Integrating social well being into assessments of water policy: meeting the challenge for decision makers

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Abstract

There is growing concern that sustainable natural resources management is not being achieved because of the lack of integration of social analysis in decision making. Following the economic philosophy of analysis of the value of water at the catchment scale adopted by Hoekstra, Savenije and Chapagain (2001, Integrated Assessment, 2, 199–208), in this paper we discuss the relationship between economic and social factors. It is concluded that a large degree of natural integration between social and economic factors exists, but that there are also some social variables that require separate consideration. The social context of water in catchment management and the range of social variables that need consideration in any adequate analysis are defined. We identify a need for a metric that can include commensurate judgements of social, economic and environmental benefits on a single scale and identifies the challenges that this scale will need to meet. Finally, it is suggested that the simplest way to include social variables in decision making is the employment of psychometric techniques that can measure subjective well being and preferably the relationship between its components. The major obstacle to incorporating such data in decision making will be the need for a cultural change in accepting that subjective measures can play a major role in policy evaluation.

Keywords: Analytical hierarchy; Catchment management; Decision making; Economic; Environmental; Social values/benefits/needs

Introduction

While social perspectives on water resource management have been researched for some time (e.g. Field et al., 1974) there have been recent expressions of concern that such insights have not been systematically incorporated or institutionalised within natural resource decision making (Dale et al., 2001; Selin &
Pierskalla, 2005). Even though the water management literature actively embraces the rhetoric of sustainable management of water resources which supposedly, at minimum, includes the triple bottom lines of social, economic and environmental analysis there is relatively little emphasis on the social dimension. The major discourse appears to be between the economic imperative and the need for environmental conservation.

This has clearly been the case in Australia where there has been a substantial effort in water reform. In 1992 the Council of Australian Governments (COAG) commissioned a joint federal-state working group to report on an efficient and sustainable reform of the Australian water industry. Many aspects of this report were adopted by COAG in 1994 (Smith, 1998: p 271). Essentially, the thrust of the recommendations was to achieve sustainability by using markets to move water to the use of highest economic value while protecting the environment by limiting human consumptive use. The third “social” bottom line (of the triple bottom line) was, however, relatively de-emphasised in the early period of reform. The recommended changes for the economy and the environment were supposed to be delivered within “social constraints”. These constraints were never defined although there was to be an emphasis on consultation and public education. Culture as an input to water resource policy has been relatively ignored. While other nations, such as the USA, have been more explicit about what should be included in social accounting for such issues as water investment, the uptake of such accounts has been sporadic in practice (Delli Priscoli, 2001). Indeed there is still considerable debate in accounting circles about the philosophy and practice of social and environmental accounting, even at corporate level (Lehman, 2001).

This is of some concern for water management generally as reliance on conventional economic analysis may be difficult as water is not regarded as a typical economic good by all (see e.g. Savenije, 2002; Batten, 2007). To some extent water’s economic value depends on where it is in the water cycle (see e.g. Hoekstra et al., 2001). These authors have demonstrated this at the catchment scale in the context of the Zambezi River. From their viewpoint if a cubic metre of water gives some kind of ecological benefit or some aspect of economic value this needs to be viewed not only at that point in space and time, but in its previous stages in its journey through the catchment. That is, in economic terms the same drop of water has many and often related values and the total value of water depends on its context or place in the hydrological cycle.

Similar observations could be made if one was to take a social perspective. For example, the same drop of water can provide for both health and recreation, and these social values can accumulate as the water moves down the catchment. Perhaps a more difficult problem than understanding what should be counted, is deciding on the distinction between what should be counted as economic and what should be counted as social in terms of value. While some human variables such as spirituality or ethics are clearly difficult to view through an economic lens, it can be contended that others are not. For example, the importance of health and recreation can be regarded slightly differently through social and economic traditions. The question then arises of whether one counts both economic and social values separately or whether one value includes the other and therefore a single value will suffice. If each component is counted separately, the difficult issue of how to combine them to come to some meaningful overall assessment then needs to be addressed. This problem is of course the basis of the difficulties found in incorporating social assessment in sustainability decision making.

But perhaps the concern with “counting” or quantitative evaluation from the point of view of separate bottom lines tends to obscure the fact that economics and social factors are inextricably linked and that their separation is conceptually unwise. For both health and recreation, human feelings on issues such as acceptable risk and aesthetics can be dominant drivers of any economic judgment (Rachlinski & La Blanc, 2005). The decision to prefer economic over social considerations as the basis for decision
making, because dollars are a universal metric in these arenas, is tenuous. Social and cultural needs can drive economic outcomes and equally economically based decisions can affect community functioning.

All three components of the triple bottom line need to be addressed if there is to be holistic feedback to ensure adaptive learning (e.g. see Walters & Holling, 1990). Indeed an important underpinning component of achieving sustainability is the development of management systems that can achieve such learning (Delli Priscoli, 2005). The development of effective processes in this regard is a key social issue in itself.

If therefore, the whole catchment approach of Hoekstra et al. (2001) is to be adopted in a sustainable management context, there is a need for a unified and commensurate metric to incorporate the many dimensions of a perception that people’s well being has been improved by changes in water management. This metric needs to be able to encompass all aspects of human and social perception. To achieve this, a number of steps need to be taken. First, there is a need to consider social assessment from a defined catchment perspective. Second, one should describe what constitutes social analysis, then also discuss some of the key conceptual and methodological questions that need to be considered in any orderly accounting for social outcomes. Finally, a discussion is needed on ways in which some sort of metric can be devised to measure human perceptions of improvements in the outcomes of water resources management.

Managing water catchments

By definition, a water catchment is an area of land supplying surface water to a common watercourse which is host to a variety of socio-ecological systems. The interdependent components of a catchment – the land, vegetation, fauna, human – are linked together by the water component of the catchment (i.e. rivers, creeks, lakes and dams as well as groundwater, stormwater and wastewater). In some areas the concept of a water catchment is also referred to as a watershed or drainage basin.

A catchment can range in size and complexity dependent upon the watercourse it services and the social and economic complexity of the area. The requirements for effective management will vary from the relatively simple in the case of a small catchment to the very complex, whether it be a large in physical area (e.g. the Murray Darling Basin in Australia) or in terms of multiple social and economic interests (e.g. the Danube River in Europe). Regardless of its size or complexity however, there is the need to understand the social context within the physical catchment if it is to be effectively managed.

Successful catchment management requires a sustainable systems thinking approach for both management and the evaluation of management initiatives (e.g. Bellamy et al., 1999; Peet & Bossel, 2000; Bellamy et al., 2001). A systems framework allows for the incorporation of social (people’s basic and contrasting needs from water resources and their cultural relationships with water), environmental (good water quality, adequate water quantity for the catchment and all its requirements, environmental and human) and economic (provision of income and employment at local, regional and national scales) aspects within a governance structure designed to achieve sustainable catchment management. A systems framework will also enable the identification and measurement of benefits achieved from water (use and existence) in a catchment from a social, environmental and economic perspective. While environmental and economic benefits of water are relatively well defined, assessing and accounting for social benefits from water is an area which has been relatively neglected, especially when it comes to social and cultural information that can seamlessly become incorporated into a systems view of sustainability within a catchment context.
In what follows we begin to redress this problem by examining what social benefits occur from water in the landscape and which should be considered in the sustainable catchment management context. The concept of “water benefits” is a central one to our approach. We contend that the most important outcome of water resources management for people is the subjective benefit that they derive from it. A water benefit is not a litre of water itself, it is the benefit that is derived, for example, from drinking it, in terms of refreshment, or the feeling of enjoyment derived from a vase of flowers, which remain fresh longer. We contend that some of these benefits can be measured in dollar terms but some cannot (Ackerman & Heinzerling, 2004). Many of these non-economic commodities such as culture or spirituality are firmly in the social category. Nevertheless, both economic and social benefits are important and both need to be included with environmental benefits in any evaluative analysis in the same metric if the success of our water management is to be understood.

Detailed analysis of social benefits

One way to conceptualise social aspects in water management, which can be regarded as the interface of people with a resource that is integral to life, is with the help of the sphere of needs (SON) (Figure 1). This sphere was developed by Syme & Nancarrow (2008) as a primer for consideration of a range of individual and community needs with regard to water. It reflects the central role that historically water has played in the ways in which communities have organised themselves around the resource (e.g. see Delli Priscoli, 1998). All these needs should be met to ensure socially sustainable outcomes. Since some of these needs are interrelated, providing for one need may also take care of another, at least partially.

Fig. 1. Sphere of needs (SON) met by water.
It is not necessary with this model to move in a sequential manner from the inside out; rather the sequence indicates the complexity and uncertainty of the associated needs, and thus difficulty of “analysis”, increasing towards the outside. However, for ease of description and understanding, the layers are described in a sequential manner.

**Survival and health**

The central and most important human water need is that for survival and health. Basic water needs include water for drinking, cooking and eating, washing, cleaning, health and healthcare. Water for waste removal is also included here. Gleick (1996) defined basic human water requirements in four areas, drinking, sanitation, bathing and food preparation, and concluded that 50 litres per person per day (l/p/d) is the minimum that should be provided for health and minimum quality of life.

Since water is so essential for survival and health, and the “right to life” and “health and well being” are human rights according to Articles 3 and 25 of the Universal Declaration of Human Rights (United Nations, 1948) and Article 12 of the International Covenant on Economic, Social and Cultural Rights (Committee on Economic, Social and Cultural Rights, 2000) it implies that adequate water for health is a human right as well (Scanlon et al., 2004). The legal basis of the right to water is outlined in more detail in Committee on Economic, Social and Cultural Rights (2003) General Comment 15: The Rights to Water, and includes the Convention on the Elimination of All Forms of Discrimination Against Women (Art. 14, para. 2) and the Convention on the Rights of the Child (Art. 24, para. 2).

Water is also necessary in order to realise many other rights outlined in the Covenant on Economic, Social and Cultural Rights besides those pertaining to personal and domestic water use, which always have priority. They include water for food production (right to adequate food), environmental hygiene (right to health), securing livelihoods (right to gain a living through work) and cultural practices (right to take part in cultural life). Implicated is also the right to equitable access to water for agriculture, subsistence farming and livelihoods of indigenous peoples (Committee on Economic Social and Cultural Rights, 2003).

Obviously, the quality of water used for drinking is crucial. It is therefore paramount that the water sources used for that purpose (rainwater, groundwater, rivers and lakes) remain free from pollution and health hazards (Committee on Economic Social and Cultural Rights, 2003; World Health Organization, 2004b) throughout a catchment. Appropriate air quality and soil that is not contaminated are important aspects here.

In addition, water in rivers, streams and dams used for the production of fish and other aquatic food items or for recreational purposes, as well as the water used for irrigation of food crops and pastures needs to be of sufficient quality to ensure no detrimental health effects, both in the short and long term (ANZECC & ARMCANZ, 2000; Committee on Economic Social and Cultural Rights, 2003; World Health Organization, 2004a), within and outside of the catchment.

Health also has psychological aspects and water and water bodies may positively influence these (see Sections on Recreation and Aesthetics). Spiritual aspects of health should also be considered (see Spiritual Section). In fact, many, if not most, uses of water contribute to health and well being if an expanded definition of health is used, rather than the narrow biomedical model promoted by Western medicine. The new model refers to total well being or quality of life based on social, economic, environmental and spiritual well being as well as the associated subjective perceptions and experiences (SCN, 2004).

It is obvious that there are great interconnections and many areas of overlap between water for health – even if health is used in its traditional sense – and many other aspects of the environment and society.
Clearly, if the “new” definition of health is used, the interconnections are enormous and far reaching. Sustainability is viewed as a great contributor to health and health is seen as one of the prerequisites for sustainability, showing human and environmental health as inseparably linked (SCN, 2004). The World Health Organisation (WHO) has even gone so far as to recommend that both should be “central objectives in the setting of priorities for development” and to be “given precedence in resolving competing interests in the everyday management of government policies” (World Health Organisation, 1991, cited in SCN, 2004).

Human behaviour and endeavour can influence water quantity and quality directly and indirectly in many areas, whereas the available quantity and quality of water and the amenity it supports influences human well being. It is therefore important to recognise and understand these interconnections in order to ensure long-term health for people as well as the environment.

**Wealth**

Wealth and economic welfare are important for human beings and their well being. Pepperdine (2001) sees these needs as relating to prosperity and therefore economic viability and financial security.

Water is used to create income through irrigation and food production (agriculture, fisheries and aquaculture), tourism and recreation, as well as industrial products and power generation, flood protection and supply of drinking water (Wallace et al., 2003). However, these short-term gains are often derived from severe changes in natural water flow through reservoirs and dams, irrigation schemes and embankments which are not sustainable in the long run (Wallace et al., 2003).

Sewage disposal, real estate and provision of transport ways, as well as science, research and education also allow for the creation of income that is directly or indirectly related to water. In many areas, resources associated with water such as riparian vegetation and fauna provide important sources of income and livelihood (Pollard, 2002). Rivers and their catchments provide a basis for economic activities such as water extraction, mining, forestry and agriculture (Environment Australia, 1998), but other sources such as groundwater also play an important role, and increasingly so.

Consequently, it is important that water of sufficient quality and quantity is available to fulfil these functions on an ongoing basis. Water and its uses can provide many employment opportunities and therefore contributes to wealth, which in turn has positive effects on community viability, cohesion and morale (Pepperdine, 2001).

Another connection between wealth and water lies in the fact that often the most fertile land, with its great importance for the creation and maintenance of wealth, is situated along watercourses and on flood plains (Postel & Richter, 2003). As a result, this land is very sought after and often owned by wealthy people who can afford to buy it, sometimes restricting access to water for other members of the community (Strang, 2004). Since water is closely related to the creation of wealth, there is great danger of perpetuating inequality and power struggles if only few people or institutions have or control access to water (Strang, 2004). Acknowledging these inequalities, some water management and water allocation policies now emphasise equity and equitable distribution of water, for example South Africa (The Water Page, 2000/1a).

Views of water increase the price of real estate (Bourassa et al., 2003; Askew & McGuirk, 2004). This is especially the case if such views in a given location are rare and therefore prices vary with the location but also with demand owing to the limited supply (unlike characteristics such as floor size which are much more elastic) (Bourassa et al., 2003).
Prestige and social identity

Prestige and status, as well as social standing and social identity depend to a certain extend on adequate wealth, which, in turn, can substantially depend on water (see above). Social stability belongs here and includes family cohesion, low drug use as well as low crime and suicide rates (Pepperdine, 2001).

Attachment to a place or the local area also contributes to identity and can provide a sense of continuity and future (Pepperdine, 2001). Communities are defined, at least in part, by their setting, and in turn the values, worldview and characteristics held by a community influence the surrounding environment (Maser, 1997). The importance of water to people shows in the many settlements that are located at or near a water body (Ripl, 2003). Water gives a place a distinct setting and identity and features prominently in the sense of place in these communities.

Real estate close to a water body is sought after and has prestige attached to it. A source of water on a property is also a great asset, especially if it is running all year. Prestige is also attached to the “ownership” of or access to water and the associated possibility of wealth creation. The prestige exemplified by certain suburban developments in turn can mandate high water use for the maintenance of lush green gardens and lawns (Askew & McGuirk, 2004).

Power and the control of water, this most vital resource, are closely linked. Ancient empires were built on the control of water and even today the control of water means great political power, as can be seen in the Middle East and many other locations, where upstream users have control over the amount of water available to downstream users. “Water is always a metaphor of social, economic and political relationships – a barometer of the extent to which identity, power and resources are shared” (Strang, 2004: p 21).

Social cohesion

Social cohesion is expressed by the ability of a community to cooperate and work together to function as a supportive and unified community (Pepperdine, 2001). It also includes community mindedness that places importance on the local community and is expressed by an active community life and neighbourliness. A cohesive community is also inclusive (open to outside help) and accepting of different points of view, other ideas and newcomers (Pepperdine, 2001). An ethic of care is central to this. A cohesive community that interacts well also provides a positive background for the formation of values and for moral development (Smith, 2000).

Basic requirements such as health, wealth and social identity, many of which depend on water, help to build and maintain a cohesive community. Catchment management groups and other interest groups (e.g. Landcare, conservation groups, sports associations) have important functions for community cohesion (Heilpern et al., 2000).

The establishment of water markets, as well as problems with water allocation or access to water, have the potential to create tension and conflict within communities, especially between the water rich and the water poor, potentially influencing community cohesion negatively. In some irrigation communities there are indications that water markets can facilitate structural adjustment, that is, assist communities to become more sustainable by forcing non-viable farmers out of business and creating larger, more water efficient and environmentally sound farms. However, there is still the possibility that marginal farmers will sell their water allocations to finance every day farm operations and pay off short-term debt with the effect that when they are eventually forced to sell the farm, the returns are not enough to start a new life.
somewhere else, leading to poverty (Bjornlund & McKay, 1999). Bjornlund (2002) stresses the role of non-permanent water markets in extending the time for non-viable farmers to have to sell their properties and therefore giving communities time to adjust to these changes.

Social fragmentation, such as seen in parts of England, “has meant a crucial shift away from collective ownership and management, placing water resources in the hands of small groups of people who either own the infrastructure and rights to abstract and supply water, or are empowered by specialised knowledge and expertise” (Strang, 2004: p 21), leaving the rest of the population disenfranchised from participation except via membership in environmental groups.

Social cohesion is obviously central to a functioning community and as such care should be taken that all efforts are made to maintain communities through providing necessary services and ensuring that new policy measures do not unintentionally lead to a loss of viability and force people to leave. The measurement and treatment of this concept is, of course, dependent upon the level of analysis and the socio-political context (Delli Priscoli, 2005). While there are a number of studies using community psychology-based techniques which can deal with this issue at the local and regional level (see Midgley & Ochoa-Arias, 2004), the issue becomes more difficult when the national context of water resources management is considered (Syme, 2006).

Recreation

Water has a variety of uses for recreation; directly for swimming, boating and windsurfing, and indirectly for fishing, as a focal point for picnics and walks and other nature appreciation activities, such as bird watching and aesthetic enjoyment (Heathcote, 1998). Environment Australia (1998) has recognised the attractiveness of wild rivers and their catchments for a number of water-based and water-enhanced recreational and tourist activities. These include canoeing, rafting, other boating, fishing, swimming, camping, bushwalking, rock climbing, photography, painting, nature studies, sightseeing, four-wheel driving, picnicking, fossicking and hunting.

Adequate recreation possibilities are related to health and well being as well. As Ewert (2003) points out, recreation in the natural environment can improve human health through exercise, relaxation and catharsis. Recreational activities may also provide benefits such as personal enjoyment, personal growth, social harmony and social change (Ewert, 2003).

Water bodies attract tourists because of the aesthetics and recreation possibilities, thereby providing a source of income and wealth for communities situated near those water bodies (Orr & Colby, 2002). It is therefore important to maintain the attractive attributes of water bodies and to ensure that not only the quality of the water is maintained (World Health Organization, 2004a), but also the surrounding landscape and associated biota. Although water clarity and colour may not be of prime importance for non-contact water recreation activities, the appearance of water is a big factor in its aesthetic appeal and therefore the potential to attract recreational users and tourists (Smith et al., 1995) (see also Section on Aesthetics).

Water is not only used for recreation in natural settings but also in the form of swimming pools and spas in suburban gardens (Syme et al., 2004). The popularity of these kinds of water features is growing and with them the associated water use (Askew & McGuirk, 2004). In addition, extensive lawn areas are still most popular in Australian gardens, despite a shift to more low-maintenance leisure-centred garden styles and they are responsible for most of the water used in the garden (Askew & McGuirk, 2004).
Aesthetics

Aesthetics of water has different aspects which are all based on observation. There are those associated with water quality in the sense of visual and olfactory pollution that are measured quantitatively and those related to visual/artistic impressions of water in its surroundings. As the saying goes, “beauty is in the eye of the beholder”, hinting at the subjectivity and social construction of all these perceptions but also expressing the idea that aesthetics is mainly placed in the visual domain although other senses can be involved.

People like to look at water and prefer landscapes with water bodies and/or mountains to those without (Herzog et al., 2000; Wherrett, 2000). These features add to the popularity of a place and therefore are important for tourism and associated industries as well as for real estate. In cases where wetlands and lakes are expressions of the groundwater level, the maintenance of these levels may have to be considered (Water and Rivers Commission, 2000).

Water features prominently in the arts as well, mainly in drawings and paintings but also in poetry and other literature, and is also represented in music, reflecting its importance to human aesthetic experiences. Conversely, since Western modern aesthetics is predominantly visually orientated, nature must imitate art to be considered aesthetically pleasing (Callicott, 2003). In Australia, this is exemplified in urban manicured parks and landscaped gardens planted with exotic species that are considered to be aesthetically more pleasing than those featuring native species which are often perceived as straggly, prickly and ugly. Water features are also popular but are often an artistic or ornamental addition rather than a functional feature that supports biodiversity.

Simus (2004) points out that water as such does not have any aesthetic qualities of its own but that these “are formed entirely by the environment in which it functions. Environmental factors such as gravity, light, containment, momentum, and surface contact form water’s aesthetic qualities” (Simus: pp 1–2).

Part of maintaining the aesthetic appeal of water bodies is related to colour and clarity of water (Smith et al., 1995). Apart from water not posing a health risk or a safety hazard, it also has to be appealing to people. Smith et al. (1995) found a close link between the appearance of water and its use for bathing, where it is important to maintain water clarity to a depth of at least 1.5–2 m and to ensure that the colour of water remains as close to a blue or blue-green as possible. For naturally coloured water (e.g. yellow or brown colour from leaf tannins) people need to understand why this occurs to be happy to use the water for bathing (Smith et al., 1995).

At present the aesthetics of water itself is measured quantitatively through water quality indicators that are related to litter, surface pollutants (oil, scum, foam, etc), odour and colour (e.g. Environment Agency UK, 2005). Quantification of aesthetic value is also being attempted through non-market valuation estimates where people are asked to approximate how much they would be prepared to pay for the beautiful and attractive qualities of a river or other water feature. It is argued that this method allows the assessment of the total aesthetic value of a water feature if the average value is multiplied by the number of community members or participants in the process. Although problems with quantifying aesthetics are acknowledged, money is seen as a useful scale of comparison since many other aspects relevant to decision making are based on it as well (Gaylord Nelson Institute for Environmental Studies, 2000).

A completely different approach is pursued by Aldo Leopold in a unique autonomous natural aesthetic that not only refers to the visual appeal of a landscape but entails being “in the natural environment, as the mobile centre of a three-dimensional, multi-sensuous experiential continuum” (Callicott, 2003: p 39) that includes sound (for example that of rain), sensation (such as the feeling of water drops on the skin),
smells and taste (such as that of water) as well as the visual experiences, and also involves the mind (faculty of cognition). For Leopold aesthetic appeal had more to do with integrity of evolutionary heritage and ecological processes than visual and scenic qualities (Callicott, 2003). It is hard to see how all these qualities and experiences could be expressed in monetary terms.

Similarly, Simus (2004) claims that the quantitative measurement of the aesthetic qualities of water alone is not sufficient, even misleading, since it does not completely reflect the human influence on water quality in a watershed nor human interest in protecting water quality. “The aesthetic appreciation of water should attend to how water functions in a particular watershed, rather than focus upon what water is, because water has no qualities of its own. An aesthetic characterization of water’s ability to sustain life, along with quantitative analysis, can establish a new metric for water quality evaluation that can influence water policy formation” (Simus, 2004: pp 3–4).

These experiences are often the motivation to visit a place and therefore are important for tourism and associated industries.

Moral and cultural

Virtually all cultures place importance on water, and for some it is central. This is reflected in language, rituals and ceremonies. For example, rivers and floodplains having been the focus for human activities such as settlement, transport, communications and recreation for a long time, hold “significant cultural and social values as a focus for spiritual, political, national or other cultural sentiment” (Environment Australia, 1998: p 3). Rivers and areas of floodplains can also have historical importance that are due to notable eras, events or people (Environment Australia, 1998).

Also, water features highly in the culture of people that live close to water and whose lives may be closely associated with water, such as fisher people and ship owners. Many older cultures in Europe had sacred wells and springs, which later were often also used by the Romans as places of worship (Strang, 2004). The Balinese rice paddy culture, with its water temples and associated practices, is an example of a water culture that has worked sustainably for thousands of years (National Science Foundation, 2004).

Indigenous people in Australia have a moral obligation to look after country, which also includes water, on the surface as well as underground (Yu, 2000; Goode, 2003). This moral obligation is clearly recognised in dreamtime stories as well as cultural and spiritual activities. Other cultures also recognise such moral obligations of care and often landscapes are imbued with moral meaning, especially where the supernatural is intertwined with the landscape (Smith, 2000).

There is also a moral obligation to provide good quality drinking water for people, as was already recognised in ninth century England (Strang, 2004) and recently reiterated by the international community through the Millennium Development Goals (MDG) (United Nations, 2000) and the World Health Organization (World Health Organization, 2004b). At its Millennium summit meeting in New York, in September 2000, the UN General Assembly passed a resolution with one of the goals being to halve the proportion of people without access to safe water by 2015 (United Nations, 2000). Later, at the 2002 World Summit on Sustainable Development in Johannesburg, a similar target was set for sewers. “Lack of access to clean water and sanitation are widely seen as a violation of human rights and an affront to human dignity” (James, 2003).

The moral, the cultural and the natural have always been intimately related. In order to achieve sustainable outcomes a moral society has to provide adequate care for its members as well as its territory.
and all it contains. This also includes care for future generations and those outside the sphere of immediate social relationships (Smith, 2000).

Consequently, a moral obligation exists to look after water resources for immediate use, for long-term benefits and for others who may depend on it in distant locations and in future times. This includes non-human life forms and ecosystems. However, a perceived dichotomy in the ethics of water may force a choice between humans and ecosystems, which can make it hard “to develop consistent measures of ethicalness that can be used for deciding water allocations” (Acreman, 2001: p 265). Recognition of the interconnectedness of humans and the natural environment at a fundamental level should make this task much clearer: looking after the well being of both at the same time.

Spiritual

Water has great spiritual meaning in many cultures and religions. These days western culture has predominantly a resource attitude to water, whereas even in Europe in earlier times numerous sacred wells and springs existed, which often retained their sacred status as places of worship even though the localities may have been invaded by other cultures, such as the Romans (Strang, 2004).

Today, most major religions still place great importance on water, primarily because of its cleansing and life-giving qualities. For example, water in Judaism is used for ritual cleansing in “living” water – water that has not been contained before. In the Christian tradition water is important to the initiation and cleansing ritual of baptisms, but is generally separated from its surroundings and used mainly in a symbolic sense. In Islam, water is important for cleansing before prayer but can be replaced by sand if no water is available (The Water Page, 2000/1b).

Other spiritual systems, religions and beliefs place much greater importance on water. This can be connected to specific water bodies or much more generalised. In the Hindu belief all water is sacred, with rivers being especially revered. The whole religion centres on water and the Ganga River in India is the holiest of seven rivers and fundamental to Hindu beliefs. Shinto also places great importance on ritual cleansing but also reveres springs and other natural phenomena, while waterfalls are sacred. Zoroastrians consider water important because of its purifying properties but also because it is a fundamental life element and therefore is sacred and not to be polluted. People are not allowed to urinate, spit or wash their hands in a river (The Water Page, 2000/1b).

As water still has a sacred status in many cultures today, it can be problematic if the resource is treated as a commodity at the same time. Conversely, a spiritual connection to water can ensure that the resource is treated with respect and that pollution or other degradation is avoided or actively counteracted, for example by the Zoroastrians (see above).

Burril (1997) points out that spiritual values are some of the most difficult to identify, valuate and accommodate and appropriate methodology is not well developed. The question is if valuation is possible or even at all desirable in this case, or if it is not sufficient to identify the values and account for them through a participatory process.

Other social water needs

Other human uses of water include those for educational purposes as well as for research and scientific endeavour (Coffey, 1990). Wild, natural rivers and their catchments especially can be valuable for
providing baseline data for environmental monitoring and information on natural systems function, as well as ongoing fluvial and other geomorphic processes. “Natural river catchments can provide biogeographical information, and may contain sites of significance for geology, geomorphology, botany, zoology, archaeology and other sciences. They also provide a store of genetic stock of the animal and plant species living in them” (Environment Australia, 1998: p. 3).

The importance of rivers and other water bodies is closely related to education especially for natural sciences students. Learning can occur through field trips or recordings (print, audio-visual or electronic media) (Environment Australia, 1998). However, it can be argued that water is so central to all life and therefore human beings, that it needs to feature highly in all education, be it formal or informal, and the values of water need to be acknowledged much more widely in all sorts of scientific and intellectual endeavours.

And last but not least, there are many people for whom it is important to know that certain water bodies not only persist but remain in a good condition although they may never go and visit these places. Economists define this as existence value. Clearly, many of these uses are closely related to many of those mentioned above.

**Embracing social needs**

Embracing the sphere of social needs within a systems and sustainability based model involves turning the conceptualisation of what these needs are in relation to the particular water management context being considered (in this case sustainable water use and catchment management) into a feasible and applicable methodology. It also requires the framing of the social perspective within a systems context (Peet & Bossel, 2000), which involves an understanding of how these social needs relate, both to each other and to other aspects of the system.

Application of social needs within a sustainability and systems-based model will be possible through understanding and accommodating important threshold points beyond which alteration of these environments becomes a loss of social benefit. Determining social benchmarks, standards and values will be a necessary part in the design and measurement of evaluation systems that either quantitatively or qualitatively recognise social needs in assessing water use changes. Providing the right information in a useable form is therefore essential for this process. Is there a way to provide a useful social metric that can incorporate people’s perceptions of environmental quality and perceived economic needs? A metric that can give us an indication of whether we are doing better or worse in a sustainability sense and whether our allocation of the benefits of water between differing groups has been just?

**Creating an approach that can incorporate the range of social needs in assessing changes in sustainable water management**

Having identified the important components of social water needs, the major question then becomes whether there is any meaningful quantitative way to provide for integration of social, economic and environmental outcomes that are an improvement on “common sense”. How can we provide social information for decision makers in valid formats that assist them in their deliberations about societal issues
within a sustainability framework? Decision makers are currently comfortable with using environmental and economic information, so how can we ensure that social information can provide equal assistance? The only way to accomplish this is to provide a commensurate metric which allows simultaneous subjective assessment of the social, economic and environmental benefits arising from water policy and management. To achieve this goal requires the examination of some basic properties of valuation methods.

Some conceptual issues

Defining what is measured as a benefit and creating a commensurate scale

There are many outstanding examples of multi-criteria analyses that have greatly aided choice between differing water resource management options or scenarios (e.g. Stewart & Scott, 1995; Pietersen, 2006). But the important issue is gaining consistent levels of interpretation over differing case studies so that there is a common benefits language rather than multi-objective ratings of individual indicators of benefits. The term “benefits” is used loosely in the water management literature and elsewhere. Occasionally a benefit may be defined as an increase in the number of trees in a catchment or the increased mass of gigalitres of water allocated for environmental flows. In short, often biophysical changes or financial income are seen as the benefit in themselves. Alternatively, environmental amenity or aesthetics or enjoyment of a chosen recreational activity may be seen as benefits. These are basically human attitudinal, emotional or perceptual measures. This discontinuity between the differing manifestations of what are thought to be benefits can be accounted for in multi-criteria analyses or similar techniques where importance ratings or equivalent scoring procedures of the disparate components can come up with some overall score of benefits and choices can be made between alternatives.

The problem with this is that these variables are often causally related rather than independent, as is often assumed. Biophysical change is often an input into the ultimate benefit received by the community rather than a benefit in itself. For example, an increase in the number of trees in a catchment may not be a benefit in itself. The real benefit is the consequences for humans. For example, the benefit may be the income received by the foresters or the recreational enjoyment obtained by campers. While it is impossible to create a perfectly equivalent and independent set of benefits by carefully defining what we mean, we are far closer to establishing a commensurate scale. As Delli Priscoli and Llamas (2001: p 43) point out “ethical considerations concerning water uses tend to revolve around the distribution of benefits and the costs of services and who pays and the distribution of risks – who is vulnerable and to what degree”.

Understanding the nature of a (water) benefit is a fundamental issue that has been grappled with over a number of years by a variety of disciplines, including economics and a wide variety of social science disciplines associated with social impact assessment (Baron, 1998). No generally agreed consensus emerges from these disciplines on which variables are most important, or what set of indicators would be generally regarded as an adequate and comprehensive guide to benefits. For example, does the increase in the number of trees on all catchments lead to predictable benefits in human terms? If not, the decision to increase the number of trees in a specific location needs to be assessed in terms of the benefits that accrue. The use of human perceptions of benefits provides the common metric across catchments. These are the units that can be transposed to all environments.
Similar observations can be made about social variables themselves. For example, population change is sometimes offered as an observable or objective indicator of social change and has at times been assumed to be a measure of social impact. But as van Schooten et al. (2003) point out “if ’social impact’ refers to the impacts actually experienced by humans (at individual and higher aggregation levels) in either a corporeal (physical) or cognitive (perceptual) sense, then many impact variables commonly measured in SIA (social impact assessment) studies – for example population growth – are not impacts but social change processes that may lead to social impacts”. That is, the measurement of population change does not per se measure the benefit or otherwise of the change itself. It is the community’s subjective experience of change that determines the level of the benefit or loss of benefit involved.

Moreover, some types of benefit are not easily inferred from any indicator that can be observed or estimated using water system models or linked economic or demographic models. These may include, for example, urban appreciation of environmental values or local perceptions of river and recreation amenities. In many cases information on the nature and level of these benefits may be derived through a range of survey techniques, including choice modelling or contingent valuation, which rely on “reported” or “stated” valuations or preferences of different types. Like most scientific methods, these techniques need to be implemented and interpreted carefully, particularly in relation to abstract or difficult to communicate issues such as landscape aesthetics (Fanariotu & Skuras, 2004).

Water benefits thus reflect human value judgments. Information on these values is best derived by asking people, using well established cognitive and attitudinal analytical techniques and recording their preferences. This information can then, where possible, be related to biophysically or economically-based system attributes, linking water allocation to water benefits, through the observable indicators produced by biophysical and economic analyses. This linking process must also recognize that perceptions of the benefits associated with a particular pattern of water use are going to vary across different groups, and may also vary over time as attitudes and understandings change.

Therefore, we conclude that, while it is valuable to relate available indicators to benefits obtained from water, such statistics do not provide an adequate basis for assessing water benefits and – if used without a reference to universally perceived benefits – they are likely to provide a distorted view.

Therefore, for the purposes of this discussion water benefits are defined as “people’s perceptions of their well being as a result of water, its use or management”. These benefits cover a wide range and have been termed here as the sphere of needs (see Figure 1).

**Water derived benefits are often related**

Having defined the level of measurement it is obvious that humanly conceived water benefits, as presented earlier in this paper, are related. For example, good water quality can result not only in increased wealth, but can also result in better recreation and meet aesthetic and spiritual benefits. This begs the question of how one “counts” benefits when a particular quantity or quality of water (or combination) can provide a number of social benefits simultaneously or in fact a series of biophysical or economic benefits at the same time. Does one avoid “double counting” or acknowledge that the allocation of water to one purpose in one location does not preclude it benefiting others elsewhere and include these values as well (e.g. Hoekstra et al., 2001)? Finally, given that one can deal with the double counting issues, how can one compare a unit of spiritual benefit with the gain from an extra recreational fish being caught?
Lexicographic preferences

On some occasions people regard certain outcomes or preferences as a “right” which under no circumstances should be denied. These preferences override all other considerations and no tradeoffs are considered. These preferences have sometimes been called lexicographic preferences (e.g. Lockwood, 1999). The issue for a social benefits “accountant” is how to put such a social need into an overall valuation measurement.

Shifting baselines

A further significant issue is that if a large proportion of the social valuation is subjective then the ruler or benchmark for measuring benefit can also change with time. For example, many people now may not be concerned by the fact that native blackfish have disappeared because they have no personal experience of the native fish and have attained an equivalent level of satisfaction from catching introduced trout. People often judge social outcomes in the light of their own experience and adaptation level. This of course is a major issue for both environmental and economic measurement as well.

Possible approaches to creating an integrated subjective metric

The requirements above indicate that there is a need for an interval or ratio scale that can incorporate perceptions of social, economic and environmentally based benefits. The following characteristics are necessary to establish a methodology that can meet these requirements if adequate valuation of water management policy (or policies) is to be obtained.

- The method must go further than just measuring dollars as there are likely to be ethical standards which will govern thresholds beyond which all value disappears. Societal values may reject the use of dollars in measuring some aspects of value such as spirituality or morals. “Ethical values serve to undermine the neoclassical (economic) notion of preferences by usurping the assumption of indifference between choice alternatives” (Jorgensen, 2003).
- The method must be able to measure changes in the effects of differing policies on all components of sustainability.
- The method has to be able to cope with the fact that water-induced benefits are related.
- The determinants of valuation such as experience or cultural background have to be able to be identified.
- Finally, the procedure needs to provide a metric that can be compared among differing societal groups so that allocation issues can be systematically addressed.

While the list of requirements seems daunting, there are a number of psychometrically-based techniques that are capable of providing ratio or interval scales such as Guttman scaling (Nunnally, 1978) and multi-attribute utility measurement (Edwards, 1977). Other techniques can provide suitable scales that deal with the significance and relationship between differing components of an overall
concept such as benefit or satisfaction with elements of a policy. These include the analytical hierarchy process (e.g., see Tzeng et al., 2002) and conjoint analysis (e.g., Alvarez-Farizo & Hanley, 2002). (One form of the latter that is popular for economists is choice modelling (Bennet & Blamey, 2001)). The outcomes of all of these techniques can be analysed to account for the determinants of the overall valuation and the relationship between previous experience and demographic factors thus helping us to understand the shifting baseline. Not only can they compare defined societal groupings but they can also aid understanding of beneficial outcomes by interpreting differing patterns of responses and their significance for interpreting outcomes of water management decisions. Finally, the distribution of the valuation scores will enable identification of thresholds in valuation.

While these techniques have usually been applied to measurements of attitudes towards environmental and social issues, there is no reason why they cannot be equally applied to the assessment of benefits obtained from water management under different policy regimes (Moran et al., 2004). These techniques can incorporate economic, environmental and social benefits in one metric and can provide for comparison between them univariately as well as accounting for their interaction in an overall policy evaluation. This is a major step forward in evaluating the sustainability of water management in all three bottom lines and in one metric. Simply by redirecting or reapplying currently existing scaling methodologies in a new arena, new opportunities for policy evaluation emerge. If this was the case, the economic analysis performed by Hoekstra et al. (2001) for the Zambezi could be recast much in the same way but in terms of benefit units as measured in multi-dimensional rating scales covering the range of sustainability concerns.

Some progress has already been made in this regard with case study measurements being conducted to assess the increase in beneficial outcomes accruing to a country town in Western Australia as part of the Water for Healthy Country Flagship (ARCWIS, 2005). In this case study a modified analytical hierarchy approach was used to identify the potential benefits from increased access to good quality water thus allowing for multiple or related benefits from the same water volume. Residents were invited to assess the importance of each benefit and how much improvement in the benefit would occur. Each of the benefits had to be clearly related initially to water by a causal mental model (Morgan et al., 2002). By multiplying the importance by the improvement in achievement (provision was also made for a decrease) an overall assessment in improvement in sustainable benefits could be made.

In the case study, nominated positive outcomes (or benefits) varied from environmental-related issues through improvements in recreational enjoyment to increased employment. Cultural issues were also raised. Interestingly, nominated outcomes were loosely categorised into environmental, economic and social with about a third of the “sustainability” benefit scores seen by this rural community to lie in each sphere. The process was regarded as having face validity by the community because the questionnaire was structured from their own qualitative discussions about water benefits. While this was a simple case study, this application of a reasonably standard scaling technique has shown that taking an integrated “sustainability unit” approach has reasonable promise.

The modified analytical hierarchy approach provides for the seamless inclusion of social outcomes within sustainable assessments of water management options. It also allows for comparisons between groups which create clear descriptions of allocation decision consequences in terms of benefits (rather than the usual contest in terms of volumes of water or purely economic considerations). However, developing this paradigm will require adherence to the philosophy that the only feasible method of evaluating the performance of our water management in sustainability terms is through valid and reliable
measurements of subjective judgment. The second assumption is that not all values, attitudes and preferences can be reduced to a dollar value. Those involved with contingent valuation studies of non-market goods or in choice modelling studies converting all variables to relative dollar ones (Bennet & Blamey, 2001) may find this difficult to accept. Nevertheless it would seem difficult to reduce culture or spiritual values to dollars in believable terms (e.g. Burril, 1997). As shown in the ARCWIS (2005) case study, once outcomes have been defined and measured for differing management regimes it is possible to find indicators (environmental, economic or social) of these benefits that can be used by water managers to develop planning targets.

Conclusions

It is clear that there are subjective techniques that can integrate social assessment with the other two dimensions on a commensurate scale of perceived human benefits. This has been demonstrated for a water example in the case study described here. As outlined in the paper there are many alternatives to the analytical hierarchy approach. These measures provide us with the ability to evaluate progress in delivering water-related benefits and can become an integral tool for guiding adaptive management.

But the largest challenge to developing this approach is not a technical but a cultural one within the water “industry”. The notion that the important measure is the subjective well being that people gain from access to and enjoyment of water use, and not a series of indicators of sustainability, is a difficult one to accept for those used to dollars or chemical indicators of water quality. But unless we can take such a leap, the hope that we can take a pragmatic systems-based approach to sustainable water management will not be realised.

We need to incorporate all significant social variables in our sustainability assessments and not just some. Despite the attempt of some economists to broaden their horizons through concepts such as merit goods (Mazzanti, 2002) in relation to cultural issues there is still an acknowledgement that the motivation for concepts such as altruism needs further analysis (McConnell, 1997). The significance of issues such as morals and spirituality are not addressed. This inevitably leads us to the psychometrically-based techniques introduced in this paper. While some are fearful of the meaningfulness of such methods, there are well developed methods for assessing the reliability and validity of such approaches (Kline, 2000). Further, in attempting to apply them, the understanding of the difficult issues can be greatly enhanced by the discussion surrounding thresholds or fundamental beliefs. The benefits-based approach promotes inclusiveness of values. At worst the application of subjective and inclusive measurement will increase our understanding of the significance of the hitherto unmeasured social outcomes of water resources policy.

References


