Water and Ethics

OVERVIEW

Jerome Delli Priscoli, James Dooge and Ramón Llamas

UNESCO International
Hydrological Programme

World Commission on the Ethics of
Scientific Knowledge and Technology

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Preface

This essay is one of a series on Water and Ethics published under the International Hydrological Programme of UNESCO. A Working Group on the Use of Fresh Water Resources was established under that programme in 1998. Preliminary drafts on fourteen aspects of this topic were prepared under the guidance of this Working Group.

An extended executive summary was prepared by J. Delli Priscoli and M.R. Llamas and was presented to the first session of the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST) held in Oslo in April 1999. At the latter meeting, COMEST established a sub-commission on the Ethics of Fresh Water under the Chairmanship of Lord Selborne. The first meeting of this sub-commission was held at Aswan in October 1999. A 50-page survey by Lord Selborne on the Ethics of Fresh Water, based on the above meetings and documents, was published by UNESCO in November 2000.

Since then, the original draft working papers have been revised under the editorship of James Dooge and published on CD ROM as an input to the Third World Water Forum held in Kyoto in March 1993. These are now being published in printed form as the first fourteen titles in a series of Water and Ethics

These essays are written from the point of view of experts on different aspects of the occurrence and use of fresh water who are interested in the ethical aspects of this important subject. They do not purport to be authorative discussions of the basic ethical principles involved. Rather, they aim at providing a context for a wide-ranging dialogue on these issues between experts in diverse disciplines from the natural sciences and the social sciences.

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This particular essay contains an Overview of the general topic of Water and Ethics and is intended as an introduction to the series. Section 1 contains a brief discussion by James Dooge of the general context of the search for a water ethic. Sections 2 to 5 are based on the extended Executive Summary of the work of the IHD Working Group submitted to COMEST by J. Delli Priscoli and M.R. Llamas in April 1999 and on the Chapter by the same authors on *International Perspective on Ethical Dilemmas in the Water Industry* in the book entitled *Navigating Rough Waters: Ethical Issues in the Water Industry* edited by C.K. Davis and R.E. McGinn and published by the American Water Works Association in 2001.

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1.1 Difficulties in global ethics

To achieve agreement on ethical issues is not easy but it is not impossible. In the general sphere of human rights, many problems remain but at least conditions in any given situation can be evaluated in the light of the agreed principles of the Universal Declaration of Human Rights (UNGA, 1948). Ethical values takes different forms in different cultural groups. In western societies, ethical restrictions tend to take the form of behavioural rules which ultimately are codified in law. In non-western societies they may take the form of taboos or rites which develop into customs of behaviour with the social sanction of the community. The outstanding problem in synthesising a system of global ethics has been analysed from an anthropological viewpoint by Cardoso de Oliveira (1996) who discusses both general principles and individual case studies. He concludes that a key problem is the application of moral values on the community scale which is intermediate between the macrosphere of global norms and the microsphere of inter-personal relationships. All three levels are important in relation to water ethics.

In recent years, the problem of differing ethnic and religious viewpoints affecting attitudes to water management problems has become apparent. One example may be cited to illustrate this point. The International Conference on Water and The Environment held in Dublin in January 1992 to provide the input on water problems to the Rio Conference on Environment and Development based its recommendations on four guiding principles. The fourth guiding principle opens by stating (Young et al., 1994):

> Water has an economic value in all its competing uses and should be recognised as an economic good. Within this principle, it is vital to recognise first the basic right of all human beings to have access to clean water and sanitation at an affordable price.

The remainder of the statement of this principle is highly relevant to the whole topic of freshwater use when it states:

> Past failure to recognise the economic value of water has led to wasteful and environmentally damaging uses of the resource. Managing water as an economic good is an important way of achieving efficient and equitable use, and of encouraging conservation and protection of water resources.

Unfortunately, this description of water as an economic good gave rise to problems in Islamic countries because the Koran describes water as the source of all life and a free gift of God. If this reaction could have been foreseen at the time, the wording would probably have been re-phrased to refer to the provision of water services being an economic activity, which would not have produced such a strong reaction. Many persons of other traditions would also have been happier with a wording less redolent of the viewpoint that market forces should act as a strategic determinant rather their more acceptable function as an implementation mechanism for achieving previously agreed strategic targets.

Six years after the Dublin Conference (in June 1998), a sharp controversy arose on this point at the UNESCO Conference on World Water Resources at the Beginning of the Twenty-first Century (Zebidi, 1998). In the course of the discussion at that conference, participants from Islamic countries attacked this principle as being inconsistent with the characterisation in the Koran of water as a free gift of God. This problem was explored in detail at a Workshop on Water Management in the Islamic World held at Amman in December 1998 (Tortajada, 1998; Faruqui et al., 2000). Two chapters in the latter publication are of special relevance to this problem. The first is Chapter 2 by Al-Jayyouoi on 'Islamic Water Management and the Dublin Statement' and the second is Chapter 8 by Kadouri et al. on 'Water Rights and Water Trade: an Islamic Perspective'. The former chapter concludes that all four principles of the Dublin Statement are consistent with Islamic philosophy. The latter distinguished between the concept of God's fundamental ownership of resources and the concept of humanity's managerial ownership on the basis of the distinction between private goods, restricted public goods, and public goods. The questions raised are the subject of an ongoing discussion (Amery, 2001; Savenije and Van den Zang, 2002). This example is typical of the problems facing the world community in formulating an acceptable ethical code of global scope.

1.2 The context of environmental ethics

Some guidance in starting the search for a water ethic can be gleaned from accounts of the similar searches in relation to environmental ethics (e.g. Bourdeau et al., 1990), in relation to the interaction of ethics and economics (Singer, 1972; Sen, 1987), and similar aspects of the problem. A water ethic should be viewed in the context of a general environmental ethic though there are some important differences. We can look to discussions and conclusions on environmental ethics over the past few decades as a starting point in attempting to develop a water ethic. The concept of environmental ethics and the term itself is relatively new compared with the general concept of social ethics.

One contemporary western approach to environmental ethics is represented by the essay on *The Land Ethic* by Aldo Leopold (1949). He characterises ethics as evolving in the past from an ethics of relationship between individuals to include the ethics of the relation between the individual and society. He regards the extension of ethics to the land as 'an evolutionary possibility and an ecological necessity.' For him 'the land ethic' simply enlarges the boundaries of the community to include soils, waters, plants and animals, or collectively 'the land.' Leopold considers conservation as a moral issue and that 'we cannot destroy the earth with moral impunity.'

The problems of the ethics of the environment were discussed in Brussels in 1989 by experts from East and West belonging to a number of disciplines (scientists, engineers, lawyers, philosophers and historians) (Bourdeau et al., 1989). The scope of their discussions is reflected by the headings in their report to the Economic Summit of that year, namely: stewardship, environmental law, quality of life and biodiversity, global commons, the role of scientific research, and environmental citizenship.

The diversity of cultures and resulting disparity of approaches to problems of environmental science and environmental ethics has been well studied and presented by Callicott (1994). This scholarly work covers in separate chapters the attitudes and values of Western Europe, South Asia, East Asia, Polynesia and Native America, South America, Africa and Australia. He traces the strength in these different cultures of approaches based on the stewardship of nature, compassion, self-realisation, kinship with nature etc. This cultural diversity is an important factor and must be taken account of. The mistake made in many other areas of imposing western values on other cultures must be avoided in the field of global ethics.

1.3 Constructing a water ethic

As mentioned above, there are some significant differences between the ethical problems relating to water and the ethical problems relating to the environment. First, the problems of water management are perceived largely in terms of such factors as human health, food production, economic development, loss of human life, displacement of persons and economic losses. Accordingly, support for action by the general public or by decision makers does not depend on a wide-scale acceptance of the extension of the concept of community to include land, plants and animals as advocated by writers such as Leopold or by doctrinaire conservationists. Writers may differ about the theoretical moral basis for contributing to disaster aid (e.g. Singer, 1972; Arthur, 1977) but the public reaction to the request for action is much stronger than for similar requests on conservation topics. The increase in such public support over recent decades for problems of remote countries is to a considerable extent a

reflection of the effect of television presentation of such crises in expanding human horizons beyond the local community.

The question of balancing the cost of preventive measures against the benefit of reduced impacts depends critically upon the proper assessment of risk which is less apparent and difficult to assess in the case of problems of water management and particularly in regard to water-related disasters. Attitudes are determined and decisions made on the basis of perceived risk rather than the real or objective risk. The gap between perceived risk and real risk is particularly great in the case of rare events and this raises the question of whether there is a moral obligation on the part of the responsible decision-makers to inform themselves and the public more accurately on the true position.

The problem of the gap between perceived risk and real risk raises problems that call for experts in science and experts in ethics to combine in an effort to produce guidelines for decision makers. A starting point for such an endeavour would be to review the work that has been done in this regard in relation to nuclear power, ecology and genetic engineering.

1.4 Role of the individual

Since we are concerned with a question of morality, the question of the appropriate reaction to any ethical problem is basically one of individual attitudes and actions. It will be exercised in various contexts depending on the relationship of each individual to the communities of various sizes of which the individual is a part. These include person to person relationships, family relationships, neighbourhood relationships, work relationships, wider community relationships of local area and political unit and region, and finally relationships involving all of humanity and all of the living world. In the present account, discussion is limited to a consideration of the general responsibilities of the individual, of groups within the larger social community, and of governments.

The basic elements of any ethical position are: (a) the acceptance of a set of moral principles; (b) the personal perception of the factual situation; and (c) a derived moral judgment on the particular case under consideration. The variety of systems of moral principles accepted by individuals, either on the basis of authority or as a result of reflection or a combination of both, have already been outlined in the earlier section on the difficulties of a water ethic. Certain moral injunctions which are considered as of vital importance and are widely agreed to, become part of prohibitive legislation in a given society. Some of these are so broadly accepted among nations of different cultures that they became part of International or Universal Treaties binding on a wide community of nations. Personal ethics is concerned with either problems

that are not encoded into national or international law or else with the application of such ethical codes.

There are certain broadly based moral principles which receive almost universal assent and attempts have been made to formulate some basic propositions in this regard. Thus Arthur (1977) states in relation to world hunger:

> If it is within our power to prevent death of an innocent without sacrificing anything of *substantial* significance then we ought morally to do it.

A key element in this definition is the meaning of 'substantial' which may depend on other ethical priorities such as one's duty to one's own family. The following alternative formulation is due to Singer (1972), covers other impacts of shortages and disasters:

> If it is within our power to prevent something bad from happening, without thereby sacrificing anything of comparable moral importance, we ought morally to do it.

Both these formulations raise the question of the second element mentioned earlier in this section i.e. the personal perception of the factual situation.

It is clear from the earlier discussion of the nature of the problems involving water ethics that the question of the perception of risk is a complex one. Nevertheless, it is a question that must be confronted and clarified since those who have studied water problems are of the opinion that improvement in management and disaster reduction through preparedness is far more effective and more economic than post hoc response. This raises two types of ethical obligation. First, there is an obligation on scientists and engineers and other experts, who are trained and experienced in the relevant disciplines, to provide the best possible analysis of the problem and of the local vulnerability. Both reliable data and coherent interdisciplinary conclusions are of the utmost importance. Secondly, there is an obligation on local and national government authorities to make the public aware of the main conclusions of these expert studies.

The approach that considers what is required as the replacement of a pre-existing uninformed perception of risk by an improved science-based perception is far too simplistic and consequently dangerous. Lee (1981) in a presentation on the public perception of risk to the Royal Society of London states in his final paragraph:

> We have to conclude, I think, that the public's perception of risk and so-called objective risk assessment are different but complementary forms of rationality and we should work towards their synchronisation.

There is a clear need for real dialogue on terms of parity. This problem is part of the wide problem described by Wynne (1991).

> Interaction between scientists and the public based on a broad parity esteem is essential. The local community must be satisfied that the knowledge offered by the scientists is useful enough to justify the effort of assimilating it and modifying their modes of action.

Once again, we find complexity to be inescapable in tackling the problem of water ethics.

1.5 The role of groups

The role of groups of various types in contributing to the development and formulation of a water ethic is extremely important. Ethical preconceptions of individuals can be refined by interactions with others and this is most fruitful when this interaction takes place within a group with some common interest so that the discussion can be focussed rather than diffuse. It would be profitable to encourage many existing groups to take ethical problems relating to water within their ambit.

One type of group involves those specialising in problems of moral judgment. Callahan (1988) states:

> There are at least four places where any given argument for a derivative moral judgment can run into philosophical trouble. These are (1) conceptual confusions in the general moral principle, (2) problems in the factual link, (3) unacceptable conclusions following from the general moral principle when it is combined with certain other factual claims, and (4) moral inconsistency on the part of the person advancing the particular moral judgment in question.

It is clear that the avoidance of the whole range of difficulties and the furtherance of action requires extensive discussion between philosophical and professional experts and between these experts and community leaders.

Many social groups are particularly disadvantaged in relation to water management. In the case of water-related disasters, Blaikie et al. (1994) list the five most vulnerable groups as: '(1) the poorest third of all households; (2) women; (3) children and youth; (4) the elderly; and (5) some number of minority groups.' In the whole area of water, women play a key role in many respects (Rodda, 1991; UNESCO, 1997) and hence their role is of particular importance in dealing with problems of water management. This was the subject of one of the four guiding

principles of the Dublin Conference on Water and the Environment. Women are more exposed to the immediate impacts of water problems, more affected by household disruption and have less access to resources during recovery from water-related disasters than men. Vaughan (1987) found the women's account of the 1949 famine in Malawi was markedly different from men's account. National women's groups can play a major role in the amelioration of water problems as a consequence of the improvement of the status of women in vulnerable communities.

Another type of group that could play a key role is the professional group. There is no generally accepted definition of what constitutes a profession but certain characteristics can be identified. Bayles (1988) characterises three characteristics of professional training: (a) it is extensive; (b) it has a significant intellectual component; and (c) the resulting ability is capable of providing an important service to society. He distinguishes between scholarly professionals and consulting professionals. Three further features that are characteristic of most consulting professions are a public system of certification or license to practise, a national organisation of members, and a high degree of autonomy in their work. The essence of professionals is that 'they profess to know better than others the nature of certain matters, and to know better than their clients what ails them or their affairs.' (Hughes, 1963).

There is a danger in relation to ethics of exaggerating the importance of professional opinion which is a vital component but not the totality of the input required. Berry (1990*a*) has commented in relation to environmental ethics as follows:

> The problem is that value (particularly in the environmental sense) suffers from the arrogance of economists, obfuscation by philosophers and rhetoric in politics.

In another presentation Berry (1990*b*) comments:

> There is a persistent assumption that ethics is synonymous with education; a well-educated person will always, it is claimed, take the right decision and the only problem is to ensure that adequate information if available. . . .
>
> This assumption is wrong. There is no automatic link between fact and action, between attitude and behaviour.

This 'enlightenment fallacy' must be resisted. Adequate information is of the utmost importance but is not the whole story. Professionals have a duty not only to provide such information as they possess but to recognize the complementary importance of public attitudes and of ethical principles.

Most professions have adopted ethical codes of conduct. Albert Flores (1982) points out that:

> Although engineering codes of ethics purport to define the standards of ethical performance expected of professional engineers, in reality these codes contain numerous elements which have nothing to do with ethics.

There is disagreement among philosophical writers about the validity of such codes. John Ladd (1980), while admitting the relevance of ethics to professional conduct argues that:

> The whole notion of an organized professional ethics is an absurdity – intellectual and moral. Furthermore, I shall argue that there are few positive benefits to be derived from having a code and the possibility of mischievous side effects of adopting a code is substantial.

This deliberately provocative statement reflects the view that there is a tension, sometimes amounting to opposition, between codes of practice and moral principles which presume that persons are autonomous moral agents. In contradiction of this view, Judith Lichtenberg (1996) argues that codes are not a violation of moral autonomy and may be subject to conscientious non-compliance. She argues further that codes cause people to re-examine the nature of the situation confronting them and see it in a new light. The difficulty of resolving the nature of professional codes of ethic and of formulating such codes is an indication of the types of difficulty likely to be encountered in all areas of water ethics. The increasing tendency for engineers and other professionals to play a managerial role adds to these difficulties (Davis, 1991).

The responsibilities of governments in relation to risk analysis in water resources management has been highlighted over the past decade. There is a growing realisation that water scarcity is an important constraint in regard to economic development in many poorer countries (Falkenmark et al., 1990). The Dublin Conference on Water and the Environment (Young et al., 1994), which provided the official input to the Rio Conference on water problems in dealing with the institutional support of water resources assessment, stressed the need to 'establish and maintain effective cooperation at the national level between the various agencies responsible for the collection, storage and analysis of hydrological data'. Unfortunately, the past decade has seen a catastrophic decline in such hydrometric survey work in many undeveloped countries due to severe budget difficulties. This is an example of the effect of the international debt crisis on increasing the vulnerability of disadvantaged communities. Inter-governmental action in regard to this problem has been intensified by initiations such as the World Water Assessment Programme co-ordinated by UNESCO.

While ethical considerations may require the redistribution of resources to reduce

inequity within a given society, the position in regard to an existing inequality arising in a given location from scarce water resources or from above average disaster vulnerability is less clear. A basic question in this regard is the nature of inequality in society which has been analysed in detail by Sen (1970, 1973, 1981, 1982, 1987). What is clear is that at the very least the traditional methods of economic evaluation should be broadened to include indirect benefits and external values. The change in attitude in regard to sustainable development following the Brundtland Report (WCED, 1987) and the Rio Conference (UN, 1992) has started the broadening process required. The radical new departure in ethical considerations will require substantial discussion at all levels in society in order to reach a consensus. Based on extended and shared knowledge a solution is possible and is most efficiently achieved through the involvement of local interests. The second of the four principles adopted by International Conference on Water and the Environment, held in Dublin in January 1992 to provide input on water problems to the UN Conference on Environment and Development held in Rio later that year, dealt with this point (Young et al., 1994). It stated:

> Water development and management should be based on the participatory approach involving users, planners and policy-makers at all levels.

It gave the emphasise that this participation should be substantial and not nominal:

> The participatory approach involves raising awareness of the importance of water among policy-makers and the general public. It means that decisions are taken at the lowest level, with full public consultation and involvement of users in the planning and implementation of water projects.

This participatory principle is equally valid in relation to all types of water problem and is essential if the impact of such problems is to be solved to the extent possible with a minimum diversion of resources.

2. Social context

2.1 Water and social ethics

Debates about water resources management mirror broader debates of social ethics. The social context of ethical questions concerning water tends to revolve around

notions of water as a common good: water and its connection to human dignity and basic needs for life: water as a facilitator of well-being of people; rights and responsibility toward water access: water and social justice: and the wealth generating and development roles of water infrastructure. One way to look at the close connection of water to broader social ethical concerns is to look at how water management concerns relate to what many consider universal ethical principles, such as the UN Universal Declaration of Human Rights (UNGA, 1948). For example, the Principle of Human Dignity means that all persons are worthy of respect, and the human being is an end and not a means. So too with water. There is no life without water, and those to whom it is denied are denied life. Water for all and meeting minimum basic needs are vitally tied to the principle of human dignity. The ethical principle of association means that the person is social as well as sacred. The principle of participation means that individuals, especially the poor, must not be shut out from participating in those institutions which are necessary for human fulfillment. Both these ethical principles mirror a major theme: namely, that those who are impacted and who would benefit from water (which is vital to their fulfillment as humans) must have the opportunity to participate in its planning and management.

The ethical principle of solidarity, or that we are all connected, teaches that we are our brothers' keepers. Loving our neighbor relates directly to our growing sense of interdependence. More than almost any other resource issue, water continually confronts humans with their upstream and downstream interdependency and calls humanity to greater solidarity. Indeed, the current call for integrated water management could be seen as a direct subsidiary teaching of this principle. Solidarity is supported by the principle of human equality, which appeals to the almost primordial sense of fairness found in humans. This is commonly taken to mean rendering to each person his or her due. In a sense this describes perfectly our challenges in river basin management today.

Both ethical principles are furthered buttressed by the ethical principle of the common good. The common good is understood as the social conditions that allow people to reach their full human potential. By almost everyone's definition, water is a common good. Our arguments are mostly about how to manage this common good – water. This principle reminds us how ethically important the management of water really is. It is a vital facilitator to reaching full human potential and realization of human dignity. Without good water management, human potential and dignity are diminished for all and denied to some.

The ethical principle of stewardship teaches respect for creation and moral responsibility to that creation. However, it also calls for wise use of creation and complete unwillingness to modify nature. Much of water management is about

finding an ethical balance among using, changing and preserving our water resources and land. The world consensus on sustainable development can be seen as an ethical norm directly descendent from this principle. For what is sustainable development, if not achieving balance among the wise use of resources (the utilitarian approach) and respect for intrinsic value of the resources? Indeed, many of the policy recommendations for sustainable development are couched as ethical norms for actions.

Christianity, Islam, Buddhism, Hinduism and most other faith traditions throughout our world mirror these principles. For example, Hindu tradition considers water as a powerful medium of purification and as a source of energy. In the Regvada, a water prayer is offered: 'The waters in the sky, the waters of rivers, and water in the well whose source is the ocean, may all these sacred waters protect me.' In Islamic tradition, the Shariah, which many feel is a better term to use than law, literally means the 'source of water.' The Shariah is the source of life in that it contains both legal rules and ethical principles. It tells people that water is proof of God's existence, unity and power; proof of God's care, and proof of resurrection, as water restores life every day. In the Koran there are sixty references to water and over fifty references to rivers. There are many references to distribution of water. Its statements on life-preserving water for the individual and sharing small quantities of water (such as obligations to give water to visitors) are well known. It says less about what might be called its macro-economic uses. However, obligations at such a level can be implied. For example, the Qur'an states that water should be divided among people, and that the resources should not be monopolized by the powerful against the poor.

Water is one of our enduring human symbols of life, regeneration, purity and hope. It is one of our potent links with the sacred, with nature, and with our cultural inheritance. It offers a medium for a global project that unifies humanity in a single cause for peace, stability, amity, and ecological sustainability. The healing powers of water, the simple pleasure of drinking pure water, and the awesome power of waterfalls have the potential to bring us together as one with each other and with nature. Water offers a medium for creating a culture of peace.

2.2 Ethical issues and technology

No doubt, technology will change how we look at water. Some futurists are predicting that in the next twenty years the cost of desalinization will fall to about one-third of what it is today. Research into genetic foods could reduce water needs significantly in the short term. The technology of dry composting now allows us to separate the need for water from sanitation.

Together, if these three trends were to come true, they would effectively eliminate much of the water supply problem often driving public 'gloom and doom' scenarios.

If so, this is good. However, we must remember that they will not eliminate the needs for multipurpose management and integration of flood management, agricultural uses and many of the other ethical issues brought up earlier. Nor would they eliminate water mismanagement driven by institutional inertia.

It is unethical to discard technological solutions, just as it is to discard traditional approaches. Both are needed. Water policy should not let the controversies over dams color our perspective on major needs for technology. As water systems begin to reach their limits, authorities face the immense ethical imperative of managing residual risk to society. As societies begin to operate water, sanitation and irrigation infrastructure close to their limits of efficiency, they may also reduce their capacity for flexible response to extreme hydrological events. Ecological disputes must go beyond the syndrome of advocacy science if we are to preserve the legitimacy of the scientific enterprise which is so necessary for water management. New ethical codes for professional water resources engineers and managers need to be established. National, regional and state and local governments, in partnership with consumers, users and non-governmental organizations all have a role to play.

2.3 Special role of women

Women, being increasingly the poorest of the poor, carry a disproportionate burden of inequity. Women often do not have access to property, whether land or water rights. The failure to address this inequity, especially in Africa and parts of Asia, is a major cause of hunger. Gender-biased poverty is at the root of the population increases which drive water scarcity and the so-called water crisis. Promoting literacy, information, education and jobs for girls and women can go a long way to overcome water scarcity.

De facto, women are the key water managers in many small villages and communities. As such they become the keys to maintenance and operations of facilities. Frequently women have the greatest direct interest in and bear the greatest direct impact of water procedures. Nonetheless, women are rarely involved in strategic decision-making processes regarding water resources management. Studies continually show that increased participation of women is both the ethical and the pragmatic approach. Those projects with active participation of women are more likely to be sustained and to generate expected benefits. This importance was formally recognised in the Dublin Principles and clearly implied in many other UN declarations. Guaranteeing women's rights to freshwater has a direct impact on the community. Thus, participation of women in water management decisions becomes an ethical imperative for social development.

3. Types of water use

3.1 Water in agriculture

Agriculture is by far the largest user of water worldwide. Agriculture is also frequently among the least efficient users of water. However, 40% of global food production stems from irrigated agriculture. The world is dependent on irrigated water, and irrigation has been a major reason why the world can feed as large a number as we can.

Agriculture can accommodate some degree of reallocation to other sectors, and reallocations to higher value use are needed. But depriving the poor of sustenance in order to build a large reservoir is ethically not defensible. Better trade-offs need to be found which allow the general progress of the country to proceed in a more equitable manner (WCD, 2000).

Exclusive attention to meeting food needs can exert a very high, perhaps irreversible, toll on the environment and make it more difficult to meet food needs in the future. Similarly, a complete focus on preserving the natural resources base can condemn millions to hunger and poverty. We must develop a more strategic calculus for the balanced use of irrigation. Reducing poverty will require supplementing rain yields with irrigation through various forms of water harvesting.

Producing food is a main role of agriculture and thus ethically highly significant. Food security for all people is a moral imperative for leaders. Ultimately, food security comes from the elimination of extreme poverty. Indeed, some of the poorest countries with food security issues have hardly initiated their water development potential because of lack of resources. Food can be traded, and thus virtual water can be imported or exported if stable trade relations exist. When competition sharpens, farmers usually sell their land to the city developers rather than grow food. This raises the ethical question of taking land out of production for urbanisation.

The opportunity costs for irrigated crops must become more explicit in national water policy. Can irrigation practice remain unchanged and justified in situations of scarcity where the economic return to industrial water use is often 200 times higher than irrigation, or where upwards of 70% of available freshwater accounts for around 1–3% of the GNP? According to experts, rapidly growing urban and industrial demands in the developing world will need to be met increasingly from water transfers from irrigated agriculture. The management of this reallocation could determine the world's ability to feed itself.

Without mitigation of the effects of such transfers, the prices of staple cereals could

increase sharply and negatively impact low-income countries. There is an ethical obligation to mitigate the negative effects from this transfer. They should be mitigated through establishing secure water use rights; transferring small amounts from a large number of irrigators; promoting irrigation water efficiency and inducing conservation measures; reinvestment of gains from trade in the rural communities; and adequate compensation of sellers and affected third parties.

When water is used for irrigation, attempts should be made to reduce water waste through water conservation practices, and to encourage a more equitable distribution of water in irrigation networks. Attention must also be paid to water quality, as use of water for irrigation can result in contamination of runoff with pesticides and fungicides, as well as increased water salinity resulting from leaching of minerals from irrigated land. Such problems can be exacerbated by excessive use of water and poor drainage systems. Irrigation run-off can be a significant source of pollution, impacting both wildlife in water bodies and human users downstream.

3.2 Industrial use

Industries should not use more water than necessary, and users should discharge wastewater only after treating it to environmentally safe standards of quality. The water and related land use upstream should consider the propagation effects downstream and in the sea. Polluters should pay for the remedy themselves, and pollution control should be exercised on a precautionary basis rather than waiting for damage to occur and be scientifically verified.

During the last two or three decades, in many industrialised countries, the water volumes used for industrial uses and the related pollution have dramatically diminished; no significant economic impact in the industrial sectors has been detected. In many developing countries, the same may occur if the social awareness for the need to avoid pollution is created. The hydromyth that polluted rivers or aquifers are almost a requirement for industrial development should be abolished. Moreover, poor countries today can more easily use the clean industrial technologies developed in the industrialised countries during the last decades.

Water is so precious that in the long run, pollution should approach zero. Products may be a bit more expensive, but the consumer benefits from a better environment and seems willing to pay for this benefit. Industry should be prevented from exporting pollution to developing countries. International markets should consider denying access to products that are more cheaply produced in countries that have not required manufacturers to subject themselves to any environmental discipline.

3.3 Municipal uses

In 1955, 68% of the global population lived in rural areas; 32% lived in urban areas. In 1995 this had changed to 55% rural and 45% urban. By 2025, it will be 41% rural and 59% urban. In almost all of the developing world, the rate of water supply and investment falls behind urban growth. The simple water investment per capita in many parts of the world can range from US$ 10 for hand pumps to US$ 200 for piped water delivered to houses. Simple sanitation services cost about US$ 100 per capita, and piped sewage with treatment about US$ 3,500 per capita. About three times the number of people relying on water vendors have no access to sanitation. About 90% of the wastewater in the developing world is left without treatment. In other words, lack of access to safe drinking water and sanitation is directly related to poverty and poor health. At a minimum, drinking water standards must be established and enforced and water sources must be protected from pollution and industrial residue.

Expansion of water supply should occur with parallel plans for sanitation. Financing for supply should be more directly linked to financing for sanitation. We must look to innovative treatment approaches beyond dilution systems. The very poor actually pay high prices for water, though their costs are often hidden. While the poor often pay a high unit cost as individuals, it is not clear whether or how they could pay high capital cost for the large supply systems that could in the long term reduce their individual unit costs. We also know that huge social dislocations can occur in cases where water is currently subsidized, when prices are adjusted to reflect costs. Ethical guidelines are necessary to deal with these issues.

4. Water and the earth system

4.1 Groundwater use

Groundwater development has significantly increased during the past fifty years in most semi-arid or arid countries. This has been brought about by a large number of small (private or public) developers, often with poor scientific or technological control by the responsible water administration. In contrast, the surface water projects developed during the same period (dams, canals, etc.) are usually of larger scale and have been designed, financed and constructed by government agencies that normally manage or control the operation of irrigation or urban public water supply systems. Many groundwater managers have limited understanding and poor data on the groundwater situation and value, resulting in such problems as depletion of the water level in wells, decrease of well yield, degradation of water quality, land

subsidence or collapse, interference with streams and surface water bodies, and ecological impact on wetlands or gallery forests. Reports on these effects are sometimes exaggerated, resulting in the myth that groundwater is an unreliable and fragile resource that should only be developed if it is not possible to implement conventional large surface water projects.

The term over-exploitation has often been used in relation to groundwater, despite the fact that most experts agree that the concept is poorly defined and that misconceptions are pervasive. The terms related to over-exploitation have in common the idea of avoiding 'undesirable effects' as a result of groundwater development. However, this 'undesirability' depends mainly on the social perceptions of the issue, which are sometimes more related to the legal, cultural and economic background of aquifer development than to hydrogeological facts. What may be perceived in one area as a benefit (for example, developing much-needed irrigation) may well cause conflict elsewhere (e.g., if it causes degradation of wetlands, which is viewed by conservationists as a serious threat to the environment).

Some specialists believe that groundwater mining (or development of fossil aquifer or of nonrenewable groundwater resources) works against sustainable development and should be socially rejected, if not legally prohibited. Nevertheless, there are those who posit that, under certain circumstances, groundwater mining may be a reasonable option. It might be said that fossil groundwater has no intrinsic value if left in the ground except as a potential resource for future generations, but that raises the question of how to determine whether they will need it more than the present generation.

The crucial importance of preventing groundwater pollution in order to avoid a future water crisis has begun to be understood in only a handful of countries. The old proverb 'out of sight out of mind' is very apt in this case. A strong educational effort must be implemented in order not to bequeath to posterity aquifers that are almost irreversibly polluted. This is the real problem in most countries, be they humid, arid or semi-arid. The depletion of groundwater storage (classical over-exploitation) is not generally as serious a problem as groundwater quality degradation, and often may be solved without great difficulty if water-use efficiency is improved.

Real or imagined ecological impacts are becoming an important new constraint in groundwater development. These effects are mainly caused by water table depletion, which can culminate in decreasing or drying up of springs or low flow of streams, diminution of soil humidity to an extent that prevents the survival of certain types of vegetation, and changes in microclimates because of the decrease in evapotranspiration. In some cases, the ecological result of such changes is obvious. For instance, if the water table that was previously at land surface is lowered by more than 10 meters during more than twenty years, it is clear that the peatland or gallery forest

that might exist on that aquifer is not going to survive. But if the water table is depleted only during one or two years and not more than one or two meters, it cannot be assumed that the ecological impact will be irreversible. Unfortunately, quantitative and detailed studies of this type of problem are still rather scarce.

Another proverb that comes to mind is 'Prevention is better than cure.' But here, too, the precautionary principle should be applied with considerable prudence. In general, groundwater development should not be rejected or seriously constrained if it is well planned and controlled. During recent decades, groundwater withdrawal has made possible undisputed socio-economic benefits. Particularly in developing countries, it is a major source of potable drinking water, with 50% of municipal water supplies worldwide depending on it, as do many rural and dispersed populations. Irrigation with groundwater has made it possible to increase food production at a greater rate than population growth; 70% of all groundwater withdrawals are used for this purpose, particularly in arid or semi-arid regions. It should also be pointed out that using groundwater for irrigated agriculture is often more cost-effective than using surface water, primarily because farmers typically assume all abstraction costs (development, maintenance and operation). Groundwater abstraction usually produces significantly more income and jobs per cubic meter than surface water.

Most countries consider that groundwater abstraction should not exceed renewable resources. Others – mainly the most arid ones – find that groundwater mining is an acceptable policy, as long as available data assure that it can be economically maintained for some time (for example, more than fifty years) and that ecological costs are compensated by socio-economic benefits. With careful management, many arid countries will be able to utilize resources beyond the foreseeable future without major restructuring. Clearly, it is not easy to achieve a virtuous middle way. There is a tendency to move from one extreme to the other, and there are potential risks associated with both extremes.

Despite the complexity of the question and the variety of responses that may be made based on place and time, there are several overarching issues that have ethical implications in trying to achieve sustainable, reasonable groundwater use. Firstly, the subsidies (some hidden and some open) that have traditionally been a part of large hydraulic works projects for surface water irrigation have encouraged the neglect of groundwater resources by water managers and decision makers. More careful consideration of cost and benefit could reveal that many proposed surface water projects are economically unsound, thus fostering serious consideration of groundwater planning, control and management.

The question of public, private or common groundwater ownership is also important. Some people consider that the legal declaration of groundwater as a public domain is the necessary foundation for acceptable groundwater development. This

assumption is far from evident, and there are examples where groundwater which has been a public domain for many decades has been subject to somewhat chaotic management. Nevertheless, there is no disputing that promoting solidarity in the use of groundwater as a common good is vital, particularly in view of the fact that thousands of stakeholders may exist on a single aquifer of medium or large size. Groundwater management should be in the hands of these stakeholders, under the supervision of the corresponding water authority.

Availability and consistency of information is a prerequisite to successful groundwater management. Development of adequate hydrogeological knowledge has to be a continuous process in which technology and education improve stakeholder participation and a more efficient use of the resource.

There is an urgent need to create appropriate institutions to manage aquifers so that all who benefit from them are made aware that if they pump permanently in excess of the renewable recharge of groundwater, they may incur serious problems for themselves and for their children and grandchildren. Considering the aquifer as a shared common good brings with it the obligation to manage it in a participatory and responsible way.

4.2 Water and ecology

Ethical norms for water policy need more explicit debate on their underlying assumptions about nature and history. Since nature is constantly changing, we must avoid blindly following equilibrium and status quo notions of nature. We need to engage in active and conscious co-design of what we think nature and the water resources should be and the criteria used to describe such ends or goals.

Ecological processes keep our planet fit for life. Ecological sustainability must be a major objective in all freshwater uses. Over-abstraction and water pollution must be minimized to maintain the integrity of the ecological system of which water is a vital part.

Maintaining ecological systems is not simply an additional newly-identified need for water. Ecological systems function as cycling systems between the earth and the atmosphere, and can perform what are often the most cost-effective solutions to water management. By the same token, water control can benefit ecological systems by regulating flows, sustaining fish and managing multiple uses. Indeed, very little of earth is natural or completely unaffected by human influences. Almost all is managed, intentionally or unintentionally. A new awareness of how humans are co-managing ecosystems with traditional methods is needed. This requires better integration of ecological values with traditional economic values, which themselves are often distorted by subsidies for uses. Claiming to preserve a state of nature or to

separate human interventions from a perceived state of nature can be as unrealistic as ignoring human impacts on the ecosystem.

4.3 Floods and droughts

Traditionally, many countries and External Support Agencies have looked at water as it relates mainly, or only, to goals of some specific economic sector (e.g., irrigation) and not comprehensively. This has reduced the capacity, especially in countries which are vulnerable to natural disasters, for early warning and monitoring of potential water related emergencies, such as floods and droughts. It has also skewed the cost and value estimates of water and generally hidden some of the realities of risk and uncertainty behind management measures.

Hazards can be man-made or natural. All hazards are not disasters, and all disasters are not the result of natural hazards. The link between hazards and disasters is the degree of vulnerability. The poor, because they lack options, often live where natural hazards are most likely to occur, and are the most vulnerable to natural hazards. In the case of water management we are concerned with vulnerability to either too much water (floods) or too little (droughts). The difficult but growing ethical imperative is to assess and share the risk or vulnerability to hazards and disasters, as well as the responsibility to take measures to prevent and mitigate disasters resulting from hazards. Unfortunately, there are many parts of the world where natural hazards can trigger broader humanitarian disasters.

Attitudes are determined and decisions made on the basis of perceived risks. But there are frequently large gaps between perceived and real risk, especially in the case of rare events. Thus, there is a need for guidelines on the moral responsibilities of experts to define risk as clearly as possible, of decision makers to raise and communicate such risk, and for publics and groups to participate actively in choosing acceptable levels of vulnerability. Nevertheless, the reality is that sometimes the poor are in the way of floods because they cannot find other better places to live.

We have obligations to keep projects from encouraging the phenomena they seek to protect against – e.g. by encroachment on the flood plains. We have obligations to find beneficial uses of flood plains which minimize risks while enhancing productivity when proposing projects.

We must deal equitably with asymmetries in flood management planning: especially between short-term concentrated interests and long-term dispersed beneficiaries. We must assure equitable mitigation of those bearing immediate costs for the benefit of those reaping long-term gains.

Investments in water policy offer great potential for enhancing community infrastructure which is critical to keeping natural hazards from becoming broader human-

itarian emergencies, and for mitigating and adapting to emergencies. Indeed, there is much room for rearranging our 'plumbing' system, and prospects for managing water without world catastrophe or water shortage are good. But we are beginning to understand that explicit policies are needed to encourage or direct these change processes. It is these policies which could cause, mitigate or avert humanitarian disasters.

The problems associated with droughts and floods are integrated: they emerge as a result of a system of behavior around a river basin. However, institutions to deal with them, even in the developed world, are fragmented. Thus, solutions tend to be ad hoc, fragmented and reactive. A more seamless web between the anticipatory and sensing agencies, reacting and planning agencies and the mitigating and relief agencies needs to evolve. Perhaps this is most clear in the collecting, processing and use of hydro-meteorological data. The sensing and monitoring water organizations need to be seamlessly linked to planning, operations and disaster relief water organizations. Professionals in these organizations need to be sharing and discussing the same real time data on precipitation, hydrology, climatic change, and disasters.

Floods and droughts are usually dealt with together because both are extreme hydrological events, and both create almost every year thousands of deaths and substantial material damage. Nevertheless, prediction and mitigation procedures are different. Today flood prediction is much more reliable than drought prediction. Additionally, floods are usually short duration phenomena (from hours to a few days), but drought is a longer process; usually disastrous droughts are several years long. Mitigation of floods is related to structural solutions (dams, dikes, etc.). Drought protection is often associated with non-structural approaches (water markets, insurance, restriction regulation, etc.,) or mixed conjunctive uses of surface and ground water. In some countries, the lack of planning to mitigate floods and droughts is a blend of lack of institutional capacity and corruption.

Sometimes 'normal' floods and droughts (e.g., in the semiarid countries) are defined as catastrophic in order to obtain public money to build large public works. These projects may be undertaken at public expense for private gain in countries where such ventures are vulnerable to bribery and corruption.

5. Water resources management

There are ethical issues imbedded in all aspects of water management decision making, including planning, regulating, operating, financing and investing, designing, and implementing. Ethical considerations concerning decision-making and management tend to revolve around the following questions: Who participates? What

are the decisions they participate in? Do they have access to formulating options or only to reacting to options already formulated? How and what type of opportunity costs are considered? What is the basis of valuing, implicit or explicit, in trade-off decisions? What level and type of information is open to the public? To what extend are environmental, economic and other impacts included, and how are they characterized? In what way do professionals interact with non-professionals in the use (or misuse) of technical and professional information?

Decision-makers should understand the linkage between development strategies and issues of water allocation, supply and pricing, and consider decisions in the context of macro-economic national and regional strategies. Decision-makers must also understand that their decisions have hidden implications for people who have limited options (and, in effect, something less than full human rights) because of poverty. They have an ethical duty to understand such implications and to equitably mitigate effects of their decisions.

5.1 Markets and pricing

Recognizing water as an economic good, now part of many declarations on water and of policies of major lenders and donors, has generated heated political debate and considerable fear. These conflicts have revealed fundamentally differing values associated with water among various cultures. Some claim that fostering the notion of water as a commodity moves public perception away from the reality of water as a common good and from a sense of common duty and responsibility toward water. In other words, there are profound ethical implications in perceiving ourselves as water citizen versus water consumers. Water as a common good focuses us on the former, while private as well as public ownership rights focus us on the second. Responsible water use depends as much on assuring equitable distribution of water as fair pricing. We should also bear in mind that in most cases what is charged for is not water itself, but the infrastructure and services necessary to bring water from its natural source to the user.

The reality is that water is used as a factor of production and managed as a commodity, in some degree, by all societies. Whether explicit or not, it is valued and it clearly incurs opportunity costs. However, all the costs and benefits are not and cannot be reduced to quantifiable currencies. Water is priced in some way by all societies. The poor often have no choice but to pay high prices. Buying water on the streets can result in the poor spending between 5–10% of their income, and in some places as much as 20% of their income, on water. In contrast, in most industrialized countries lower middle class families only spend 1–3% of their income for potable water and sanitation.

Market allocation requires secure user rights and low transaction costs. However, value in use is much higher when it is controlled in terms of both time and space, which usually means hydraulic structures with public subsidies. Indeed, the power to use water for economic development or as an avenue to redistribute income and wealth is really a significant political and social tool. Thus, effective government or legitimised governance is central in any use of markets. It provides for secure user rights; assures low transaction costs; assesses and assures mitigation of third party impacts; and provides means for consensus building and resolution of conflicts not solved in the market.

All variations of public and privatization policies to deal with water should aim toward enhancing public institutional capacities. Although water pricing needs to take into account water costs, we must acknowledge the role that subsidies have played and are realistically going to play in the future. Because of the complexities of these issues, broad public access to information and opportunity to participate in decision-making are ethical imperatives in determining water prices and the most appropriate institutional structures for water management.

5.2 Institutional issues

The current debates over private versus public roles in water management are too narrowly focused and sometimes ignore important historical realities of the developed countries which are advocating increased privatization. Today, privatization is often seen as a way to increase efficiency and to bring more water to more people (i.e., to democratize water and sanitation). However, privatization also raises a question of open information flow and transparency. Organizations which operate to seek a profit are frequently not as prone to share critical information on water flow or water quality as their public counterparts, particularly where there is a weak regulatory environment.

Privatization of the vendable aspects of water can reinforce older notions of single-purpose planning and management of water and directly contradict the ethic of integrated water resources planning. Some water services such as flood control cannot be privatized. Others, such as navigation, can only be privatized to some degree. As a result, pushes to privatize may encourage the fragmentation which integration seeks to overcome.

The debate over organizing for water must move beyond choosing between the poles of privatization and public bureaucracy, and consider the myriad of possibilities between these poles. For example, there is a difference between public good and a common property under public trust. The evolution of water law and water institutions historically have been inspired far more by the concept of common property

under public trust than by private or pubic ownership. Indeed, the debate in Europe is moving from private versus public to a debate between public regulation on the one hand and common property based forms of governance on the other. Europe's history has been one of considering water as common property, held in trust by the State, but managed at more adapted subsidiarity levels.

Often privatization occurs not for positive reasons, but because public entities are not able to make needed investments, or because elected officials are unwilling to take responsibility for water price increases. However, in these cases, other options exist, such as managing utilities services together and pooling financing needs, or temporal averaging of interest rates to lower the cost of money. The cost of money can be decisive in determining water investment. In this regard, we should not forget that the initial infrastructure investment in Europe was based on massive subsidies. Thus, in those places such as southern Europe and the developing world where the initial infrastructure is not yet complete, full cost recovery takes on a different ethical meaning. This raises serious questions of equity in relation to those places with well-developed infrastructures which were historically heavily subsidized. We must be cautious about prescribing policies and solutions which are based on our experiences, when these are not shared by those for whom we are prescribing them.

5.3 Water and conflicts

Conflicts over water can and have caused violence. If water stress increases so too will social violence. However, violence at the personal and local level does not generally translate into the broader regional and international levels. In fact, water has more often been a medium of building community than a cause of war. Water management also confronts us with the reality of conflicting human rights (for example, between preserving a traditional way of life and creating new opportunities for growth and reduction in malnutrition).

Conflicts over water arise from a variety of causes. Although the problems associated with water crises are usually integrated around a watershed or river, those institutions both affecting them and responding are not usually integrated. Incompatible goals exist regarding the access to, control over and sustainable use of transboundary water systems. Problems are created by maximizing single-purpose uses without coordination.

Water is forcing us to rethink our notions of security, dependency, and interdependency. Increased interdependence through water sharing plans and infrastructure networks is often viewed as increasing vulnerability and dependence and reducing security. However, there is an alternative way to look at interdependence. Connections can be seen as networks, which will increase our flexibility and capacity

to respond to exigencies of nature and reduce our vulnerability to events such as droughts and floods. Actually, such networking can increase our security.

This flexibility addresses the fear and insecurity that have driven humans to reduce uncertainty and build predictability and safety into what was often experienced as a harsh environment. While often challenging the engineering mentality, this same fear, that we are destroying life, inspires environmental concerns. Both reflect a commitment to the right to life, even though they produce conflicting views of what we should do. Somehow water forces us to go deeper than familiar adversarial positions and acknowledge what we really share – a respect for life and well-being.

Water can be a superordinate value, the appeal to which is capable of coalescing conflicting interests and facilitating consensus building within and among societies. The symbolic content of water as cleansing, healing, rebirth and reconciliation can provide a powerful tool, symbolizing the acts of reconciliation's so necessary to conflict resolution in other arenas. In a sense, negotiations over water use, itself, could be seen as a secular and ecumenical ritual of reconciliation and creativity

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