Pukekohe Groundwater System: Valuing the Resource to Improve the Design of Groundwater Management*. Master of Management Studies Thesis, University of Waikato, Hamilton.

Niewijk, R.K. 1992. “Ask a Silly Question …”: Contingent Valuation of Natural Resource Damages. *Harvard Law Review*, 105(8): 1981–2000.

* Nugent, G. and Henderson, R. 1990. Putting a Value on Hunting in the Oxford Recreation Hunting Area (RHA). *New Zealand* Wildlife, 12(93): 39–40.

* Omwenga, R.M. 1995. *The Manawatu River Water Quality Improvement Project*. Unpublished Masters Thesis in Agricultural Sciences in Resource and Environmental Economics, Massey University, Palmerston North.

* Patterson, M. and Cole, A. 1999a. *Assessing the Value of New Zealand's Biodiversity*. School of Resource and Environmental Planning, Massey University, Palmerston North (February).

* Patterson, M. and Cole, A. 1999b. *Estimation of the Value of Ecosystem Services in the Waikato Region*. Environment Waikato Internal Series 1999/02, Hamilton.

* Patterson, M. and Cole, A. 1997. *Valuation of New Zealand's biodiversity*. Paper presented to Australia New Zealand Society for Ecological Economics Conference, Melbourne.

Portney, P.R. 1994. The Contingent Valuation Debate: Why Economists Should Care. *The Journal of Economic Perspectives*, 8(4): 3–17.

* Quazi, M.A. 2002. *The Quantification of Indirect Benefits from Flood Protection in the Lower Waikato*. Unpublished Masters Thesis in Applied Economics, Massey University, Palmerston North.

* Radovich, B. and Foster, J. 2000. *Urban Travel Time Value - Some New Zealand Findings*. *Road Transport Research*, 9(3): 27–39.

* Riley, D.F. 1990. *The Social Value of an Indigenous Forest: An Application of the Contingent Valuation Method*, Masters in Social Science in Economics, The University of Waikato, Hamilton.

* Riley, D. and Scrimgeour, F. 1991. The Social Value of an Indigenous Forest. In: *Papers Presented at the Sixteenth Annual Conference of the Australian Agricultural Economics Society*. AERU Discussion Paper No. 131, Lincoln University, Canterbury.

Rolfe, J. and Bennett, J. (eds.) 2006. *Choice Modelling and the Transfer of Environmental Values*. New Horizons in Environmental Economics, Edward Elgar Publishing.

* Sandrey, R.A. 1986. Non-Market Valuation in New Zealand: An Empirical Analysis of Vehicle Bias. *New Zealand Economic Papers*, 20: 53–60.

* Sandrey, R.A. and Simmons, D.G. 1984. *Recreation Demand Estimation in New Zealand: An Example of the Kaimanawa and Kaweka Forest Parks*. Bulletin No. 40, Department of Horticulture, Landscape and Parks, Lincoln College, Canterbury.

* Saunders, C. 1999a. *The Potential for Expansion on the Organic Industry in New Zealand: A Contingent Valuation of Consumers WTP for Organic Produce*. Commerce Division Discussion Paper No. 77, Lincoln University, Canterbury.

* Saunders, C. 1999b. *Organic Farming Industry in New Zealand: Current and Future Prospects*. Paper presented to the Joint Australian and New Zealand Agricultural and Resource Economics Societies Conference, Christchurch.

* Saunders, C., Bateman, I. and Brouwer, R. 1998. *A Contingent Evaluation of New Zealanders' Individual and Social Willingness to Pay to Reduce the Risk of Malignant Melanoma*. Paper presented to the Annual Conference of the Australian Agricultural and Resource Economists Society, Armidale, Australia.

Scarpa, R. and Willis, K. 2006. Distribution of willingness-to-pay for speed reduction with non-positive bidders: Is choice modelling consistent with contingent valuation?. *Transport Reviews*, 26 (4): 451–469.

* Sharp, B.M.H. and Kerr, G. 2005. *Option and Existence Values for the Waitaki Catchment*. Report Prepared for the Ministry of Environment, Wellington.

* Sharp, B.M.H., Kerr, G.N. and White, P.A. 2000. *Total Economic Value of the Waimea Plains Groundwater System*. Paper Presented to 10th World Water Congress, Melbourne (March).

Smith, V.K. 1993. Nonmarket Valuation of Environmental Resources: An Interpretive Appraisal. *Land Economics*, 69(1):1–26.

Smith, V. K. (Ed) 1984. *Environmental Policy Under Reagan's Executive Order: The Role Of Benefit-Cost Analysis.* Chapel Hill: University of North Carolina Press.

Sutherland, R.J. and Walsh, R.G. 1985. Effect of Distance on the Preservation Value of Water Quality. *Land Economics*, 61(3): 281–291.

* Symonds Travers Morgan (NZ) Ltd and McDermott Miller Ltd. 1997. *Tourism Benefits from Sealing Unsealed Roads: Perceptions of Discomfort and Risk.* Transfund New Zealand Research Report No. 81. Transfund New Zealand, Wellington.

Thoreau, H.D. 1864. The Maine Woods. Online at http://etext.virginia.edu/etcbin/toccer-new2?id=ThoMain.sgm&images=images/modeng&data=/texts/english/modeng/parsed&tag=public&part=all (accessed 4 September 2007).

Thoreau, H.D. 1854. *Walden; or, Life in the Woods: On the Duty of Civil Disobedience*. Introduction by Norman Holmes Pearson 1948. Molt, Rinehart and Winston Press. New York.

Tourism New Zealand. 2007a. International Visitor Survey Year End December 2006. Online at URL:http://www.tourismresearch.govt.nz/Datasets/International%20Visitor%20Survey/Data%20and%20Analysis/ (accessed 30 August 2007).

Tourism New Zealand. 2007b. Domestic Travel Survey Year End December 2006. Online at: http://www.tourismresearch.govt.nz/Datasets/Domestic%20Travel%20Survey/Data%20and%20Analysis/ (accessed 4 September 2007).

Transit New Zealand. 2000. Stoke Bypass. In: *Top'n Tales*, a newsletter Published by the Wellington Regional Office of Transit New Zealand.

* Vadnjal, D.T. 1994. *Valuing Environmental Views*. PhD Dissertation, Department of Land Economy, University of Cambridge, UK.

* Vadnjal, D.T. and O'Connor, M. 1994. What is the Value of Rangitoto Island?. *Environmental Values*, 3:369–380.

* Vesely, E.T. 2005. Green for green - the perceived value of a quantitative change in the urban tree estate of New Zealand, School of Geography and Environmental Science, University of Auckland.

* Walker, D.P. 1992. *An Economic Valuation of Bottle Lake Forest: Using Both the Travel Cost and Contingent Valuation Methods for Analysis*. Research project in Advanced Forestry Economics, School of Forestry, University of Canterbury.

* Walker, D.P. 1990. *An Economic Valuation of Kaitoke Regional Park: Using the Travel Cost Method for Recreation Analysis.* Research Project, Natural Resource and Environmental Economics, Massey University, Palmerston North.

* Welsh, C. 2001. Community Benefits Survey: Stormwater and Wastewater Improvements. Report to Ecowater from Resource and Environmental Management Ltd.

* Welsh, C. 1991. *A Contingent Valuation Study of Consumers' Willingness to Pay for Water: An Approach to Conserving Christchurch's Groundwater Resource*. MSc in Resource Management Dissertation, Lincoln University, Canterbury.

* Wheeler, S. and Damania, R. 2001. Valuing New Zealand Recreational Fishing and an Assessment of the Validity of the Contingent Valuation Estimates. *Australian Journal of Agricultural Economics*, 45(4): 599–621.

* White, P.A., Sharp, B.M.H. and Kerr, G.N. 2001. Economic Valuation of the Waimea Plains Groundwater System. *Journal of Hydrology (New Zealand)*, 40(1): 59–76.

* Williamson, J. 1998. An estimation of the Value which Auckland Residents Place on an Improvement in the Water Quality of the Orakei Basin: Summary Report Submitted to the Auckland City Council.

* Williamson, J. 1997. *An Estimation of the Value which Auckland City Residents Place on an Improvement in the Water Quality of the Orakei Basin*. Unpublished Thesis for Master of Arts in Economics, University of Auckland.

Wood, S.E. and A.H. Trice. 1958. Measurement of Recreation Benefits. *Land Economics*, 34: 195–207.

* Woodfield, A. and Cowie, D. 1977. The Milford Track: Valuation Estimates of a Recreation Good. *Australian Journal of Agricultural Economics*, 21 (2): 97–110.

* Works Consultancy Services (1995) (Title not available: Hypothesized title - An Expert Opinion Study on the Proposed Construction of Stoke Bypass in Nelson, South Island). Report to Transit New Zealand.

Appendix A

List of Studies in the New Zealand NMV Database

(Note: CVM=Contingent Valuation Method, TCM=Travel Cost Method, BT=Benefit Transfer, HP=Hedonic Pricing, CM=Choice Modelling, GT=Game Theory, and EO=Expert Opinion)

Study No.	Author/s	Item Valued	Publication Year	Valuation Year	Valuation Method
1	Gluck	Recreational Fishing in Rakaia River	1974	1973	TCM, CVM
2	Woodfield and Cowie	Milford Walking Track	1977	1975	TCM
3	Harris and Meister	Recreational Value of Lake Tutira	1981	1981	TCM
4	Harris	Benefits from Water Pollution Control in the Waikato Basin	1983	1982	CVM
5	Everitt	Forest Recreation in Coromandel Peninsula	1983	1982	TCM
6	Sandrey and Simmons	Kaimanawa and Kaweka Forest Parks	1984	1982	TCM
7	Cairns	Lobster Diving – WTP	1985	1985	CVM
8	Cribbett	House Prices in Christchurch	1985	1985	HP
9	Kerr	Aesthetic Features of the Kawarau Gorge	1985	1985	CVM
10	Kerr, Sharp and Gough	Visit to Mt Cook National Park	1986	1984	TC
11	Sandrey	Canoeing at Wanganui River and Visit to Hanmer Forest Park	1986	1985	TC, CVM
12	Kerr	Tramping in Greenstone & Caples Valleys	1987	1986	CVM
13	Kirkland	Preservation of Whangamarino Wetland	1988	1987	CVM
14	Kerr and Manfredo	Recreation at Arthur's Pass National Park and Tararua Forest Park	1988	1988	CVM
15	Kask and Maani	Value of Safer Shelters	1989	1983, 1984, 1986	HP
16	Clough and Meister	Recreation at Tongariro National Park	1989	1985	TCM
17	Kerr	Value of Mountain Climbing at Mount Cook National Park	1989	1984	TCM
18	Kirkland	Environmental Design	1989	not reported	CVM
19	Kerr	Reduction in Flood Risk from the Waimakariri River	1989	1988	CVM
20	Greer and Sheppard	Research on the Biological Control of *Clematis vitalba* for Native Bush Conservation	1990	1989	CVM
21	Nugent and Henderson	Oxford Recreational Hunting Area in Canterbury	1990	1987	TCM
22	Riley and Scrimgeour	Kauaeranga Valley	1990	1990	CVM
23	Walker	Kaitoke Regional Park recreation	1990	1985	TCM
24	Fahy and Kerr	Royal Albatross chick fatality research and Life Saving Beach Patrols	1991	1990	CVM
25	Kane	Hollyford Valley Track	1991	1990	CVM
26	Welsh	Christchurch Domestic Water	1991	1991	CVM
27	Guria and Miller	Value of a Statistical Life	1991	1989/90	CVM
28	Lambert, Saunders and Williams	Upgrading Dunedin City's Sewage Treatment and Disposal System	1992	1992	CVM
29	Lock	Possum Control Programme - For Wildlife Protection and Conservation of Species	1992	1991	CVM
30	Beanland	Preservation of Aorangi Awarua Forest	1992	1991	CVM
31	Lynch and Weber	Ashburton River Water Instream Values	1992	1991	CVM
32	Walker	Recreation at Bottle Lake Forest	1992	1989	TCM, CVM
33	Killerby	Recreational Resources at Western King Country	1992	1991	CVM
34	Mortimer, Sharp and Craig	Conservation Benefits of Little Barrier Island	1993	1991	CVM
35	Heylen Research Centre	Value of Travel Time Savings	1993	1993	CM
36	Mayer	Methven Recreational Lake Project	1994	1993	CVM
37	Cocklin, Fraser and Harte	Recreational benefits of the in-stream flows of the Upper Wanganui and Whakapapa Rivers	1994	1988	TCM
38	Gan and Zwart	Waterfowl Hunting Lease	1994	Not reported	HP
39	Vadnjal and O'Connor	Existence Value of the Rangitoto Island	1994	Not reported	CVM
40	Kerr and Cullen	Possum Protection of the Forest at the Paparoa National Park	1995	1992	CVM
41	Omwenga	Improved Water Quality of the Manawatu River	1995	1994	CVM
42	Moyle	Conservation of Endangered Species	1995	1995	GT

Study No.	Author/s	Item Valued	Publication Year	Valuation Year	Valuation Method
43	Works Consultancy Services	Stoke Bypass Property Price Changes	1995	1995	EO
44	Kerr	Entrance Fees in Wellington Parks	1996	1994	CVM
45	McDermott Fairgay Group and Valuation Technologies	Te Puke Highway Bypass	1996	1996	CVM
46	McDermott Miller	Transport System Improvements	1996	1996	CM
47	Williamson	Water Quality Improvement of the Orakei Basin	1997	1997	CVM
48	McBeth	Tongariro River Recreational Fishing	1997	1997	TCM, CVM
49	McDermott Fairgay Group Ltd.	Attendance at the Wellington Street Race	1997	1996	CVM
50	Beca Carter Hollings and Ferner Ltd and Malcolm Hunt Associates	Road Noise Reduction	1997	1993	CVM, HP
51	Ball, Cullen and Saunders	Recreation at Auckland Regional Council Parks	1997	1995/96	BT
52	Symonds Travers Morgan (NZ) Ltd and McDermott Miller Ltd	Sealing Unsealed Roads	1997	1994	CVM, CM
53	McDermott Miller Ltd	Value of Travel Time Savings	1997	1997	CM
54	Awatere and Scrimgeour	Improved Water Quality at the Manukau Harbour	1998	1996	CVM
55	Nelson	Pukekohe Groundwater Improvement	1998	1997	CVM
56	Bateman, Brouwer, Langford and Saunders	Skin Protection from Sunscreen	1998	1997	CVM
57	Guria, Jones-Lee and Loomes	Value of Human Life	1998	1997/98	CVM
58	Farrelly, Koorey, Mitchell, Nicholson and Wong-Toi	Highway Passing Lanes	1998	1998	CVM
59	Saunders	Premium for Organic Produce	1999	1998	CVM
60	Patterson and Cole	NZ Land-based Biodiversity	1999	1994	BT
61	Montgomery Watson	Recreational Lake	1999	1999	CVM
62	Cole and Patterson	Waikato Ecosystem Services	1999	1997	BT
63	McKinney	Light Rail Transportation	1999	1998	CVM
64	Moore	Community Sewage Schemes	1999	1998	CVM
65	Beca Carter Hollings and Ferner Ltd	Upgrading of State Highway 3	1999	Not reported	CVM
66	McDermott Miller	Transmission Gully Motorway	1999	1999	CVM
67	Radovich and Foster	Value Travel Time Savings in Tauranga	2000	1999	CM
68	Kerr	Water Quality Improvement in the Lower Waimakariri River	2000	1992	CVM
69	Booz-Allen & Hamilton	Value of Travel Time Savings	2000	1999	CM
70	Kerr	University Facilities	2000	1999	CVM
71	Kerr and Greer	Salmon Angling at the Rangitata River	2000	2000	CVM
72	Bond and Hopkins	Presence of Transmission Lines on Residential Properties	2000	1983-1993	HP
73	White, Sharp, and Kerr	Maintenance of the Waimea Groundwater System	2001	1999	CVM
74	Lee	Preservation of Recreational Areas in the Whangaroa Harbour	2001	2000	CVM
75	Wheeler and Damania	NZ Recreation Fishing	2001	1999	CVM
76	Kerr, Sharp and White	Domestic Water Supply in Christchurch	2001	2000	CVM
77	Kerr and Welsh	Water Pollution Reduction	2001	2001	CVM
78	Quazi	Flood Protection in the Lower Waikato	2002	2001	CVM
79	McDermott Miller	Highway bypass	2002	2002	CVM
80	Beca Carter Hollings & Ferner Mike Copeland Forsyte Research Steer Davies Gleave Ian Melsom	Transportation Convenience and Safety	2002	2001	CM
81	Craig	Preservation of Trees in 15 NZ Cities	2003	2003	CVM
82	Kerr and Sharp	Water Quality	2003	2002	CM, BT

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83	Kerr, Sharp and White	Maintenance of Christchurch River Flows	2003	2000	CVM
84	Kerr, Hughey and Cullen	Marine Recreational Fishing License	2003	2002	CVM
85	Cullen, Kerr and Hughey	Government Budget on Health, Education, Environment, Income Support	2003	2002	CM
86	Bicknell, Lamb and Kaye-Blake	Labeling of Genetically Modified Food	2003	2002	CVM
87	Kaval, Hughes and Scrimgeour	Te Kouma Farm Park	2004	2004	BT
88	Kerr, Sharp, and Leathers	Preservation Value of Rakaia River	2004	1983	TCM, CVM
89	Kaval	Recreational Value of the Maungatautari Ecological Island	2004	2004	BT
90	Kerr and Greer	Rangitata River Salmon Angling	2004	2000	TCM, CVM
91	Sharp and Kerr	Angling at the Waitaki Catchment	2005	2004	BT
92	J. Kerr	Residential Land Values in New Zealand	2005	1991-2005	HP