

Natural Resource Management and Indigenous Well Being

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Abstract

This paper considers the usefulness of a range of analytical approaches to describing the impact of natural resource management on Indigenous people. Six approaches are reviewed here with examples from the literature. These include: a well-being index approach used recently by Greiner with the Australian Nywaigi people; a replacement value approach to valuing wild resource harvests for the Wallis Lake area of north eastern New South Wales; a bio-economic approach to Indigenous/Non-Indigenous fisheries management of the Ontario Great Lakes used by Dyack; a stated preference approach used in New Zealand; a Choice Experiment in northern Saskatchewan and Alberta; and, a Goal Programming/Multi-Criteria Analysis with the Wik People from the York Peninsula in north eastern Australia. The purpose of this review is to provide a discussion document for a new project. This project is developing as a collaboration in the Murray River Basin in south east Australia with the Ngarrindjeri People. Examples highlight the challenges for measuring values and well being especially when the context implies potential tradeoffs between Indigenous interests for health of country and non-indigenous interests. References in this regard are made to sport fishery expansion in the Great Lakes and irrigation diversions for the Murray

Key Words: Indigenous; Aboriginal; well being; non-market valuation.

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Natural Resource Management and Indigenous Well Being ¹

1. Introduction

Natural resource management (NRM) has become a focus for public debate as concerns about externalities of pollution and non optimal exploitation have intensified. The concern is with ensuring sustainability of not only the extraction and environmental conditions but also the sustainability of human well being. On an analytical level, debates about how resources are managed are supported by ongoing biophysical and economic research about how conditions are changing and how the best outcomes may be sought. On another, social level, there is a growing concern that attaining the most efficient outcome possible will not always mean that people are better off. The equity issues relate to the needs of future generations as well as the needs of groups that may not necessarily have a significant economic or legal control over the outcomes of NRM. This paper addresses one such group. This is the group of First Nations (FN), Traditional Owners (TO) or more generally, Indigenous People, who may not have legal rights over property or a significant market presence in the use or extraction of resources but who derive benefits and also bear costs.

In this paper we acknowledge that these issues have no international borders. We review six research projects in Australia, New Zealand and Canada that seek to quantify the benefits that derive from natural resources for Indigenous People. Each project involves collaborative work among researchers and Indigenous Peoples and groups and each project has taken a different route to providing evidence of the benefits that are generated by natural resources. The six approaches include the following: a well-being index approach used recently by Greiner with the Australian Nywaigi people; a replacement value approach to valuing wild resource harvests for the Wallis Lake area of north eastern New South Wales; a bio-economic approach to Indigenous/Non-Indigenous fisheries management of the Ontario Great Lakes used by Dyack; a stated preference approach used in New Zealand; a Choice Experiment in northern Saskatchewan and Alberta; and, a Goal Programming/Multi-Criteria Analysis with the Wik People from the York Peninsula in north eastern Australia.

We recognize that our focus for this paper is a narrow one because there are important economic and legal issues that we do not address concerning property rights and efficient and just allocation of those rights. For this paper we acknowledge that our scope is narrow and we focus for now on taking a critical look at the pros and cons of using a range of analytical approaches at the community level to address the question of how Indigenous people value resources, in particular and ultimately, how they may be affected by NRM policy changes. In each case, the work is largely motivated by the reality that Indigenous interests for health of country frequently conflict with other interests such as sport fishery expansion in the Great Lakes and irrigation diversions for the Murray.

The work presented here is contributing to a process underway in Australia for management of over-allocated River Murray water flows. The ultimate goal of the research we report on here is to identify and quantify the change in benefits that result

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from different resource management actions or policy. As such, the objective is to identify a menu of ways that a range of approaches can be used to provide support to evidence-based policy development for NRM. Our motive for taking this journey through the methodologies and how they have been applied is to develop better ways to describe the outcomes of NRM in support of society's goals and particularly for Indigenous People. Our hope is that by sharing this work with others, their own collaborations may be made easier.

2. Background

2.1. Motivation for this Work

This paper was motivated by a desire to measure the range of benefits associated with different water uses and management practices. Research into measuring benefits that flow from water was initiated by the CSIRO² with the goal of supporting management changes for resources in general. Research is underway throughout Australia under CSIRO's Water for a Healthy Country Research Flagship for urban, coastal and other areas. The project we are concerned with here is based in the Murray River Basin of south eastern Australia. Work is underway to study a range of options to measure and understand how a range of multiple forms of benefits could be increased for the range of sectors, groups and environmental conditions. One group of interest is Indigenous Peoples.

Indigenous groups have indicated their interest in being involved in the project by pursuing a collaborative research effort with the CSIRO to help delineate the benefits associated with water management and use. Staff from the CSIRO and members of the Murray Lower Darling Rivers Indigenous Nations (MLDRIN) Confederation met two years ago to discuss common interests in supporting water management change in the Murray Basin and initiated the process of collaboration. MLDRIN includes representatives from 10 Indigenous groups from the Murray River Basin. The first step agreed upon for understanding the benefits that derive from water, is a case study collaborative project with the Ngarrindjeri people who live in the vicinity of the Murray Mouth, Coorong and Lower Lakes (Lakes Alexandrina and Albert). Collaborators include researchers from the Australian National University, Centre for Aboriginal Economic Policy Research (CAEPR), Charles Sturt University and Flinders University. While the partners have agreed to collaborate and the goal is to develop an understanding of how benefits to Indigenous people could be increased, it is not clear how benefits will ultimately be measured. How multiple forms of benefits that are identified will be measured is the challenge facing the research collaborators. This paper is one input to the process. It is intended to outline possibilities for measuring benefits for Indigenous People in the Murray River Basin. The next section sets the scene for the Water for a Healthy Country Murray Basin water benefits project by describing the study region.

² CSIRO is the Commonwealth Scientific and Industrial Research Organisation, which was established in 1926 and is the single largest employer of scientists in Australia, with more than 6 500 people conducting and assisting with scientific research at 57 sites in Australia and around the world. CSIRO's primary roles are to: carry out scientific research; assist Australian industry and to further the interests of the Australian community; contribute to national and international objectives and responsibilities of the Commonwealth Government; encourage or facilitate the application and use of the results of its own or any other scientific research. The CSIRO role is to deliver great science and innovative solutions for industry, society and the environment. We work on new ways to improve your quality of life, as well as the economic and social performance of a number of industry sectors through research and development. <http://www.csiro.au>

2.2. The Murray River Basin and Indigenous People

The Murray River is part of the Murray-Darling Basin, which is one of Australia's largest river systems extending across one-seventh of the continent from Roma in Queensland to Goolwa in South Australia. The Basin has a population of nearly two million people with another one million outside the region heavily dependent on its resources. The Basin includes the three largest rivers in Australia - the Darling River at 2740 km, the Murray at 2530 km and the Murrumbidgee at 1690 km. The Basin has been highly developed over the past 200 years and now generates about 40 per cent of national income derived from agriculture and grazing. It supports one quarter of the nation's cattle herd, half of the sheep flock, half of the cropland and almost three-quarters of the irrigated land. Water has been extracted from the Murray-Darling system for irrigation and other uses since the early 1900's, but the volume extracted has risen dramatically since the mid-1950s. While this has brought many economic and social benefits, the health of the rivers and wetlands has suffered.³ Currently, wetlands are degrading and the mouth of the system at the Coorong in South Australia has been closed for most of the last two years. The Coorong is part of the lands traditionally owned by the Ngarrindjeri people. For the Murray River, there is widespread concern that the 'Cap', or official limit, on water diversions from the rivers has been exceeded and that water is unavailable in the system to support a healthy river and floodplain environment. Quiggin (2001) discusses the problems, noting that, given water scarcity relative to demands, the common pool characteristics of the Basin water, and given the institutions governing how water is taken from the rivers, there are inefficiencies that will not be resolved easily. The consequence is that degradation has continued.

The Murray Darling Basin Commission (MDBC) is responsible under a joint agreement between States and the Commonwealth for managing the Murray River Basin water allocations in a sustainable way. Its actions have evolved over time with more and more attention directed at the allocation of water to highest value uses and to the environment. This is because the Cap is exceeded and the flow of the Murray River is over-allocated to urban and irrigation uses with detrimental impacts on environmental condition of floodplains, water levels and water quality through increased salinity.

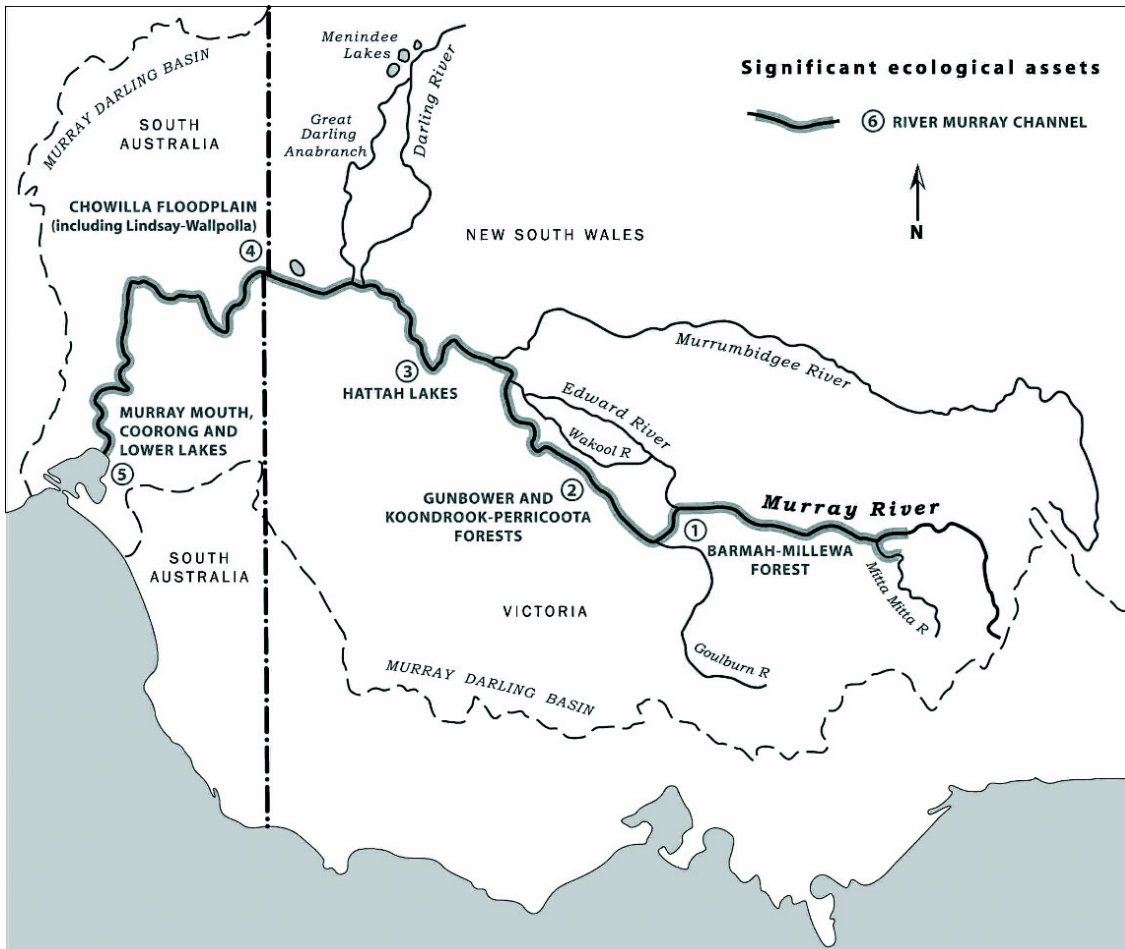
States and Commonwealth Governments have been facing political pressure over the condition of the Murray-Darling Basin. The main policy now determining investments in renewal and management in general has been in place since November 2003 when the Murray-Darling Basin Ministerial Council (MDBMC) announced The Living Murray (TLM) 'First Step Decision' towards its vision of a healthy River Murray system sustaining communities and preserving unique values (MDBMC 2003). The First Step was made in support of the more general TLM initiative, which was announced earlier in 2002 by the MDBMC with the goal of taking collective action to return the River Murray to the status of a 'healthy working river' thus addressing the degradation that has been evident in the decline in native fish populations, decline in wetlands and decline in water quality (MDBMC 2002).

One of the key objectives of the intergovernmental agreement supporting TLM First Step includes a commitment to invest \$500m over five years in cost effective, permanent,

³ Information is from the MDBC website: http://www.mdbc.gov.au/river_murray/river_murray.htm

recovery of water to achieve environmental outcomes. In terms of volumes of water, up to an estimated average of 500 GL/year of 'new' water over a five year period is committed to what have become known as 'environmental flows', with this water coming from 'a matrix of options' including infrastructure improvements and rationalisation, on-farm initiatives, efficiency gains, market based approaches and purchase of water from willing sellers (MDBMC 2003). The focus of the environmental flows is on specific iconic sites along the Murray where there are Significant Ecological Assets (SEAs) including sites of significance to bird breeding and feeding and native vegetation. The River Murray channel is one of the six designated SEAs, as illustrated in Figure 1.

Figure 1: The Living Murray – Location of the six significant ecological asset sites



Source: Murray-Darling Basin Commission

The Murray-Darling Basin Ministerial Council also has supported the development of the Murray-Darling Basin Indigenous Action Plan, which recognises Indigenous interests. Determination of these interests, their measurement, evaluation and prioritisation in overall planning for the Basin are as yet not well defined, however there has been a commitment to appoint Indigenous officers to monitor and advise on the placement and construction of new engineering works in a sensitive manner so as to not disturb significant cultural heritage sites.

In addition, there has been some work done to survey the socio-economic characteristics of the Indigenous population of the Basin. What is important here is the finding that the share of the population that is Indigenous is growing and it is growing in the young age groups as well as through returns to country of older Indigenous people later in life. However, with life expectancy at less than 50 years of age, this is not an elderly population. In 2001 the total estimated resident population of the Basin⁴ was just over 2million and 3.4 per cent were Indigenous People (approximately 70,000) with a share of 4.2 per cent in non urban centres. This compares with a share for all of Australia of 2.4 percent. What is significant is that the share has grown in the Basin by 13 per cent since 1996 with the share of population of non-Indigenous people falling. Indigenous population of the Basin grew at five times the rate of non-Indigenous population. A major contributor to this shift is occurring with an out-migration of young non Indigenous people that outweighs the losses of Indigenous young people. The Indigenous share of the population of

the Basin is predicted to continue to increase. Taylor and Biddle (2005) estimate that the Indigenous share of the population will grow by 44 per cent from 2001 to 2016. This growth in the share of the population is an indicator of the need to understand better the needs and priorities of this group in resource management.

In terms of economic interest and control, the extent of the asset base is of Indigenous people in the Basin is not clearly known, however, the income figures do not indicate that there could be a very great saving and investment effort from the relatively low income levels. The income figures reported by Taylor and Biddle indicate that of the total \$35b in gross personal income accruing to adult residents of the Basin in 2001, only 1.6 per cent went to Indigenous people despite the fact that they represented 2.9 per cent of the adult population up to the age of 65 and only 1.2 per cent of the total regional employment income went to the same group. This is because approximately 38 per cent of total Indigenous income is attributable to 'welfare' sources such as the Community Development Employment Projects (CDEP), compared to only 19 per cent for non Indigenous income.

In response to TLM and in support of the Indigenous interests and Indigenous concern for country, Morgan, Strelein and Weir (2004) introduced the idea of 'cultural flow' allocations to support the health of the river and surrounding lands in a holistic way. While The Living Murray initiative has allocated funds to support environmental flows, cultural flows per se have not been addressed through funding allocations. One approach to dealing with the question of cultural flows is to consider the benefits that would be associated with the flows in a parallel process to understanding the environmental benefits that follow from environmental flows. While not the same, this approach may have the potential to engage managers by relating to a topic with which they are familiar.

⁴ These shares refer to the whole of the Murray Darling Basin of which the Murray Basin forms the southern portion. Figures for the Murray are not available independently at this time.

3. Benefits

The goal of the CSIRO and Ngarrindjeri collaboration between researchers and Indigenous People in the Murray Basin is to delineate benefits that derive from water for Indigenous People in support of more informed water resource management. Benefits are assumed here to include the sum of values attached to resources and the outcomes deriving from them. Values are both for use and non-use. Values also derive from market and non-market returns from the resource. Hence, water is used directly in a market sense for drinking where the alternative is bottled water, perhaps, and water supports fish, a further consumable with a market value. Water also supports non-monetary, non-use values attached to a sense of place, importance of living on 'country' as ancestors had done and a sense of well being from being attached, and responsible for country. Non-use values can incorporate non-monetary, bequeath values to future generations as well. If the resource declines in value, through quality reductions or introduction of predator species or pollution, then the use and non-use values decline. To the extent that these changes in value are measurable and subject to management discretion, the value (or cost) of management decisions can be estimated. The methods described below take a number of perspectives on benefits and the values that determine them.

4. Measuring the Value of Resources

In this section we survey a range of approaches for measuring the benefits that derive from resources. Our main interest is in measuring benefits that flow from water resources, however, the review here draws upon research that covers the range of natural resources. Some take a comprehensive approach and measure changes in well being while others measure values on a more restricted, micro basis, such as replacement value. The emphasis here is on examples of how the approaches have been used and the advantages and disadvantages of the approaches. The final few examples provide alternatives to values measurement taking the position that it is not possible to measure the benefits and that the best management approach is one that takes into account that the benefits exist, although unquantified.

For each of the studies, we provide the key aspects that distinguish the approach used. We refer readers to the references for details about monetary estimates and further details, because our interest here is not on the details of research done elsewhere but instead on the methodological approaches and their usefulness in application to the challenge of measuring benefits that derive from water for Indigenous people in the Murray River Basin.

4.1. Well-being approach to measuring the value of resources - The Nywaigi People, North-Eastern Australia

The research by Greiner et al. (2005) seeks to identify the value of natural resources – through use and non-use – for one Traditional Owner group, the Nywaigi language group, in North-Eastern Australia through a well-being approach. “Well being” is an inclusive concept, integrating aspects of human life such as economic opportunity (employment/income), health (mental/physical), country and culture, among others. It offers an alternative perspective to the economic concepts of utility and welfare, which

are typically applied in a narrow sense dealing with monetary measures and preferences.

This work was motivated by a perceived need on the part of natural resource managers in Queensland and the Nywaigi people that NRM policy development would be improved by a better understanding of what mattered to people and how their well being was affected by resource management. In particular, the approach taken has a number of purposes that are listed below:

1. The approach taken is readily repeatable with other Traditional Owner groups and can thus it helps to provide a comparative analysis of what things matter (most) to different groups. Similarities and differences can be established. Requirements for different Traditional Owner groups can be articulated and explained on the basis of systematic research and solutions developed for group-specific problems.
2. By providing understanding of issues it delivers important clues for policy and service prioritisation. The depth of information complements regional statistics, which typically include standard quantitative indicators of well-being, including age structures, employment, house ownership.
3. The quantitative aspect of the research, if repeated in intervals, can help measure changes in well-being over time and assist with the evaluation of policies and programs.
4. By being part of the research, Traditional Owners and their representatives gain more understanding of themselves, have opportunity for self-reflection and articulation, and research collaborators gain methodological experience.

The conceptual approach is guided by a number of existing models that are useful for providing the principle connection between humans and the natural environment (Table 1).

Table 1: Comparison of domains contained in various human – ecosystem well being models

	Person-environment relationship (Mitchell, 2000)	Concept of liveability (van Kamp et al, 2003)	Millennium Assessment Framework (MEA, 2004)	ABS concept (based on OECD, 1976)
Social equity	Community	Community	Material minimum	Family and community
Conviviality	Health	Health	Health	Health
Opportunity	Personal development	Personal development	Good social relations	Education and training
Accessibility	Goods and services	Economy	Security	Work
Liveability	Physical environment	Natural resources	Freedom of choice	Economic resources
Sustainability	Security	Built environment		Housing
		Services accessibility		Crime and justice
		Lifestyle		Culture and leisure
		Safety		
		Culture		
		Natural environment		

The person-environment model (Mitchell, 2000) examines a combination of measurable spatial, physical and social aspects of the environment and a person's perception of these. The perception is not only related to the objective characteristics of the environment but also integrates personal and contextual aspects. The model is a "thinking model" and presents layers of concepts that are related to each other.

The concept of "liveability" (Pacione, 2003) refers to the conditions of the environment in which people live (for example: air and water quality, state of housing) and the attributes of people themselves (such as health or educational achievement). Examples of various definitions of "liveability" are given in van Kamp et al. (2003). Veenhoven (1996, in van Kamp, 2003) describes the concept of liveability as quality of life of a nation and the degree to which its provisions and requirements fit with the needs and capacities of its citizens. Newman (1999, in van Kamp, 2003) notes that liveability is about the human requirement for social amenity, health and well being and includes both individual and community well being.

The main differences between the various models relate to object, perspective and time-frame (van Kamp et al., 2003) Some concepts are primarily related to the environment, (physical, built, social, economic and cultural), while others are primarily related to the person. Some are normative while others are person-based/experiential. The time frame of the concepts of well being, liveability and quality of life tend to focus on the 'here and now' and are less concerned about long-term considerations associated with the notion of sustainability.

The empirical aspects of the research adopt a subjective experience approach to the concept of well being. It reflects on how well one's life is going on balance, and a sense of the extent to which one feels life as enriching or rewarding. A person's assessment of well being is based on his/her personal characteristics and circumstances. Well being is determined by a suite of factors, which vary in the literature but broadly encompass material sufficiency, health, social relations, security and freedom of choice. The state of the natural environment and its ability to provide ecosystem services greatly influences the state of many of these factors.

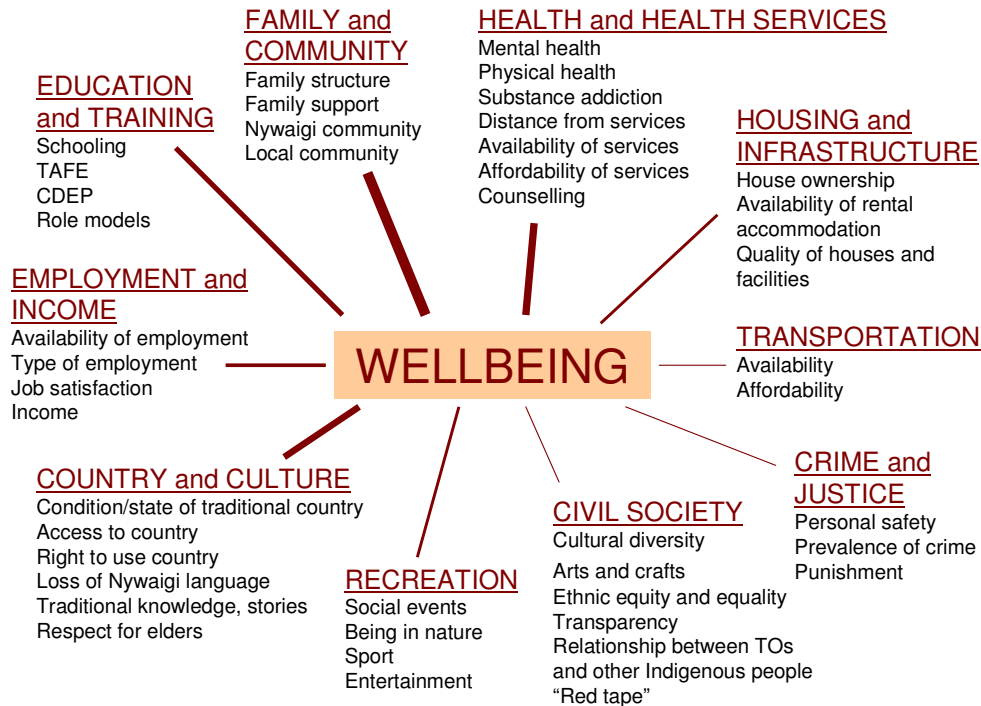
The research method negotiated with the Nywaigi Traditional Owners was focus group discussions. The various insights developed by each focus group into what contributes to and detracts from well being are consolidated into a model of Nywaigi well being (Figure 2).

'Family and community' is the single most important domain of well being, based on the close ties that exist among members of (extended) family, which are also manifest in sometimes large families living together as households. Health is identified as a key contributor to well being. Substance abuse and addiction, and the state of health services are key issues on the mind of Nywaigi people.

'Country and culture' are identified as critical determinants of well being. Country and culture are seen as intrinsically linked to the identity of members of the Nywaigi community. There is a strong sense of loss and frustration at the extent to which traditional knowledge, stories, lore and understanding of country have been lost. This is regarded as the root of many social problems that Nywaigi people are facing today.

Figure 2: Model of Nywaigi Well being

Note: the thickness of lines indicates the relative importance/contribution of the domain to well being



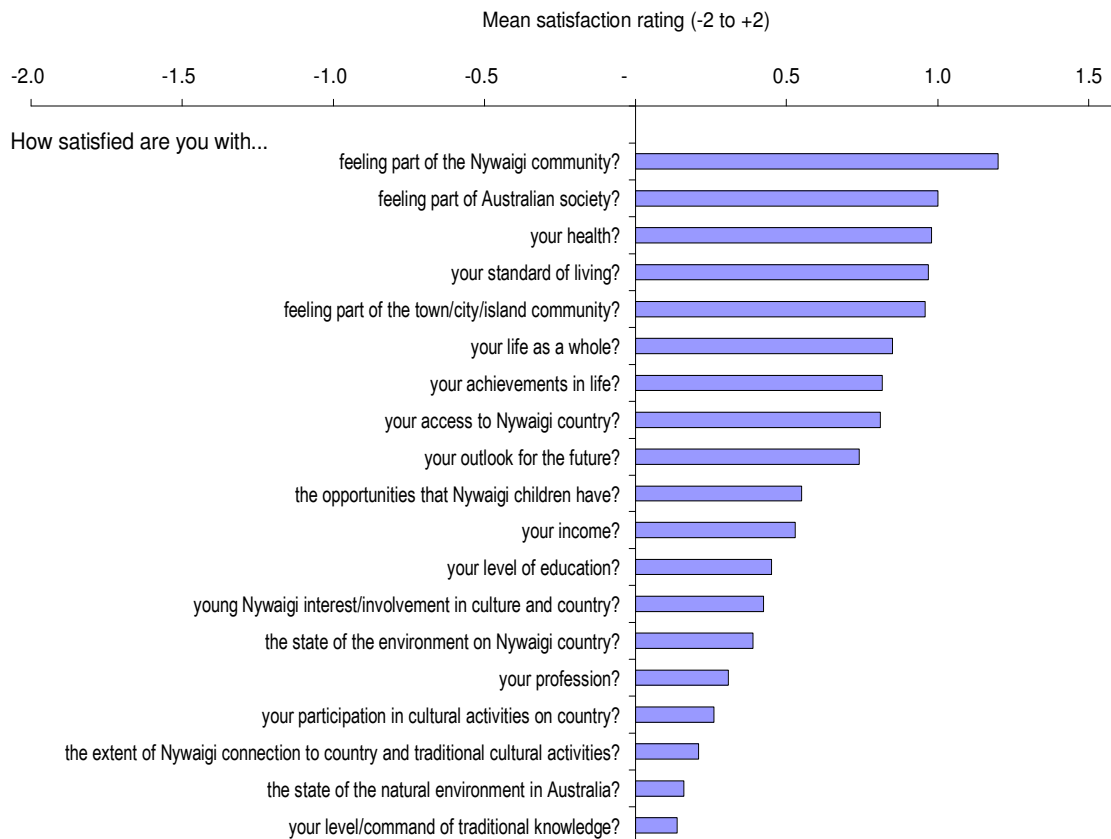
Greiner et al. (2005) complement the qualitative approach given in Figure 1 with a survey of workshop participants. The main reason for including a short questionnaire as a research tool at the end of the focus group discussions was to generate a quantitative data base that:

1. Provides complementary quantitative information, which might enable triangulation of the qualitative information;
2. Assists the integration of data across all locations and across all segments of the Nywaigi population; and
3. Makes it possible to compare aspects of Nywaigi life with other quality-of-life statistics compiled. The questionnaire is partially based on the Australian Unity Wellbeing Index (Cummins et al, 2001, Cummins et al, 2003 and Cummins et al, 2004).

Respondents were asked to rate their satisfaction with a series of attributes relating to life in general and to Nywaigi issues on a five-point scale from “not satisfied at all” to “highly satisfied”. For analytical reasons, the answers are coded as ranging from -2 (not satisfied at all) to +2 highly satisfied). Figure 3 provides an overview of the survey results. It shows the mean values of scores obtained for each attribute.

Research participants express their highest satisfaction rating for ‘feeling part of the Nywaigi community’. They are also generally satisfied with life as a whole, their health (adult Nywaigi tend to be less satisfied), being part of Australian society and being part of their town/city/island community. Respondents are least satisfied with their level of traditional knowledge (men are less satisfied than women), the extent of Nywaigi connection to country and traditional cultural activities. Women tend to recognise the interest of young Nywaigi in culture and country.

Figure 3: Mean satisfaction with attributes; sorted by mean values



The research outcomes have been readily accepted by the key stakeholders of the research who are

1. The financial sponsor of the research, the Burdekin Dry Tropics Board, which is a regional natural resource management body in North-East Australia. The Nywaigi people are one of 11 Traditional Owner group in the region which the Board administers.
2. The official representatives of the Nywaigi Traditional Owners, specifically Giringun Aboriginal Corporation and the Nywaigi Land Corporation.

Research questions and methodology were developed in collaboration with both stakeholders and the research team liaised with both on an ongoing basis and provided regular updates.

The research has also received much interest from Queensland State Government departments, specifically the Department of Communities and the Department of Aboriginal and Torres Strait Islander Policy. Multiple briefings and presentations were provided to bureaucrats at the levels of regional manager and senior policy advisors. The research results were influential in the process of “Girringun Round Table” discussions, which sought to establish a Federal/State co-funding model for the Girringun Aboriginal Corporation as a key service provider to Traditional Owners in North-Eastern Australia. However, these discussions have as yet not been resolved, a major stumbling block being the issue of representation of Traditional Owner versus Indigenous People in general.

A follow-on project has recently been established and received funding, which will provide an institutional analysis of Girringun Aboriginal Corporation and seek to quantify the impact on Traditional Owner well being generated by the services which Girringun provides.

This approach would be useful to use in the Murray River Basin because it is a comprehensive approach that could be used to help identify values and priorities and provide a benchmark for future evaluation.⁵ It would also provide a productive process for learning between researchers and Indigenous people in the Basin. Running a parallel non-Indigenous valuation would be a novel addition that could build cross cultural awareness as well. The challenge would be in applying the approach across language groups, Traditional Owner groups and other Indigenous residents since there is no homogeneity expected across groups. One way of dealing with this challenge would be to identify groups that could self identify as group members with preferences that could be aggregated for the purposes of producing the index, however, assigning group weights would still be challenging.

4.2. Replacement Cost Approach to Measuring the Value of Wild Resources – The Wallis Lake Catchment

A replacement cost approach includes a much narrower definition of values than the well-being approach discussed above. The replacement cost approach deals with one activity - wild harvests - and their substitute value in the market. The motivation for the work, the methodology and its usefulness are discussed below.

Jon Altman, Matthew Gray and Natane Halasz of the ANU CAEPR group were contracted by NSW Department of Environment and Conservation to develop a cost-effective methodology for estimation of the value of wild resources to Indigenous communities with a small pilot study. The task was to provide a methodology for measuring values of resources to Indigenous people in a way that would be accepted by

⁵ An extension could be the UN Human Development Index as used by Cooke et al. (2004) in Canada, however, the statistical base in Australia may be a limiting factor and at its best this indicator is useful for whole-of country comparisons rather than for evaluation of local conditions. Furthermore, the index uses three types of indicator, income, education and health whereas well-being goes beyond these three indicators as discussed in this section. However, this approach should be followed up in more detail.

the people and also repeatable over time and across different groups. The goal was to determine a methodology for measurement that could provide input to management and prioritisation that included Indigenous interests. The goal was to provide an assessment of whether the use of wild resources by the Indigenous population is significant and to provide an order of magnitude for their value. It was anticipated that the information provided in their report would be of value to the NSW Government's ongoing Comprehensive Coastal Assessment (CCA) process by quantifying one category of the economic value of natural resources in the CCA study area. The CCA process is primarily about collecting information on the value of different uses of coastal areas of NSW and developing decision-making tools and methods (Altman et al. 2004, 2005).

The study was also motivated by the fact that there is no reliable national information on use of wild resources by Indigenous Australians. The *1994 National Aboriginal & Torres Strait Islander Survey* (ABS and CAEPR 1996) is the only nationally representative survey with any information on use of wild resources but the use of wild resources is asked only as part of a question on voluntary work with the estimate of 6.3 per cent of the Indigenous population being engaged in hunting, fishing and gathering bush foods seeming implausibly low. The *2002 National Aboriginal & Torres Strait Islander Social Survey* asked about use of wild resources in the previous three-months only in remote areas with findings indicating that 52 per cent participated in very remote areas and 16 per cent in remote areas. The Wallis Lake study was intended to provide better micro data that could be more useful in regional planning than these disparate estimates.

The study area was the part of Great Lakes region of the mid-north coast of NSW covering 1440km² in either coastal plain and estuary or ridges and valleys. The land use is 39 per cent cleared for agriculture, mining and infrastructure, five per cent developed for urban & rural residential uses and nine per cent managed by the NSW National Parks and Wildlife Service.

For the Indigenous people of Wallis Lake, the harvesting of wild resources is not seen as a recreational activity. They say that harvesting is done because it is a customary activity and part of being Indigenous as well as a means of obtaining food. As noted by Gray these reasons are very different from the reasons given for fishing as reported by the Australian population as a whole. The reasons given for fishing are to relax and unwind (37 per cent), for sport (18 per cent) to be with friends (15 per cent), to be outdoors (13 per cent), and for food (eight per cent) (National Recreational and Indigenous Fishing Survey 2000-01).

The Altman et al. study considered only economic benefits accruing from the direct use of wild resources through consumption of wild resources harvested, use of wild resources as an input into something which is sold (for example, a work of art) or employment resulting from connection with wild resources. Economic benefits were calculated using market prices to calculate the market replacement value of the wild resources harvested.

Information was collected about average amounts of each species harvested, number of people harvesting each species, market price of each type of wild resource and costs of harvesting the wild resources. The method of collecting information was a retrospective questionnaire in an interview situation with information collected from 10 interviewees about amounts of each species harvested over previous 12-months for 27 members of the Indigenous community. Interviews were conducted over four days in July 2004.

There is a wide range of wild resources non-commercially harvested, with the use of the terrestrial plant and wildlife primarily symbolic and cultural the vast majority aquatic. It was decided that due to the scoping nature of the study and its small scale, only aquatic based resources would be used in the economic valuation. This covered 33 species. The total value of resources to the whole community was estimated from the sample as the midpoint from the high catch harvesters versus the low catch harvesters in proportion to the sample population. Using this method, the estimate Altman et al. found was that harvesting of wild resources represented about five per cent of total income for the community.

This approach provides a good first step in understanding the harvesting activities and ways of the people as well as a way to learn about what matters to the people. A replacement cost approach does not, however, provide estimates of total value. Neither does this approach provide indications of the way values would differ under different management strategies. The stated preference methods described in section 3.4 below provide opportunities to go beyond replacement value of currently extracted resources and to explore the way values change when site conditions change.

4.3. Optimal Resource Extraction in a Holistic Community Assessment – The Chippewas of Nawash First Nation, Great Lakes, Ontario, Canada

The work described in Chami et al. (1997) seeks to contribute to an understanding of how well the Nawash community are managing their resources, how well regional NRM of a shared fishery is supporting the wellness of the Nawash community and how management could be improved. The approach taken focuses on the Nawash whitefish commercial fishery with an economic analysis and then provides the results within the context of the importance of the economics as a basis of cultural, social and economic well being for the First Nation. The approach taken is characterized by three steps:

1. A direct estimate of economic values using a bio-economic model of the fishery that focuses on optimal resource extraction
2. Evaluation of this estimate within the context of the community and its culture and social structure as well as its control over its environment
3. Sharing of this information with the wider community including provincial natural resource managers

The Nawash people sought an opportunity to work collaboratively with a group of economists and with a fish biologist from the University of Guelph in 1996 in order to explore the opportunities to improve the management of their fishery. Although the basic expertise of the outside team was either economic or biophysical, it was clear that it would only be possible to evaluate the management of the fishery within the more general context of the culture of the people. However, the contributions of economic analysis were sought by the Nawash as a tool with which to communicate with provincial managers and other groups. Hence, the approach taken was to evaluate the economic implications of different management approaches, quantify these in market terms and

then to put this information within the context of the cultural and social values of the Nawash people. This approach is explained here.⁶

The Chippewas of Nawash First Nation is located at Cape Croker, Ontario approximately 64 km north of Owen Sound and an approximately four-hour drive west-north-west of Toronto. The First Nation lands are comprised of 15,500 acres with three sides surrounded by the waters of Lake Huron and Georgian Bay, both part of the Canadian Great Lakes in central Canada.

The key concerns about the value of the resource and how it affects community well being includes the following:

- Could the fishery be managed better so as to improve the long term sustainability of the fishery resource?
- Is there a better way to optimize the catch?
- Is there a better mix of boat and other capital stock than is currently used?
- Is Georgian Bay generally being managed to support sustainability of the commercial Nawash fishery?

Key characteristics of the fishery and the community:

- Given the nature of the reserve and its region, fishing is, and has always been, the main source of on-reserve employment that is not within the public service.
- The Nawash fishery is unique in Canada in that it is managed by the owners of the resource. This right was recognized by the courts in 1994 when it was established that the Nawash had operated a commercial fishery before first European contact.
- Other commercial and recreational fisheries in the Great Lakes are managed by some level of government.
- Nawash community involvement in their fishery is characterized by small size and close contact among fishers thus indicating a good set of circumstances to encouraging good resource stewardship and optimal extraction and internalizing of stock externalities that are typical of fisheries and which typically lead to economic over-exploitation. These community characteristics have the potential to avoid the open access problems typical in common property resources without intervention.
- A major concern is that the whitefish stock, which is the commercial catch of the Nawash fishery, is being depleted by habitat competition and predation by salmon. Salmon are not native. They are stocked by the sports fisher community which lives outside the Nawash community and typically is not permanently local.
- Salmon may not be caught commercially, they are strictly for recreational use and they do not reproduce naturally in the Great Lakes.
- Information has been gathered collectively through interviews and sharing of memories.

Based on the information gathered, a bio-economic model of the fishery was constructed which indicated the following:

⁶ For the most part, this section draws directly from the report presented to the Nawash which is summarized in Chami et al. 1997.

- Through its effect on stock size and optimal harvest of whitefish, salmon predation has a significant negative impact on the present value of the Nawash fishery.
- It is likely that the fishery is over capitalized.

These general results would hold under a range of circumstances, however, better biological information on all fisheries and the rate of stocking of exotic species is required to derive specific management changes for the fishery.

The economic evaluation was assessed within the context of community well being and the realities of the control the Nawash have over the joint use of the Great Lakes to support a number of fisheries. The main conclusions of the research were:

- A lack of opportunities for investment off reserve is potentially encouraging over-investment in the fishery.
- Due to the importance of the fishery to the community, the decline of the fishery would cause non-trivial community-wide impacts on the Nawash.
- Predation and habitat competition by stocked exotic fish are detrimental to the Nawash commercial fishery, under any set of parameters, however, there is no mechanism by which the Nawash could control this effect, which was modeled as pollution.

The outcome of the collaborative work was far-reaching. The results were shared widely with resource managers and management strategies were modified. The success of the process has no doubt been due to the following key aspects of the approach:

- Information was collaboratively generated.
- Information was freely shared.
- The information was provided in a way that managers could understand. This applies to the Nawash people, the state managers, the fish biologists and the recreational fishers. Previously heated confrontations and intimidations reported in the press were defused by the objective analysis.
- The information provided was both quantitative and qualitative, which allowed a range of interested groups to understand and identify with the conclusions.

This work has continued with improved biophysical information gathered, further analysis and a more comprehensive and inclusive resource management approach being developed and adopted over the past decade (Chami et al, 1997; Crawford 1996).⁷

4.4. Stated Preference Techniques

Stated Preference techniques including Contingent Valuation and Choice Experiments provide the opportunity to ask respondents through a survey or interview technique how values change for them under altered conditions.⁸ They also allow for estimates of welfare change and also for investigation of preferences. Contingent Valuation may be

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http://www.uoguelph.ca/%7Escrawfor/research/research_greatlakes/research_greatlakes_fisheries/research_greatlakes_fisheries_basins/research_greatlakes_fisheries_basins_huron_basins_commercial.shtml

⁸ The appendix to this paper provides a glossary of terms.

limited in its usefulness for Indigenous communities, however, for a number of reasons including the fewer economic experiences and alternatives typical of this group in most situations and also given the cultural approach where health of country is basic to all existence and cultural context and continuity and therefore, comes without a price tag. Alternatively, as discussed below for one case study, the opportunities for Choice Experiments may be very promising.

4.4.1. Contingent Valuation Method (CVM)

Shaun Awatere (2004) used a CVM approach to estimate the values held for changes in the environment in New Zealand where the response was expected to be culturally influenced. He used cultural indicators to segment the respondents by their commitment and involvement in Maori cultural issues including language (Te Reo), Whakapapa (genealogy), Tikanga (Maori world view and whanau (other Maori). The Maori world-view is holistic in nature because it embodies historical, environmental, and spiritual values as well as modern experiences.

The case study used was the 'Improvements to the Road Surface and Roadside Survey', which was mailed out and designed to be have equal explanatory power for both Maori and non-Maori respondents. Two sets of willingness-to-pay options were offered. One offered improved road services and the other offered improved native plantings for roadsides thus improving mainly scenery, biodiversity and erosion control. For the first, the value would be reduced costs in the form of noise, fuel usage and increased braking capacity. For the second, the costs would be higher for indigenous plantings. Also included were cultural knowledge questions for the Maori respondents. The results indicate that the willingness to pay was not dependent on cultural knowledge with all Maori willing to pay more for improved plantings and for environmental improvements in general.

Awatere interprets the results as indicating that to all Maori, it is not appropriate to ask the monetary value of the life giving force of mauri (life force). This is not only because the question may not make sense but also that there may be a perception that there is an intrinsic right to ownership that should not have to be paid for. This has been discussed widely elsewhere (Godden 1999; Adamowicz et al. 1998) In future studies, if CVM is pursued, he recommends that alternative payment vehicles should be tested including labour or knowledge contributions.

4.4.2. Choice Experiments (Choice Modeling – CM)

Two studies of the value of non-timber resources to Aboriginal People of the northern Saskatchewan and northern Alberta boreal forest in Canada report on the usefulness of stated preference and revealed preference approaches (Haener et al. 2001 and Adamowicz et al. 2004). In the first, a stated preference approach is used and in the second, a combined stated and revealed preference approach is used with the stated preference information used to account for limitations in the revealed preference approach. The authors note that stated preference (or a choice experiment), is useful because the changes induced by management of forest resources, extraction and development in general have changed the forest from any state familiar to current users and therefore revealed preference about response to these states is unavailable. Choice experiments allow the consideration of hypothetical cases that can allow consideration of these altered states. Two further reasons for using a stated preference approach

include: the reality that traditional ways have been weakened with weakened connections to the land due to migration, population pressures and changing preferences thus revealed preference techniques may not give a good indication of future patterns of activity and, stated preference technique can address choices without revealing private information. When sacred hunting or fishing sites are at issue, this is a valuable attribute of an approach. People can respond to the choices without revealing the secret information. This is in direct contrast to Altman et al. (2004), who also conducted interviews but who did ask for information that may have been considered to be private. There are two considerations here, either the interviewer would need to be adept at extracting good information or the information extracted may be incomplete. There are ethical considerations with the first and accuracy considerations with the second. Offering choices under the stated preference approach does not eliminate all the problems since the choices must reflect real choices and these can only be determined with good, candid local input to the actual situations faced by those using wild resources.

Haener et al. (2001) discuss the importance of trust and reciprocity, or gift giving, during the interview process as well as the importance placed on sharing results with not only the respondent group but also with resource managers as users saw this as an important purpose for sharing with the researchers. Results indicated that the value estimated using replacement value of meat is similar to the value of the trip as a whole using choice experiments. However, the stated preference approach is preferred for the reasons discussed above and below.

While the earlier study focuses on monetary welfare measures (Haener et al. 2001), the second (Adamowicz 2004) extends this by incorporating revealed preference data so as to develop spatially explicit models of resource use. Information was gathered on special sites, which is an important recognition of Indigenous ecological knowledge and contributed to a supplementary 'zonal' approach to resource management where special sites could be identified, mapped and excluded from logging. The zonal approach is one way to incorporate Indigenous values directly into the management plan without having to estimate the dollar value of the sites. Revealed preference information about actual harvests was collected as well as stated preference information for the identification of preference for attributes of wildlife harvesting sites where the preferences were influenced by values held for the total experience of hunting and gathering. Data were also gathered about forest characteristics from the forestry company.

The circumstances related to development and the emphasis on eliciting values so as to influence management in these Canadian studies are key similarities with the Murray River research being pursued by CSIRO in collaboration with the Ngarrindjeri people. For the same reasons, it is likely that a stated preference approach would be a good process to use once the initial information was gathered together in a more direct, revealed preference approach. As Haener et al. discuss, stated preference can address change in conditions as a 'package' in a way that is more closely aligned with the Aboriginal approaches to holistic environmental well-being and their place in that environment. Replacement cost can only consider the value of a particular part of that environment – fish or moose harvest, which is limiting when a holistic approach makes more sense to the group being considered. However, there are challenges in estimating monetary values when it is difficult to estimate the opportunity cost of time for a group of people not fully active in the labour force. Resource compensation techniques may

provide an alternative approach. Morrison and Hatton MacDonald (2006) suggest a budget re-allocation approach for an alternative payment vehicle that should be pursued.

4.5. Use value and Non-use value

The approaches referred to above estimate use values. Rolfe and Windle (2003) address non-use values in a study that used a stated preference approach to estimate the value of cultural heritage in the Queensland Australia, Fitzroy Basin. They found that the Indigenous group valued cultural heritage more highly than the non-indigenous groups when there were potential tradeoffs between protection of cultural heritage and development of water resources. The study raised issues about how valuations by different Indigenous groups, Traditional Owners and other resident Indigenous People could be aggregated together and aggregated with non-Indigenous groups to estimated total values. It was clear that preference sets are based on different foundations and therefore aggregation would be inappropriate. A further process for assigning relative weights for each group's values would be required for NRM decisions.

5. Goal Programming – The Wik People of Cape York Peninsula, Queensland, Australia

Venn and Quiggin (2005) suggest that price-based approaches to valuation, as discussed above should be replaced by or complemented by quantitative constraints that reflect the acknowledgment by planners that rights should not be violated. They suggest a Multi-Criteria Analysis approach (MCA) in the form of goal programming, which is a continuous and quantity-based MCA Technique. This approach was used with the Wik, Wik-Way and Kugu people (Wik people) of Aurukun Shire on Cape York in Northern Queensland, northern Australia.⁹ The goal with this research was finding a design for the commercial extraction of forestry resources that was compatible with the culture of the people. The Indigenous People were not involved in the model design but they were involved in weighting a comprehensive set of feasible options. This was done in a culturally sensitive way during rest periods and traditional and contemporary land management planning sessions (Venn 2004).

Venn interpreted the five goals for planning to be:

- Maximise total employment generation
- Maximise employment generation on country
- Maximise income generation, measured in millions of dollars
- Minimise forest area harvested south of the Archer River, as protection for cultural heritage, environmental protection and development of other economic ventures such as eco-tourism
- Minimise forest area harvested north of the Archer River and outside of mining leases, for similar reasons to above

Shadow prices can be derived for the non-monetary goals. Although goal aspiration levels could not be identified, tradeoffs that implied weights could be identified in some cases, however, the Wik people have not yet come to a conclusion about a specific strategy and are using the tool to continue to consider their options.

⁹ They discuss the drawbacks of Cost-Benefit analysis that would use a price-based approach to including values. Some of these issues are raised in the Appendix to this paper for those less familiar with the techniques.

Given the wide variance of Indigenous People, including Traditional Owners, it is questionable if this approach would be appropriate on a Basin-wide scale for the Murray, however, in a local region, as for the Ngarrindjeri case study, weighting of options could be incorporated in the overall evaluation of options and opportunities of value to the Ngarrindjeri. In addition, using stated and revealed preference as part of the information base of a goal programming/MCA could enrich the understanding of options and perhaps encourage more clear choices and weighting for the Ngarrindjeri than was possible for the Wik people. This option could be explored collaboratively during the process of understanding what is important to the Ngarrindjer people.

Venn and Quiggin (2005) caution against the use of willingness-to-pay approaches for a number of the same reasons discussed elsewhere in this paper, however, they emphasise that using a valuation approach may be an inappropriate strategy for policy analysis in part because any values that are incomplete could compromise the native land title claims made by traditional owner groups. This is an important point and needs to be heeded but we do not agree that partial information is necessarily bad information. If the information is gathered within a context that clearly defines it as partial, then there can be no claim that the partial value covers total value.

Venn and Quiggin recommend an iterative approach that does not involve economists 'parachuting' in to communities to elicit values using techniques that are incomprehensible to the people. We agree that this would be a costly option both in monetary and non-monetary terms. It would not be useful. For this reason, we have worked over the past two years with the people in the Murray Basin to understand what can be done. This paper and the work it summarises for others, contributes to a sharing of information and inclusion of the people in a process of finding a workable solution to understanding values, benefits and acceptable management options.

Venn and Quiggin also recommend a quantity approach that is bounded by minimum acceptable protection levels for cultural heritage as constraints bounding the decision space. As an overall management planning tool this approach could conceivably circumvent the focus on values and benefits that derive from water in the same way that the MDBC used background information about bio-physical and economic outcomes of various environmental flow options to decide to allocate 500GL under The Living Murray First Step Decision discussed above. However, for TLM, there was a great deal of valuation work done that underpinned this decision and it is likely that any further decisions concerning cultural flows, for example, would need to be supported by a similar range of informative studies that address the values of the diversions, if not the exact total monetary value (For example: MDBC July 2004; Brennan 2004; Bennett 2002; CRCFE 2003).

6. Conclusions

As this review has illustrated, there is no one way to evaluate benefits that derive from resources when there is no simple set of market prices for valuing the outcomes. The challenges are greater than for activities such as agriculture where much of the value would be expected to be for market. The ultimate challenge is to adapt the tools we have to a situation that reflects the social welfare concepts that are relevant for Indigenous communities and individuals. The emphasis is on developing an approach that draws on

established approaches, and is firmly based on a collaborative process that seeks to find a common language and common understanding of what it means to estimate the value of resources to specific groups or communities of Indigenous People.

As this overview has indicated, replacement value provides a first step in the analysis of how resources are valued but this approach does not allow for estimates of changes in value if future conditions were to change. For this, the bio-economic modelling as for the Nawash fishery can provide estimates of the impact of management change. Stated preference methods such as CVM can provide further information about values as a willingness-to-pay estimate. Where CVM falls short in being able to value changes in intangibles such as cultural identity, Choice Experiments could indirectly elicit information about the cultural values attributed to different potential outcomes. In the limit, where values are not estimable, a goal programming approach that acknowledges a necessary amount of cultural flow, may be a beneficial approach. This would address 'cultural flows' as described by Morgan et al. (2004), in a way similar to environmental flows allocated under the MDBC Living Murray initiative. In this approach, there is no value of the environment that is estimated as such. It is assumed that the environmental flows will be sufficient to attain positive outcomes. These positive outcomes reflect a change in condition that could be measured ex post any augmented flows. Key here is that although the total value is not known beforehand, it is accepted that the value is positive and a decision to provide an allocation is made. However, as noted above, a great deal of supportive information was available before TLM First Step was taken.

Given the options discussed in this paper, there is a range of approaches that could be taken to valuing water. Each has some contribution. Given funding, time and researcher constraints, the analysis may be best approached in steps starting with a revealed preference or simple replacement value approach. The value of doing this is manifold. It can generate partial, 'ready' results quickly that are tangible and easy to communicate with management agencies. Starting the dialogue with a simple common language in a sequential way for researchers, resource managers and Indigenous People, is essential to going forward on a common path of understanding. Furthermore, starting the dialogue with the Ngarrindjeri on what is done and what matters in a collaborative process that begins with a dialogue that includes reference to current uses seems a good first step. The approach can be used to scope the information required for the other approaches including a bio-economic model, a choice model and a well-being index approach. As the dialogue continues, the adaptation of existing methods can progress collaboratively and potentially include goal programming that is informed with values obtained from the previous stages of analysis. With each of these in turn, there can be an iterative accounting that address the determinants of social welfare and therefore approaches a total picture of the total value of the benefits that derive from water resources for Indigenous People of the Murray Basin.

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Appendix

This section includes a short description of a range of approaches to assessing values and assessing tradeoffs for those unfamiliar with the techniques. Each is referred to in the text of the paper.

Cost-Benefit Analysis (CBA)

CBA, or BCA, is a useful and widely used method for evaluating proposals of many sorts in terms of the balance of costs and benefits.¹⁰ From the point of view of public authorities, the goal of doing a full CBA, which includes all costs and all benefits of investment options, is to reveal opportunities that can be pursued in order to expand the well being of society.¹¹ When used well, CBA is a powerful framework for ranking options because it is firmly based on the principle of maximising social welfare. CBA is designed so as to identify those options that can make society better off and to rank the options if there is more than one that is found to be beneficial. CBA does this by identifying whether or not an investment that changes the way that resources are used will increase income, or output without there actually being an increase in the amount of resources available. Investments that increase net returns represent an improvement in *allocative efficiency*. In other words, more is achieved with the given resource allocation. Resources are defined to include not only natural resources such as water and trees but also labour effort and physical capital services.

The CBA decision rules are simple:

- Adopt all projects that have a positive net benefit or, in other words, where benefits exceed costs or the ratio of benefits to costs exceeds 'one'.
 - (Sum of Benefits/Sum of Costs where benefits and costs are summed over time and discounted to the present¹²)
- Where there is more than one option for an outcome, adopt the option that has the highest net benefit after taking into account all contributing complementarities and conflicts of actions
 - Net Benefit = Sum of (Benefits minus Costs for each year discounted to the present)¹³
 - Choose the combination of policies that maximises net benefits

In general, the validity of CBA as a tool to measure whether benefits exceed costs rests on some underlying assumptions that must hold true if CBA can be defended as a 'stand-alone' and sufficient tool for identifying opportunities for increasing allocative efficiency.¹⁴ The use of CBA requires that the benefits (gains) generated by an option are great enough to compensate for the costs (losses).¹⁵ As long as the analysis takes

¹⁰ Arrow et al. (1996)

¹¹ Here well being is restricted to an improvement in *allocative efficiency* and does not assess opportunities in terms of improving well being through a re-allocation of wealth, for example.

¹² Discounting itself is controversial when it comes to investments in the environment for the public good. There is a large literature on this and a basic introduction provided in Boardman et al. (1996).

¹³ Discounting makes this a Net Present Value of Benefits minus Costs or, NPV.

¹⁴ This section is based on welfare economic theory of the Potential Pareto Principle as discussed in any welfare economics or CBA text. Highlights are given here with more detail available in textbooks. See, for example, Boardman et al. (1996) and Hanley Splash (1993).

¹⁵ To be deemed a good option, it is not necessary for any compensation to take place but it is necessary that there are sufficient benefits generated so that there is the potential for compensation to take place. Whether or not to make the

account of all benefits, in terms of willingness-to-pay monetary terms, and all costs, including the foregone value of resources in their next best use (opportunity cost), then a CBA ratio that is greater than one indicates that society benefits from the action. While net benefits and the ratio of benefits to cost are each sometimes used to evaluate options, where there is a suite of options from which to choose, net benefits is the correct measure to use when options are ranked.^{16 17}

With methods such as CBA, dollar estimates of net benefits of options are obtained and can be ranked, however, dollar values of many important benefit categories will not be available for environmental management or decisions about allocations for cultural purposes, and therefore, a further method will be required to provide enough information to come to a decision. For example, Choice Modelling, may be used to elicit dollar value willingness-to-pay estimates for non-market benefits that can then be used in the CBA. But these same Choice Modelling values could also provide important information for an MCA analysis so that more informed rankings can be made by participants. MCA is described below.

Multi-Criteria Analysis (MCA)

Multi-Criteria Analysis¹⁸ is a framework for measuring the utility of competing options. The technique is useful where the benefits and costs are not easily assessed in monetary terms and the ranking is attempted on the basis of the overall benefit. The technique brings together the views of people or groups who have an interest in the outcome of a policy or management decision. The goal of the process is to determine the weights that interested participants attach to a number of attributes that characterise the available options so that a decision can be made that accounts for the current assessment of alternative actions. The main aim is to prioritise actions and come to a consensus decision via the MCA approach. The method is attractive because it provides a way to elicit information about preferences that are held by those who have an interest in the decisions. Some proponents claim that it is more objective than methods that attempt to place a dollar value on specific alternatives and that MCA can deal with a number of complex options in the same exercise. However, dollar estimates of the net benefit of pursuing options are not an outcome of MCA – this is not the goal.

MCA is also useful for assessing complex contexts and complex concepts mainly because the evaluation is based on current informed judgement about a range of information rather than a strict adherence to a particular metric, such as ‘dollars’. In the same way, tradeoffs can be assessed within and across sites and due to the process itself, the activity of participating in an MCA can lead to group consensus as well as allow people to consider options that involve a completely changed state.

compensation through another mechanism such as a tax and subsidy scheme is another discussion. CBA just determines whether or not, on balance, society ‘as a whole’ is better off with the project or option going ahead.

¹⁶ One reason this is true is because the ratio can mask the influence of the scale of a project and lead to the wrong choice. It is because of this that it is not appropriate to rank projects according to their ratios. (Boardman *et al.* 1996) However, because CBA seems straightforward and logical, it is sometimes adopted by inexperienced practitioners who receive inadequate guidance on accurate interpretation.

¹⁷ There are many difficulties associated with carrying out CBA. Not all are discussed here.

¹⁸ This section is a brief outline of methods used to rank options. See Teclé 1992 and Massam 1988 for more detailed discussion of the methods.

Non-market Valuation

Non-market benefits are all aspects of human experience outside markets which contribute to overall well being but are not encompassed by markets. In the general economy, examples might include volunteer work, unpaid labour in the home, etc. In natural resource management, the non-market category involves the more intangible benefits associated with hiking in a forest or re-vegetating along a stream bank. By establishing dollar value estimates of non-market benefits, these values can be included in Cost-Benefit analysis alongside estimates of revenues. In addition, the information provided by these studies can contribute to other decision-making frameworks by providing value estimates of the change in desirable attributes associated with investments.

Estimating Non-market Benefits

Non-market benefits can be estimated using two different types of techniques:¹⁹

- Revealed preference techniques – uses behaviour and the cost of surrogate goods or services in related markets to reveal willingness to pay for environmental quality. Some of the most widely used techniques include travel cost and hedonic pricing models.
- Stated preference techniques – often use surveys or experiments to ask questions to uncover underlying preferences and identify the trade-offs respondents are willing to make with respect to changes in environmental quality. These are usually benchmarked against a plausible monetary outcome as part of a process of asking people to make choices and trade-offs as in contingent valuation and choice modelling.

Revealed Preference Techniques

Revealed Preference techniques are suitable for estimating the use values associated with an environmental or cultural good. Travel Cost models rely on information from people engaging in time expending activities to understand the trade-offs people are willing to make in terms of time and income in order to enjoy an activity or pastime such as fishing, duck hunting, mountain-biking, bushwalking, etc.

Travel Cost models rely on some measure of the value of time which is subject to assumptions and ultimately involves a judgment call by the analyst. For instance, in incorporating a value of leisure time in a model of recreational fishing may involve 0.7 or 0.3 of an average hourly wage rate. Hedonic models involve compiling datasets that are subject to measurement error, especially perceptions of quality and not useful for establishing values for things people have difficulty understanding or outside their realm of experience.

A good example of an application of a Hedonic Pricing model is where large datasets on property characteristics are compiled and used to untangle the value of various characteristics of the property, including the value of changes in water quality, conservation status, noise or air quality as reflected through selling prices.

Revealed Preference techniques, on their own, are of limited use for environmental issues or cultural sites or activities because they rely on past behaviour and conditions experienced in the past. Further, Revealed Preference techniques are only useful for

¹⁹ For example and further description, see, for example, Goodstein (1999) Grafton et al. (2004).

uncovering the benefits associated with using a resource and cannot uncover non-use values. Non-use values include the passive use values (the value attached to knowing a resource merely exists), bequest values (the value placed on a resource being available to future generations) and option values (the value associated with ensuring access to a resource or an area in the future).

Stated Preference Techniques²⁰

Typically a Contingent Valuation Method (CVM) CVM study will ask respondents if they are willing to pay some amount of money to achieve a particular environmental outcome. CVM techniques rely on a detailed description of a particular situation or scenario where the detail is crucial to the analysis. The use of CVM for estimating non-market benefits has come under scrutiny and debate. The controversy can be summarised as problems of reliability, bias and validity.²¹

Choice modelling (CM), or Choice Experiments, emerged in the wake of the CVM controversy and represents the current state of the art in stated preference techniques to estimate willingness to pay. A CM application presents the survey respondent with a number of different alternatives and as a result provides a richer set of information for policy makers about the non-market values associated with environmental improvement programs than does CVM.

In summary

- All of the methods included provide dollar value estimates of benefits.
- The techniques are of little value in gaining consensus on options in and of themselves.
- Revealed Preference techniques such as the Travel Cost Method is not capable of dealing with changed states or cultural values per sé, while Stated Preference techniques can be designed so as to be particularly helpful in providing estimates of the value attached to drastically changed environments with complicated contexts and concepts.
- Stated Preference techniques are useful in the sense that they can be designed so as to impose a spending constraint thus realistically limiting desires in a way that is not straightforward when biophysical indices are used.
- While Stated Preference techniques have the potential to deal with complexity and tradeoffs within and across sites, they are limited in a number of real ways. These include the limitations of survey techniques themselves where responses, and thus estimated values, are affected by the length of the survey, the number of questions, the amount and quality of background information, the ordering of the questions, the incentive to provide truthful answers, etc.

Finally, where there are no perfect markets where people can reveal their values and associated preferences by what they buy and for how much, these techniques provide a way to elicit these values. As such, they are not perfect, however, research continues, practice expands and the techniques improve.

²⁰ For further description, discussion and an example, see the text references to this paper as well as Adamowicz et al. (1999).

²¹ The authors thank Darla Hatton MacDonald for her contribution to this section.