Water and Ethics

WATER IN AGRICULTURE

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UNESCO International
Hydrological Programme

World Commission on the Ethics of
Scientific Knowledge and Technology

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Series on Water and Ethics, Essay 5

Published in 2004 by the United Nations Educational,
Scientific and Cultural Organization
7, Place de Fontenoy, 75352 Paris 07 SP (France)
Composed by Marina Rubio, 93200 Saint-Denis
Printed by UNESCO

ISBN 92-9220-020-8

Printed in France

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.

James Dooge
John Selborne

This publication deals with the ethical context of water use in agriculture which accounts for over 80% of total water use. It discusses the need for solidarity at local, regional and global level to tackle effectively the problems of water scarcity.

Bo Appelgren is a former Programme Specialist at the UN Food and Agricultural Organisation and currently a UNESCO consultant.

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1. Driving forces and threats

1.1 Water for agriculture

Water for agriculture covers a wide range of consumptive and non-consumptive water uses in all the agricultural sub-sectors related to ethical conflicts and significant social, economic and environmental issues. The waters for agriculture represent the dominant water use in the form of abstractions of flowing water for irrigation and as rainwater and soil moisture in croplands and forests.Evaporation from freshwater bodies and wetlands is important for biodiversity and inland and marine fisheries. Irrigation uses about 70 percent of total globally abstracted water volumes (estimated at 6,800 km^3/yr), while total agricultural use represents about 92 percent of total uses of flowing water and rainwater (25,000 km^3/yr). The matrix in Figure 1 illustrates various categories of agricultural water and their use for crops (irrigated, rainfed and dryland), livestock, fisheries and forestry sub-sectors (FAO, 2000*a*). Agricultural demands represent actual current use of rainfall, soil moisture and flowing waters for agricultural production. This is different from generally planned demands and an enormous, rapidly growing investment gap for water supplies, sometimes referred to as the *water supply paradox*.

Above all agriculture produces the necessary food for the world's populations under both rainfed and irrigated conditions (Appelgren and Klohn, 2001). In a wider perspective, agriculture is not only the main consumer of water but also a critical factor shaping important terrestrial and freshwater biomes that form part of necessary life-supporting eco-system services. Agriculture has also become a critical cause and a source of water pollution that has also upset the nutrition cycle in the watercourses and soil-water systems and rendered the water unsuitable or less valuable for other water uses.

Agriculture represents the first, traditional life-supporting economic sector closely linked to established cultural and ethical values of land and water on which traditional societies are built. Agricultural water use and ethics therefore forms a broad subject that goes beyond producing food, maximizing productivity, improving water use efficiency and protecting the environment.

Water in agriculture is largely associated with irrigation. The green revolution and the increase in global food production from the 1960s to the 1980s was to an important extent based on the expansion in the world's irrigated area, from 140 million hectares to 240 million hectares. Over one third of the world's food is now produced on the irrigated 17 percent of the world's croplands. There are currently some 250 million hectares of irrigated area, almost three quarters of it in developing

countries and four countries: China, India, the United States of America and Pakistan, contain half the world's irrigated land. The remaining two thirds of all food is being produced on a five times larger rainfed area (1,250 million hectares).

Figure 1. Matrix of water uses in agriculture and their impacts

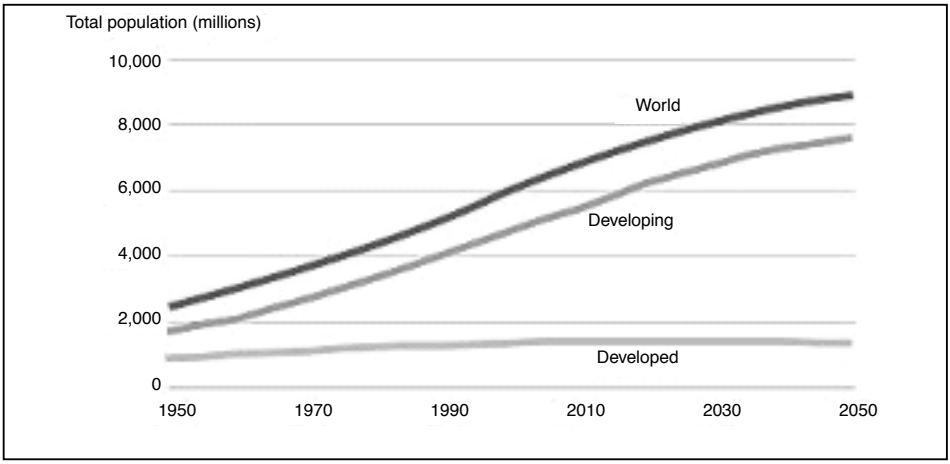
Agricultural sub-sector	*Abstractions from rivers and groundwater use*	*Rainwater and soil mosture use*	*In-stream use and impacts*	*Virtual water trade, changes in stock, environmental degradation*
Irrigation	12% of cultivated area	supplementary irrigation/water harvesting; non-rival uses	non-point source river pollution	food trade; food aid
Rainfed crops	supplementary irrigation/water harvesting; rural water supplies	88% of cultivated area; cash export crop production	non-point source river pollution	food trade; food aid; land degradation
Livestock	livestock watering supplies; production based on irrigated fodder	range; grazing land management	grazing of seasonally flooded lowland	reduction and expansion in stock; food trade; food aid; land degradation
Fisheries	pond aquaculture	n/a	capture fisheries; farming in natural water bodies	food trade; food aid
Forestry	forest irrigation	annual consumptive use (500–1,500 mm) reduced runoff, improved low-inflows	impact on sedimentation and floods	reduction in stock, export/import of timber and fuel wood

1.2 Population and food

Water is essential for agricultural production and its linkage to food security and population issues are often reflected in water scarcity and per capita water availability

with finite water resources distributed over growing populations. As a consequence the ethical perspectives of water in agriculture have become closely related to the Malthusian debate on population, resource scarcity and conflict. The global population will continue to grow, though at decreasing rates (Figure 2) and is projected to reach around 9 billion by 2050. In general the growth will occur mainly in the collective population of the developing countries with even a slight decline in population in developed countries.

Figure 2. Projected population growth



Source: FAOSTAT, 2000.

With accelerated rural-urban migration, more and more of the population is living in urban areas. Transportation and processing of food products, largely driven by domestic and international capitalism and the ability of a growing urban population to purchase, will become increasingly important to meet food demands. Together with global population migration (Box 1) and reduction in rural labour, there is however a risk of further accentuating rural stagnation, abandonment and poverty in developing countries.

The general ethical position was for long, and still is, to develop and protect natural resource for human social well being. With the concept of a perceived scarcity of natural resources, sensitive issues of balanced demographic growth arise. General statements on global population growth could be biased and hide important details. For example some industrialised countries with growing life length, immigration and high fertility now experience high population growth. In the light of economics,

Box 1. Population migration

One consequence of improved communication is the increased South to North flow of poor, displaced or persecuted emigrants. With the perceived aspects of poverty and desperation growing migration reflects hard ethical conflicts related to natural resources and agriculture but is also a consequence of globalisation of labour markets and forms a test of global solidarity. The sensitive debate incorporates arguments and counter-arguments, such as:

- Increased migration stems less from population pressures, poverty and out-migration of subsistence farming populations and owes more to dynamic international capitalisms employing illegal farm labour as well as 'guest workers' in industry,
- Immigrants have often become victims of inconsistent and erratic immigration policies in the recipient countries. However official immigration is changing to accommodate social needs and more focused on family members of earlier immigrants,
- Grey agricultural labours are often explored to work under poor conditions with the consequent poverty and health issues and social costs eventually paid by the society,
- The effect is the support by society of an artificial irrigation sub-sector and unfeasible agriculture that contributes to overproduction and over-abstraction of water and environmental degradation in the industrialised countries,
- The moral issue of agricultural investments in the rich countries at the expense of human hardship and social conflicts rather than appropriate incentives for capital investments in poor economies results from the outreach of international capitalism to make investment choices for return and security, and
- Developing economies are constantly drained of the young and job-worthy part of the rural work force further eroding the labour base for local agricultural production.

scarcity is based on values as opportunity costs and on efficient allocation through markets to maximize the value of the resources to the society. With growing social risk and more weight given to the true public good of disaster management, economic scarcity concepts that do not address social threats are losing in application. Following the Rio Earth Summit in Rio 1992, demographic issues were dealt with separately in the International Conference on Population and Development, 1994. Ten years after Rio, the World Summit on Sustainable Development, 2002, was focused on the needs of growing populations and alternative concerns, including

eradication of poverty, increased food availability and affordability, sustainable development guided by ethical principles and global solidarity living together guided by effective multilateral institutions. Maybe an era of pessimistic per capita resource assessments and water scarcity indexes is coming to an end.

Malthus (1798) anticipated disasters and a consequent imbalance in 'the proportion between the natural increase of population and food'. The Malthusian concept on scarcity and population issues touches on sensitive taboos and has thus met with resistance. Its supporters are often accused not only of exaggerating crisis diagnosis but of supporting anti-humanism and equalising resource scarcity with a position that that there are too many people and of state-centralism for unethical objectives, such as of isolationism, racism and elitism (Ohlsson, 1999). In a world governed by global and domestic political realities, the debate of water scarcity is principally 'red to agriculture and food production and the related sensitivities. In the perspective of new emerging threats from environmental degradation and slow technology development in water and agriculture and growing risk of hydrological and environmental disasters and consequent social and economic welfare gaps, agriculture continues to be associated with rural poverty, low productivity and subsistence farming outside the formal economy, with limited access to and limited demand on technology, capital and the benefits from market liberalisation and globalisation. The situation is more complex and goes beyond resource scarcity as it conflicts with the ethical principles of development and increased choice for all.

1.3 Globalisation and technology

The advancing powers of modern technology continue to result in increased productivity in agriculture and improved rural welfare but only for limited privileged groups of the world farming population. The rural population in the OECD countries is about 20 percent or about 190 million compared to more than 70 percent or 1,800 million in the low-income countries. Intensive agriculture results in greater production using less water and land resources and labour, but also introduces new risks to the natural resources and the environment. Thanks to intensification and new technology in agriculture, the world has recently reached the global productive capacity to produce and distribute the required food for all. With market liberalization and globalisation, new technology together with the institutions and marketing systems are becoming more widely available and the economies, which have moved toward market orientation for natural resource allocation, have in generally achieved at least temporary economic growth and been better fitted to sustain economic development and food security. However due to deprivation and limited access to food, land and water resources and technology and capital, sufficient food

and the means to local food production are not made available to all. One visible and tragic consequence is that more than 800 million people continue to live under conditions of poverty and food insecurity.

From a moral perspective and in the perspective mentioned above of increasingly frequent disasters and emergencies with risks for future negative social effects, there are legitimate ethical claims for more global solidarity and attention to the adverse impacts of political and economic liberalisation and globalisation programmes on poor and vulnerable groups and on the environment. There are also legitimate doubts concerning the sustainability of the global market systems with tendencies of a return to protective and inward-looking agricultural and trade policies and a tendency of increasing pressure and conflict to secure national shares of transboundary water flows. The World Trade Organization recorded a spectacular growth in international trade of 12 percent in year 2000. The prediction for year 2001 however showed a drastic decline to 2 percent, with agriculture representing probably the most protected and conflictive sector. As more countries are relying on food imports, there is a perceived risk also based on considerations of national sovereignty in the food-importing countries of being held hostage by the arbitrary decisions of a limited number of food-exporting countries. It may not be sufficient for a country to rely on its economic strength to buy food in the international market if there is no guarantee for free access to exportable quantities of food. While the right to food forms a human right, it is unfortunately not very likely and even dubtful whether long-term food security could be built on equitable and solidarity-based global access to food items being produced.

While global agricultural production is reaching higher levels, the economic power of international capitalism is becoming ever more concentrated. Only 200 large multinational corporations account for a quarter of the world's economy (FAO, 2001*b*) and the number of companies engaged in inputs to agriculture, food processing and food retailing are getting less than ten percent. At domestic and local levels, agricultural land is being concentrated into larger units in the hands of a smaller number of owners. The scope for the necessary intervention and social protection in the sector is being reduced as governments withdraw from food production and agriculture leaving initiatives and control to the profit-oriented private sector.

1.4 Human induced disasters

Agricultural and water resources development for intensification and higher productivity are linked to increasingly higher social and environmental externality costs. These costs, whether invisible or unknown or just ignored or considered non-

significant or non-detectable or just being too high to be accommodated by feasible investment projects, have often been left non-internalised or even accounted for. Social and environmental impacts, in the form of environmental damage caused by human-induced disasters and resulting social conflict and instability, have started to appear as high deferred social and economic costs demanding growing shares of the limited social resources and capacities both in the developing and the industrialised economies. An estimated 60 million people are affected by disasters with more than 30 million flood victims. The international insurance industry has reached its capacity to cover for major flood and disaster-related damage and the collective toll on social and economic resources to cope with natural disasters will soon (2025) exceed half the economic products in the industrialised economies threatening global economic growth. Disaster relief in developing countries is becoming increasingly dependent on global solidarity. As a response there is a switch to pragmatic risk-based natural resources management with shrinking capacity and motivation for integrated long-term management of natural resources.

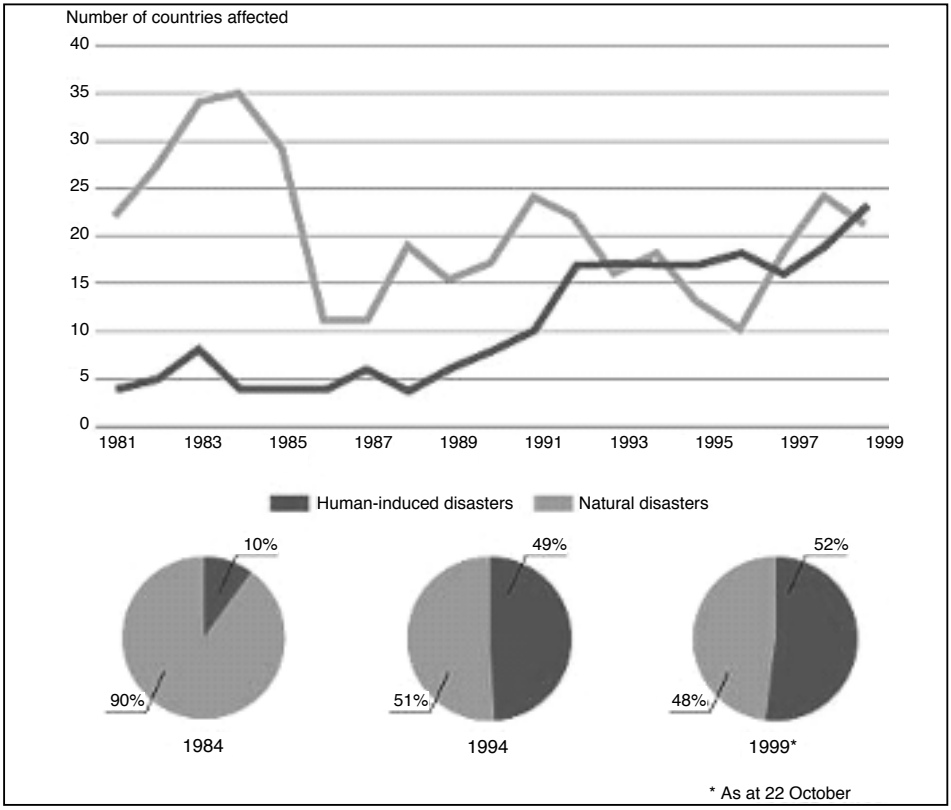
It is more than 70 years since the concept of integrated water management in river basins replaced single-purpose approaches and the experience suggests, '… realization of the full potential of truly integrated water management may be very long in coming. Problems of improved analysis and of necessary institutional reform are formidable' (White, 1999). Figure 3 (FAO, 2001*a*) shows the rapid increase only in the last 15 years in the number of countries affected by a growing share of human-induced emergencies, including famine, crop failure, floods, drought and civil strife with social losses and tragic consequences (Box 2). While the related social, economic and environmental risks concern all countries, threatening both the industrialised and developing economies and going beyond ethical perspectives of

Box 2. Rwanda: Apocalypse, the result of scarcity and conflict?

Of a total population of 7,5 million in Rwanda only 300,000 formed part of the formal economy with the balance living as subsistence farmers and too poor to exert any demands. In contrast to other developing countries Rwanda had not experienced any large rural-urban migration and failed to create alternative livelihood options to build a modern sector and the economy remained too small too sustain industry or to raise sufficient government revenues. The tragic consequences of the Rwandan *ultra-poverty* (40 percent poor versus 9 percent non-poor and 1 percent rich), culminated in the 1994 genocide. The question is whether this apocalyptic event was also an ultimate outcome of persistent rural poverty and natural resource scarcity (Ohlsson, 1999).

solidarity, any significant global pro-action remains unlikely until a minimum of a global framework and mechanisms for prevention and civil protection have been put in place.

Figure 3. Trends in causes of food emergencies, 1981–99



Source: FAO, Global Information and Early Warning System on Food and Agriculture.

1.5 Assessment and change

Notwithstanding the visibility of large disasters or the warnings from scientific scholars and institutions, any substantial change is not likely to be triggered from threats and crisis alerts. Even in a perspective of hard realities of growing crisis and disaster, it is unlikely that the politicians, for various reasons, will not take into account long term political risk in undertakings that carry limited political currency.

The general public, saturated with too much apocalyptic pessimism will remain indifferent to warnings – unless related to stability and peace, social welfare, health and food security. The challenge is therefore to identify alternative communication mechanisms to motivate and mobilize society towards balanced decisions on social, economic and environmental patterns for sustainable use of water and land and secure that such decisions are ethical-based on solidarity and high moral values and not just limited to favour short term self-interests. Ultimately, this will depend on ethical-based policy for demographic development, urbanization, economic transition including for productive agriculture and international trade representing critical driving patterns of increased natural resource use. Implementation at global level still carries many question marks.

2. Development and conservation

2.1 Environmental principles

Ethical behaviour is based on consistency and integrity. The truth of ethics is often perceived as too grey and irrational for institutional efficiency. At a practical level, this is probably the reason why ethical principles have only limited impacts on modern approaches to water and land resources management and why water and land law systems, responding to the social and environmental dimensions of the development of resources, tend to adhere more to pragmatic balances between investment needs, economic use and the need for public regulation. *Environmental ethics* (Box 3) has emerged as a recent branch of applied philosophy focused on intrinsic valuation to include environmental costs and values in the appraisal of capital investment in development projects and non-physical programmes including structural adjustment and sector policy. This occurred in a period when, for a variety of reasons including a firm belief in sector protection and 'trickle-down and multiplyier' effects,

Box 3. Environmental ethics

Environmental ethics theory has evolved over the last three decades built on the claims by Aldo Leopold and other scholars that the root causes of ecological crisis are philosophical. Environmental ethics was for a long period focused on intrinsic environmental valuation but has recently then reflecting the global switch in political economy and taken a turn towards the conceptions of values.

national governments followed inward looking policies with high agricultural subsidies and large public investment to explore water resource for rural development and food self-sufficiency. More recently in response to market based systems, and liberalisation environmental ethics is focused on the conception of ethical values.

Box 4. Ethical development and environmental principles: (1) Precautionary and preventive action; (2) Natural systems values, and (3) Solidarity-based risk management

1. The principle of ***Precautionary and Preventive Actions*** aims at protecting the rights of future generations and disqualifies any action, unless 'shown not to effect too serious risks'. The principle is frequently incorporated under environmental conventions and official documents. Common criticisms include the following: that application implies a signal to 'do nothing', the unfeasibility of categorizing 'too serious risks' in relation to short-term gains, and the difficulties of deciding by whom and based on what moral justifications these risks should be 'shown'. Some critics question the morality of taking any risk once it is known. On a practical level it might be difficult to apply the principle especially in situations with resource scarcity and also poverty and food shortages and when hard decisions have to be left to more soft approaches.
2. The principle of ***Natural Systems Values*** supports nature preservation also at the expense of human well-being and socio-economic development. Steps to reshape nature even for the purpose of gaining preservation values are rejected. The principle is often being questioned on the feasibility to distinguish natural from non-natural systems and on the moral relevance of limiting to the single alternative of preservation while resisting reshaping and leaving out the options of nature restoration.
3. A compromise between the two above conflicting principles, ***Solidarity-based Risk Management*** builds on calculated risks reflecting short term pragmatism as vested in disaster management, social prevention and civil protection. As large disasters are multiplying with increasingly adverse effects on societies and the environment, disaster management has becomes a global concern dependent on international solidarity for relief and reconstruction. This approach might encounter resistance as it reflects abandonment of wider sustainability goals and earlier integrated approaches with institutions and investments in support of sustainable socio-economic development and environmental protection.

The ethical imperatives in water for agriculture build on a diversity of basic principles. General principles such as 'doing good or 'beneficence'; 'avoiding harm'; 'pursuing equity'; or 'right and wrong' are based on a classical decision-making yes-or-no situation, while application of the precautionary principle (Box 4) involves a series of judgements.

Ethical action should support independent involvement of all concerned parties and is generally analogous to promoting the universal exercise of human rights. To ensure sustainable agricultural development and to meet moral inter-generational responsibilities, it will be necessary to stop using technology and science for short-term gains at the expense of long-term risks of negative ecological effects for future generations. The principles and approaches presented in Box 4 demonstrate different views in relation to moral issues and philosophical complexities. The principles reflect a 'good' intention to apply moral values but also show the difficulty to combine general validity with practical applicability.

Irrigation development projects for water resources development for several decades formed one of the principal sectors for international technical and financial assistance and have generally been successful in showing favourable economic results. However as international co-operation in general has also been accused of encouraging irregularities and corruption this has raised basic moral and inconsistency issues (Box 5).

2.2 Human behaviour

Similar to other social processes, ethics of agricultural development and agricultural water use is driven by current political preferences and based on legal practices where principles and views are 'crystallized' and made rational thus enabling the establishment of norms, laws and administrations. The process represents a top-down approach that involves the legislative unit of government and has proven to be time-consuming and not always effective when it comes to enforcement and implementation. The opposite bottom-up approach is based on evolving social local institutions that build on predominant moral norms as 'background ethics' within and between different parties and groups. The background ethics relate to interrelations within a community or between governments and groups of peasants. For example, 'a majority will care about collective welfare, a minority will take more than is 'safe or fair', while both will act accordingly irrespective of what they think others will do'. These social moral norms are not static but represent current social capital at local level that is evolving but also affected by external influence and stress.

Box 5. International Co-operation

On a pragmatic pessimistic note, it is seen necessary to review the general lack of morale and ethical-based management at global and macro-level. While consistency forms a main feature of ethical behaviour, there are moral issues at macro-level with entrenched moral deficiencies in prevailing social norms and non-sharing ethics. Few poor countries are seriously committed to mitigate domestic poverty and public social spending often favours elite groups in urban areas. There are indications from recent research that the development of the poorest countries has stalled because of inefficiency and corruption in their governments, while other countries such as South Korea, extremely poor 50 years ago and today an OECD member, show that progress is possible with efficient governments and appropriate economic policies.

With these inconsistencies in the moral and social norms in the poorest countries development aid is by and large inefficient. The same is valid for the ongoing remission of international debts. Donor countries, often based on 'good' criteria of poverty alleviation (but often driven by own objectives of alliances, political relations, neo-colonialism, export promotion or self-directed domestic politics) have approved large amounts of credit to developing economies without sufficient critical review of the political balance in the recipient countries. This has resulted in false signals to the leaders in developing countries that corruption pays, and to the western public that underdevelopment depends mainly on decision of politicians in the donor countries. These misconceptions need to be challenged and changed to avoid another cycle of indebtness and poverty.

2.3 Development and conservation

In reality, biodiversity and agricultural development represent conflicting objectives, and form a major difficulty in the global North-South dialogue. Biodiversity is generally labelled as a Northern imperative and used by the South as argument for increased international development aid and larger shares of the world economy for the South. The northern position, supported by science is that sustainable development depends on protection and conservation of biodiversity. Agriculture is often perceived as damaging and conflicting with conservation and there is growing global demand for biodiversity and tourism. From a social aspects, it remains however less clear how and to what extent biodiversity and tourisms can be translated into benefits to local developing economies in the form of income and employment.

In Lake Malawi (FAO, 2001*c*) (Box 6) the global long term interest of biodiversity conservation is conflicting with immediate local needs for economic, rural develop-

Box 6. Lake Malawi/Nyasa Basin,
Conservation of Biodiversity versus Poverty, Food Insecurity and Water Scarcity

Lake Malawi/Nyasa is the third largest fresh water lake in Africa with an area of 29,000 km^2 and a total basin area of 98,000 km^2. The Lake is a site of natural beauty and rich in flora and fauna and the Lake Malawi National Park was a declared a UNESCO World Natural Heritage in 1984. Conservation of the biodiversity, in particular of close to 1,000 unique freshwater fish species in the Lake, is of high global priority. The basin, shared between three low-income countries, Malawi, Mozambique and Tanzania, has a total population of 15 million. With extensive rural poverty and few alternative options for sustenance, low-productivity subsistence farming will continue to expand to mantain food security and compensate for a rapid decline in the fisheries resources in the Lake, thus further accelerating environmental degradation in the terrestrial basin and in the lake (FAO, 2001*c*).

ment and poverty alleviation. The political costs for a final choice in one or the other direction would however be high and, a cautious approach with limited scope focused on establishment of a an institution for fisheries management is likely to be preferred in order to defer hard decisions and to manage differrng interests. This cautious solution that also implies higher high risks and social costs and less than optimal benefits, forms therefore the most likely outcome of the current legal and institutional review in the Lake Basin.

3. Ethical values

3.1 The value of water and food

The ethical values central to the use of water to secure production of food fall close to the basic human rights provided in FAO's constitution (Box 7) and to the development and environmental principles that form part of a common vision of an ethical-based, efficient and safe food and agriculture framework that respects a diversity of value systems including biodiversity. However this important ethical vision might be dimmed by the conflicting objectives of conservation of biodiversity and agricultural development.

Water is indispensable for human existence in its direct use as drinking water, as a

Box 7. FAO's Constitution, Food Security, Agriculture and Rural Development

The Nations accepting this Constitution, being determined to promote the common welfare by furthering separate and collective action on their part for the purpose of:

- raising levels of nutrition and standards of living of the people under their respective jurisdictions,
- securing improvements in the efficiency of the production and distribution of all food and agricultural products, and
- bettering the conditions of rural populations;

thus contributing towards an expanding world economy and ensuring humanity's freedom from hunger.

vital resource in food production and as a necessity for the continuous functioning of terrestrial and aquatic ecosystems. Water is an essential but non-substitutable resource that can be used more-or-less efficiently, but cannot be replaced.

In the same sense food is essential for the survival of human beings and hunger is seen as neglect of the universal human right to food which is equally non-substitutable. Formal ethical systems and ethical practices of any society recognise the responsibility to provide the citizens with the means to produce or get food or to provide food directly to them. The principle is provided in international documents among them the 1948 *Universal Declaration of Human Rights* (UN, 1948), the 1966 *International Covenant on Economical, Social and Cultural Rights* and the *Rome Declaration on World Food Security* (1996) (FAO, 1996*a*).

The availability of food and nutrition are linked to public health and consideration for responsible care of children. Box 8 provides a summary of the total global adverse health effects from nutritional deficiencies. One ethical issue reflected in different societal and religious systems is whether solidarity, including access to food and natural resources, could be built on ad hoc charity or should be institutionalised and monitored by society. The Universal Declaration of Human Rights has proven an effective instrument to enable unity of action in situations of serious global crisis. The globalisation moves remain strictly focused on international trade and it is doubtful if political support and appropriate institutional mechanisms to solve poverty and development issues could or should be handled at the global level. The ethical challenge at all levels is to fix global imperatives and secure the means for equitable access to the natural resources for agricultural and food production without losing the opportunities, momentum and initiative for growth and development.

Box 8. Nutritional challenges

- Over 800 million malnourished people.
- Over 200 million malnourished children.
- By 2020, one billion children growing up with impaired development, with sub-optimal growth affecting another billion.
- Stunting of children strongly depends on malnourished mothers.
- One billion adults in developing countries are underweight. Maternal malnutrition increases the risk to future generations.
- Infantile anaemia results in poor brain development.
- Maternal anaemia pandemic – over 80 percent in some countries.
- Childhood malnutrition linked to adult obesity, diabetes, heart disease and high blood pressure.
- Diet-related chronic adult diseases are already a major public health challenge.

3.2 The value of well-being

A persistent and growing income gap between low- and high income countries forms a major obstacle to well-being based on global solidarity. Table 1 indicates that the annual GNP is 23 times larger in high-income counties, while three times as many people live in low-income countries from only 4 % of the collective resources in the high-income countries. Even with a current rapid urbanization in the developing economies, 70 percent of the low-income populations live in rural areas and depend on agriculture. Economic restructuring and development may be delayed as precious time and resources are being lost in correcting this basic ethical issue.

Table 1. Low and high income country indicators

Countries	*Surface area (millions km^2)*	*Population (millions)*	*Population growth (%)*	*Urban population (%)*	*GNP per capita, yr (current US$)*	*Freshwater per capita, yr (m^3)*
Low income	33,7	2,500	2,1	30 %	410	6,200
High income - OECD	32,0	852	0,6	78 %	28,000	10,000
World	133,5	5,700	1,4	46,8%	5,240	8,200

Source: World Development Indicators, World Bank (04/2001).

The development option to address this problem has been proposed as intensification of agriculture for higher labour productivity also in the developing countries. New biotechnologies also hold promises (Box 9) for producing more food with less water and lower other inputs, especially labour, and create opportunities for enhanced labour productivity and higher rural income in areas currently dominated by low efficiency subsistence farming. There are also risks and some of the challenges are to minimise external dependence for inputs and to manage new environmental and health risks in agriculture, especially in countries with limited agricultural research capacities.

Box 9. 'NERICA': the new rice for Africa

Advances in agricultural research have allowed scientists at the West Africa Rice Development Association (WARDA) in Ivory Coast to cross African rice species with high-productivity Asian species using a technique called embryo-rescue. The *new rice for Africa*, like its Asain parent, chokes weeds and resists drought, pests and problem soils and has inherited higher productivity from the Asian species, and can double production with fewer inputs. The new 'Nerica' variety promises to provide an alternative option to low-yielding traditional rice and genetically modified varieties from abroad and so reduce rice imports, which are a growing load on domestic trade balance in Africa, by by between 25% and 50% already in 2002.

Agriculture is becoming an increasingly large-scale business and as a consequence smallholders and farm workers, particularly women, are not taking part in the process and are being forced out of work. Inputs including water are often subsidized, replacing farm workers with mechanised systems. While increased supplies and declining prices of farm products result in less expensive food for the urban poor, they also cause the displacement of smallholders or reduce them to subsistence farming. In terms of water, intensification is focused on capital-intensive irrigation with less incentive for labour-intensive land and water management in extensive rainfed farming based on limited investments and water harvesting methodology. A labour-intensive approach is in itself in conflict with the need for improved labour productivity and raises several ethical questions on the distributional objectives for poverty alleviation and development in both the short term and the long term.

3.3 The value of natural resources

As a result of poverty and with many disincentives for producers and consumers to

ensure conservation practices, the renewable natural resources upon which human life is dependent are being rapidly degraded or not put into productive use for development and welfare. Traditional resource systems based on common property – including land, water, forestry and fisheries – are collapsing under increasing pressure from both population growth and external market penetration. Large areas are being deforested, leading to soil erosion and massive flooding. Overuse of marginal lands is turning fields into deserts and depriving future generations of vital crop and pasture land.

4. Trade and investment

4.1 Water and trade

There are many conflicting and complex food trade issues such as food dumping and export subsidies together with specific non-trade concerns of poor developing countries such as poverty alleviation, rural development and food security, and related environmental degradation and loss of natural resources. The main food exporting countries including Canada, Brazil, the US and the EU group, together with the few Asian countries that dominate the small international rice trade, are also the main exporters of virtual water to the developing countries in the dry regions.

With the dominance of the water volumes and shares of total use in agriculture, virtual water is a useful concept used to recall that food imports, when they can be afforded contributes to food and water security. Under other conditions, in poor countries with large proportion of rural population, subsistence farming and low agricultural productivity, food needs will continue to depend on local production. 'Virtual' water is the volume of rain or irrigated water needed to produce one unit of food, if that unit is affordable and traded. In the case of traded food between countries and production areas with too much water, the 'virtual' water is the volume drained per unit of food produced. The significance of drainage investments and removal of surplus water for food production and trading of such 'negative virtual' water is rarely mentioned in water and food assessments. One cubic metre of water is needed to produce one kilogram of wheat, and if traded, binds one cubic metre of 'virtual water'. In round figures, the virtual water for grain is about 1 cubic metre of water per kilogram and for meat about 20 cubic metres per kilogram. The annual 'virtual' water equivalent of a large carnivore such as a lion, with high nature and tourisms value, is about 35,000 cubic meters (Fattah, 2000).

The most water-intensive and water polluting form of meat production is with confined livestock fed with grains and legumes imported in the form of concessions

from water scarce developing countries. Menu preferences limit the crop options and often imply areas of ethical concern. The tsetse free grazing land in the middle section of the Nile Basin has the largest livestock population, some 200 million heads, in Africa. A reduction in this stock and a 10% shift in meat consumption, from beef to poultry would correspond in significant virtual water savings of about 5–6 cubic kilometres or 7–8% of the annual flow in the water scarce Nile Basin (FAO, 2000*a*). Also other agricultural commodities, such as forest (Box 10), represent important volumes in virtual water flow and stock equivalents. Reduction of forest in upper parts of a catchment results in totally higher runoff but also impaired flow regulation and increased sedimentation and a substantial change in 'virtual' water stock.

Box 10. Deforestation – loss of virtual water stock

Forestry in semi-arid areas (e.g. in the upper semi-arid to semi-humid watersheds of the Nile (FAO, 2000*a*)) uses about 500 millimetres per year of green water. For a regeneration cycle of 20 years deforestation implies 'abstraction' of about 10 metres of virtual stock of green water. In the same terms, global deforestation estimated as 2% of total forest area of 40 million square kilometres, translates into a global reduction in virtual water of about 8,000 cubic kilometres per year.

Agricultural overuse, made possible by modern technology, is common in the most water scarce areas including the Near East and North Africa. The over-use is driven by inappropriate water and other subsidies and agricultural pricing of high value/high water consuming crops with a very high disparity between net benefits and water costs (Table 2). While establishment of incentives that give the right signals is

Table 2. Near East region: water cost and values for high value crops (US$/m^3)

Country	*Water value*	*Water cost*
Egypt	0.28	0.025
Jordan	3.40	0.100
Palestine (Jordan valley)	3.00	0.100
Syria	0.12	0.005
Yemen (Highlands)	0.22	0.035

Source: Ahmad, 1996.

important, in general water pricing in agriculture beyond partial recovery of costs has not been successful.

4.2 Water and land investment

There is generally room for efficiency improvements in the agricultural use of water and land. Water, and land scarcity is not always an absolute constraint but a driving force for changes in the structure of society and the economy. Increased productivity in the use of the primary resources and other factors of production requires increased investment in agriculture and especially in land and water development. However, as these investments are not forthcoming, governments and the local farmers have been obliged to rethink the development and the means for production of food and to build on improved use of rainwater resources which already is the basis for more than 70 percent of all food produced. This is responding to social necessities and poverty alleviation as large areas of rainfed and drylands lag behind in economic development with the consequence of increased food insecurity and poverty accompanied by degradation of soil and water resources.

Already on development and environmental grounds, there is a case to provide a greater focus on rainfed areas for policy and public investments. Social and environmental crises are already common in these areas and are sometimes soliciting more investment in crisis assistance than in development from governments and donors, whereas more pro-active investments in development of these areas could be more cost effective than relief. Increased public investment in technology and infrastructure in the form of integrated water development for conservation and development in less-favoured areas may yield higher marginal returns than comparable additional investments in irrigated agriculture (FAO, 2001*b*). For example World Bank-funded integrated watershed development projects in India and Indonesia during the 1980s yielded economic rates of return of the order of 17–19 % with important additional conservation benefits.

Social and economic resources and capital budgets in poor developing economies are generally fully committed to meet immediate high priority social needs including administration, defence, health and education together with a lack in institutional capacity and resources to induce substantial change. With the time involved in structural change and in developing a new economy, socio-economic development will need to focus on productive uses of the natural and human resources in the established agricultural sector.

The fall in international aid has had a severe affect on agriculture. The real value of net aid disbursed to agriculture in the late 1990s was only 35 percent of its level in the late 1980s also with a significant fall in the share of international agricultural lending.

This points to the case for a larger flow of concessional development assistance to countries with both undernutrition and budgetary constraints (FAO, 2001*b*).

On a positive note, the investments in the water and land sectors are changing towards increased resource-user participation drawing on indigenous techniques and traditional knowledge. This has led to enhanced motivation for less costly and more effective land development schemes and forms the foundation for food sufficiency especially in China, India and other parts of Asia. Small farmers and the rural poor are investing in improved rainfed management and minor irrigation. Social capital has been invested in cropland intensification, mainly in rice paddy and irrigated wheat. Indigenous social capital is actively being invested into drinking-water supplies, including multipurpose facilities serving livestock or irrigation.

5. Water scarcity, perceived and real threats

5.1 Water scarcity

In the last 100 years, while the world population doubled the water uses increased more than six-fold. In the last decade water scarcity and vulnerability assessments and alerts have become more of a rule. Based on the standard hydrological index of water scarcity it is concluded that by 2025 one-third of the world's population will live in water scarce countries. The water scarce countries include many of the least developed countries with limited social resources but also more wealthy economies with the necessary capacity for investments and social adaptation to water scarcity. It is often being stated that, even with improved efficiency and productivity of agricultural water use, some countries will not have sufficient water resources to satisfy minimum water requirements for domestic uses and meet industrial, environmental and agricultural demands for water. Recently proposed approaches have aimed at a widening the scope of national water scarcity beyond a simplified per capita water availability index to reflect and compare the level of domestic social capacity to adapt to situations of emerging scarcity (e.g. through a compounded Social Water Scarcity Index (SWSI)) (Box 11).

While the dominantly agricultural water demands are increasing, the fresh water supply is considered as finite and the volume available per inhabitant is decreasing to an average 4,800 cubic metres by the year 2025 against 7,300 cubic metres in 1995. In reality water is a shrinking resource with rapidly reducing suitability and increasing cost due to pollution and related environmental degradation. These resource losses affect flowing water and to a less extent also rainwater. However resource loss, quality and pollution have not been considered and well quantified in

Box 11. Hydrological and social water scarcity

Ranking of countries for water scarcity is based on per capita water availability or the hydrological Water Scarcity Index (WSI). The WSI has become increasingly insufficient, overemphasizes population numbers and growth and does not reflect or compare socio-economic factors and causes for scarcity. When combined with socio-economic indicators, using e.g. the UNDP Human Development Index (HDI), the Social Water Scarcity Index (SWSI) reflects at the same time the level of water scarcity and the social adaptive capacity (Ohlsson, 1999).

the assessment of water scarcity. The main 'culprits' or causes for this trend are often stated as population growth and economic progress, which are in reality socially desirable and necessary developments in social and ethical terms, when based on collaboration and enhanced choice and knowledge (Sen, 1994). The implicit alert and warning in the these projections aim at enhancing awareness and establishing a sense of urgency for legitimate action. One action is to mobilize capital resources for necessary investments required to meet the needs for today's and tomorrow's water consumption, estimated as some US$ 600 to 800 billion over the next ten years. Another action is to remove trade barriers and encourage international food trade and imports to address national water scarcity and to support investments in industrial high productivity agricultural production in the North and phase out less competitive production in the developing countries. These aspects are examples of complexities in the relation between water and agriculture and reflect the risk of perceived, intentional or unintentional, ethically questionable misconceptions for water scarcity assessments.

5.2 Joint water and land scarcity

A critical review from an ethical perspective shows that water scarcity assessments are generally:

- limited to abstracted 'blue' waters that represent only about 35 percent of total water flows in croplands,
- based on per capita water availability without consideration for economic realities and pricing of the water and social capacity, resilience and adaptation to water scarcity,
- not considering agricultural realities, for example that most food comes from rainfed farming with a much larger cropping area and supporting a larger work force,

- are limited to water and not to the joint local availability of water and land within the sub-basin that determines real demands in the dominant agricultural sub-sector, and
- not accounting for balancing social and economic values as growing human resources and economic progress.

In a visionary perspective concerning future food production the baseline will be that more than half of world food production comes from rainfed and dryland production systems. In Africa, irrigation facilities serve less than one-tenth of the arable land, whereas for India the corresponding figure is about one-third. The water volumes needed for food and ecosystem (Box 12), point to the future importance of rain and 'green' water. The two estimates that are presented in Box 12 – (a) focused on intensification and irrigation expansion and limited to water abstraction from surface and groundwater flows for intensification, and (b) with an assessment of the total volumes of flowing 'blue' water and 'green' water in the soil and plants – arrive at estimates of the additional freshwater requirements in croplands of the same order, 3,000–4,000 cubic kilometres per year and with the common conclusion, but from different perspectives, that these requirement could not be covered by abstractions for irrigation.

The water scarcity assessment in the *water-food nexus* need to be linked and reconciled with the joint local availability of suitable arable land and water is used and related to projected production increase from (a) intensification, with improved yields and enhanced cropping intensities, on land with abstracted waters, and (b) arable land expansion consistent with current methodology for land capacity assurance.

About 30 percent of the world's land surface is suitable for rainfed agriculture. Of this area, some 2,800 million ha in the developing countries have the potential for growing rainfed crops above an acceptable minimum level. With 960 million ha already cultivated, this leaves 1,800 million ha for further expansion. However 90 percent of this area is concentrated in seven Latin American and sub-Saharan countries and together with land constraints and human induced degradation the balance for expansion for crop production in developing countries by 2030 is only about 120 million ha, with the bulk of it in sub-Saharan Africa (57 million ha) and Latin America (41 million ha).

By 2030 about 80 percent, with more than 90 percent in the land-scarce parts of the Near East, North Africa and South Asia, of the growth in crop production in developing countries will come from intensification in the form of higher yields (69 percent), cropping intensities (11 percent), with only 20 percent from arable land expansion (FAO, 2001*a*).

Box 12. Water for food production and ecosystem services

a. The water needed to produce food for one person in one year is about 3,000 m^3, 18,000 km^3/yr to feed the present population of 6 billion, and 27,000 km^3/yr for billion people projected in 2050. This quantity when compared to the total annual rainfall on the continents, estimated at 110,000 km^3 (Shiklomanov, 1996) indicates that water appropriations for agriculture are reaching a significant level even in relation to the total hydrological flow of freshwater resources.

The current effective irrigation water use for food production can be estimated to be about 3,800 km^3. Economically accessible flowing or blue water amounts to some 12,000 km^3, meaning that irrigated agriculture has already appropriated about one third of all accessible flowing water.

To project towards the future, an assumption must be made about the role of irrigation in future food production. While ethically questionable more intensified production forms a likely scenario and up to 80% of additional food production would come from irrigated agriculture. To produce food for 3 billion additional inhabitants in 2050, an additional 3,800 km^3 of water would be abstractions, giving a total of 7,400 km^3. This forms a highly unsustainable proposition, as it would require 60 percent of all accessible 'blue' water to be appropriated for agriculture.

b. About 87 percent of the total green water derives from the biomes in temporal and tropical regions – grasslands, croplands, wetlands, and woodlands and forests – that produce the bulk of the ecosystem goods and services on which humanity depends. Human livelihood is ultimately conditioned by 'green' water scarcity of waters. The life-supporting terrestrial biomes sustain society including for food production and generates horizontal 'blue' water irrigation needs in agriculture. The total global green water flows, estimated at 63,000 km^3/yr, dominated by 40,000 km^3/yr through forest and woodlands include the use of 6,800 km^3/yr of green water in croplands. A recent study (Rockstrom et al., 1999) of linkages between green water flows, food production and other welfare factors and ecological water needs, assessed the additional freshwater requirement in croplands to 3,100 km^3/yr in 2025 where only one third could be met with irrigation and modern technology on existing croplands.

5.3 Domestic and global water policy

Since agriculture consumes by far the largest percentage of water, seen from a perspective of water resources management it is often stated that water scarce countries

will have to improve end-use efficiency in agriculture and improve use efficiency and re-allocate water from agriculture to higher yielding sectors and also rely on increased food imports to meet their needs. The process of change will have high social costs and touch on and conflict with long established ethical values and principles in agriculture. Agriculture carries the key to address the problem of global and local water scarcity and food security. This is an important option that will however not progress in a climate of liberalisation and sudden change to market systems. The process is likely to be gradual and evolutionary and consistent with the economic paradigm of *evolutionary political economy* based on the fundamental social processes in contemporary time in providing goods and services to the society that is increasingly challenging market-oriented economic approaches (Merret, 1997). The concept is based on an acknowledgement of contemporary institutional realities and positions, sound base of scientific knowledge, and consideration of the interdependencies of economy and environment.

It is only recently that the food and agricultural sector is being conceptualised globally and the linkages between global water scarcity and food security and agricultural production in general have become increasingly important in the exploration of alternative management approaches for global intervention. The debate on whether there is enough water and food for the future is becoming confrontational especially in regions where economies are increasingly dependent on food imports and on transboundary water flows. As globalisation in agriculture impacts domestic water and land policy, local action loses in importance (Allan, 2001). The global aspects of water and uses that are economically and environmentally sound uses represent an important element of water policy that are often in conflict with domestic development imperatives. Global intervention carries high risks in the absence of high-level jurisdictions with authority and legal mechanisms for management and interventions – do not exist. And ultimately water conservation in agriculture will depend on local farming decisions including crop management built on local acceptance and collaboration.

It could be expected that the values and imperatives in water policy would be changing – to fit the world, from technology, supply and development – mainly for agriculture as part of the green revolution towards desirable, but less practiced paradigms, with higher components of ethics for wider participation and aesthetics – with higher for esteem of cultural and ecological values (Lopez and Llamas, 1999). The water scarcity problems based on 'perceived' high agricultural demands not related to economic and development realities and water prices are frequently supported by vested self-interest, often with no consideration of public opinions and environmental damage or without knowledge of social and economic aspects of agricultural production. Narrow and influential lobbies have an interest to promote

water resources and agricultural investments or to take positions and secure higher national or sector shares of national and international water resources and larger domestic or international capital development budgets. There is an ethical issue in relation to this risk already at the domestic level with the challenge to avoid similar repeated lobbying at the global level.

6. Ethics and water governance

6.1 Ethical approaches for effectiveness

In western countries, improved water governance is understood as the change of policies and institutions to introduce decentralized administrations and to secure transparency, accountability and participation through strengthened governance capacity and to support participatory development processes. However from an ethical perspective, this perception is sometimes too scientific and theoretical and the prescription of policy and institutions to other states is seen as not only hypocritical but also to disregard the social context of diverse political economies and even put doubts on traditional and long established capacity to develop and implement domestic policy. Approaches based on 'social and institutional engineering' and capacity building based on foreign references tend to use the same approaches successfully used for engineering design but to ignore the social fundamentals. They could even be perceived as foreign arrogance and sharpen the domestic preference of taking no action at all in order to avoid stressful politics in vulnerable political economies and wasting of limited social resources. Whether well intended or not, imposition of ineffective alien policy and institutional formulae, even when promoted with external incentives and assistance is ethically doubtful as it doesn't work and therefore could maintain a *status quo* of unfair and inequitable practices.

With the growing recognition of the importance of political and social processes it has become appropriate to adopt science and facts as 'political engineering' and to revisit institutional arrangements in order to promote communication, dialogue and compromise and evaluate the costs, investments and options to mobilize necessary resources for implementation as integrated part of sound water policy packages and *effective water governance*. There are however widespread doubts that many institutional changes in national waters sectors over the last two or three decades had a real impact on the effectiveness in addressing management issues in the sector. Water managers have come to increasingly recognize and express their concern about such flawed approaches and their ineffectiveness in water governance, Box 13.

Box 13. Who governs whom?

With increased water demands and environmental degradation, the shortcomings in water management have not become less. This is in spite of the many changes in the institutions in the last two or three decades in the directions of reduced government roles, private participation and market mechanisms. These initiatives were however taken without due regard to basic underlying causes such as increased economic conflicts brought about by social and environmental impacts from increased water uses and a growing number of external actors. It is therefore the conflict *per se* that created the necessary political willingness, to some degree proportional to the duration and persistence of the conflict, to address and solve the problems. Most conflicts are caused independently of government from decentralized decisions of external actors in the informal user and self-development sub-sector. The requirements are for mechanisms for resolution of emerging individual conflicts and risk; the call is therefore for less integrated and complex but more practical and implementable governance options (Dourojeanni, 2002).

Without effective water governance mechanisms that allow immediate interactions with the political economy and without rules and incentives that give the right signals together with well defined institutions with authority and resources to act, policy principles will remain as theoretical constructs and not be implemented. Water governance at the right level is today's first priority in water management and represents a challenge in a world of change and globalisation. Water governance becomes a particularly high priority when dealing with water for agriculture especially in the developing and transition economies that depend on agricultural production for growth and food security and welfare of their predominantly poor rural populations. This is further complicated by the fact that in the majority of these countries effective political, economic and governing mechanisms to secure conditions for sustainable development have not yet been established. The issues therefore touch on internationally agreed priorities of poverty alleviation and risk mitigation.

Policy making and implementation are closely linked to and driven by social and political realities. Putting forward policies that are alien to the local political and economic conditions or introducing ineffective governance mechanisms that are outside the contexts of the local political economy have too often resulted in *status quo* with continued inequitable and unfair distribution. The recent recognition of policy principles and reform that respond to pragmatic political necessities as an alternative to integration, as discussed in section 1.5, can be expected to result in

wider understanding and respect for social truth and wide acknowledgement of politically determined policy evolution as 'the only way' (Allan et al., 2000).

6.2 Science, law, economics, capital

Nations are faced with developing mechanisms for good governance by reforming laws, treaties, and programs to reconcile issues of social equity, environmental protection and development. To be successful in this mission, they must learn to integrate ethical discourse into the policy languages of science, law and economics. If, however, they allow 'facts' and neutral scientific language to continue to dominate and steer the debate this will reduce the principal force to political and institutional change. The ethical limitations and implications of scientific tools must be understood. Most standards in law and regulatory action are ethical and not scientific questions. If scientific standards dominate the legal institutions, the made choices may be inconsistent with the ethical intentions, the legislators and the public that but dead internal supports them, think they have established. Economic assessments often rely on utilitarian approaches and con onfidence that most questions can be reduced to quantifiable amounts. Quantification of social and environmental benefits, however, is often difficult and sometimes impossible. For example utilitarian analyses are incapable of answering how benefits or costs should be distributed among potential losers and winners and need to be supplemented by concepts of distributive justice (Brown, 1993).

Water governance will remain ineffective if only addressed as reform and programmes for capacity building in isolated water sectors. The consequences – in the form of poverty and underdevelopment from ineffectiveness, neglect and imported principles in governance – are recently identified in the *The Mystery of Capital* (De Soto, 2000). The wisdom in 'The Five Mysteries of Capital' and the truth behind it can be expected to provide guidance also on basic requirements for ethical water governance in particular the use of water in agriculture. De Soto (Box 14) proposes necessary steps to mobilize and turn the important but unused capital resources of the poor in developing and transition economies into productive capital. These

are essentially ethical attributes, based on actual data reflecting the features of the political economies in developing countries, that could allow the countries themselves to solve financial *water paradoxes* and to address problems such as water scarcity, food security and rural poverty without further indebting themselves. This will take some time but there will be no hurry as long as the move is in the right direction. The steps as concluded by De Soto represent ethical intuitions and also signals pointing critically at the tragic consequences of ineffectiveness in the *status quo* with the need for alternative forms of global solidarity that minimize alien

Box 14. The Five Mysteries of Capital (De Soto, 2000)

- Missing information – on the large financial capacities in the developing countries kept as savings in the form of non-productive and dead capital,
- Capital versus savings and dead capital,
- Political awareness of the actual already ongoing transition in the form of urbanization and industrialization in developing countries is generally low,
- The missing lessons of Western history, and
- Legal failure and ineffectiveness as developing countries continue to copy the laws of the West, while most of their citizens are not able to use them to convert their savings into capital.

De Soto's recipe to address poverty is concise, pragmatic and practical. The conditions are limited to securing political acceptance by governments of the following:

- The potential of the poor need to be documented and formalized,
- The poor do not have legally integrated property systems to convert their work and savings into capital,
- Adherence to events, often labeled as adverse in existing legislation, such as civil disobedience and mafias, that are positive indications of the large scale change from life on a small scale to life on a large scale,
- In this context, the poor are not the problem but the solution, and
- Implementing a property system that creates capital by getting in touch with people, comprehension and respect for the social contracts and profound review and reform of the legal system.

prescription and charity and allows poor economies to form governance system that effectively support sustainable national development **including** effective water governance.

6.3 Governing water for agriculture

As national food security is becoming difficult to attain in a growing number of countries, there are proposals to make arrangements at the international level to secure affordable access to food (FAO, 2000*b*). On the other hand food security and rural welfare can only be sustained if based on local agricultural production and there is the growing evidence that hunger has generally been reduced in countries where the national governments have performed well. The question arises – on what level governance should be improved first? The countries with food insecurity in

Sub-Saharan Africa and in South Asia are, for completely different reasons, not connected to international markets and private investments and are barely related to global liberalization. As a consequence improving governance at the national level has become the highest priority in these countries. Democracy has been supported as standards of good governance for food security. However non-democratic governments have often been successful in introducing incentives and mobilize domestic resources for investments to mitigate hunger. Good governance at national level depends on the government's capacity to provide basic public goods to all citizens including peace, rule of law and public investments in rural infrastructure, education and research. The consequence is that the common advice of 'think globally, act locally' is quickly being substituted with, 'think locally, then act nationally'.

Most irrigation economies fall in the large group of developing and transition countries where agriculture and agricultural water use are in general subject to a political bias against rural development and favouring the urban areas. The losers are the smallholders engaged in subsistence farming, representing most of the poor and women water users especially in Sub-Saharan Africa. This vulnerable group has been unable to have its economic interests articulated in current political processes and the neglect of not transforming smallholder agriculture has been seen as one of the most serious post-independence faults of the Sub-Saharan African countries (FAO, 1997). Food insecurity resulting from this secondary role accorded to agriculture in general and smallholder agriculture in particular, with persistent lack of public sector support and investment in rural areas, cannot be separated from the issues of politics and governance. This should be referred back to the ruling political economy and guided from the roles and interaction between various interest groups in the society.

Governance issues on water and agriculture are closely focused on ownership and with such issues as land tenures, access to water and water use rights. In Africa most irrigated land under smallholder cultivation is held under indigenous customary land tenure systems irrespective of the formal legal position under national law. Most African governments, however, designate traditional land as state land and accept the *de facto* prevalence of customary tenure, while they at the same time maintain the *de jure* state ownership. This it turn supports government interest groups and allows bureaucrats, politicians and influential people to exercise privilege and authority over traditional land and rural communities. As a consequence most smallholder irrigation systems are controlled and managed by state administrations. While some governments have attempted to replace customary tenure with registered titles as individual rights guaranteed by the state, the general experience is that the imported policy of state imposed individualized rights has also caused fundamental problems and does not necessarily offer greater security for the land users in Africa because of the inherent weaknesses of government institutions. The clash is between customary

laws governing tenure, vis-à-vis statutory laws, which often are based on Western legal principles. A general observation is that customary laws tend to give greater recognition to group rights, whereas western laws emphasize individual rights with further differences in the property rights – such as inclusion, exclusion, succession and inheritance. Water rights under traditional customary law is common property, managed for the good of the community. State laws assign water rights to land by title deed, while the state retains water rights over traditional land. Smallholder irrigation, therefore, generally has the benefit of water rights only via a third party, usually a state bureaucrat holding such rights in trust for the community. This situation worsens the already insecure land tenure situation and the rights of smallholder irrigators are often susceptible to state and political interference. The tragic consequences of the resulting low productivity leading to poverty, vulnerability to pressures and risk and outard-migration, abandonment-of-land and urban poverty for a major part of the poorest populations in the world are well known

As in the case of standards for drinking water, similar standards for the reuse of waste water imported from rich developed countries also have an adverse impact on agricultural use of this important additional water resource. The rapid urbanization with concentration of large populations in urban areas has resulted in growing volumes of municipal waste water. However with limited sewage collection and treatment, untreated sewage is often discharged directly within the urban environment and into water courses and coastal waters with resulting social inconveniences and hazards for health and the environment. The scope for drawing important economical, health and environmental benefits from wider re-use of waste water in agriculture remains limited due to the stringent re-use water quality standards imported from the West and defended by biased business interests in the conservative water technology and construction industry. While limiting health risks, the stringent standards have lead to increased social and health risk by not making this important water and economic resource available for social, economic and environmental uses in agriculture. The consequence is that the farming communities are deprived of using available affordable technology for appropriate low-cost advanced primary treatment based on dissolved air flotation to eliminate bacteriological and toxic hazards without reducing nutritional content in waste water. The following are ethical questions that come up for debate (Jimenez and Garduno, 2001):

- Should developing countries with less competitive food crop and subsistence farming sub-sectors adopt less rigorous, affordable reuse water quality standards?
- Should wastewater reuse standards depend on the social and economic level or be universally valid?
- Should developing and transition countries emulate such less stringent wastewater reuse standards?

It would be inappropriate and outside the scope of this essay to give recommendations for institutional arrangements for ethical water governance. An ethically perceived requirement of effectiveness point towards very simple and practical setups. A minimum for a revamped model for good water governance at a national level in agricultural developing and transition economies includes a water resources ministry to secure the political influence and the necessary resources at government level. Allocation of resources should be addressed under the social sectors but, in the general absence of the institutional base for a sustainable water industry, a department for water supply and sanitation development to operate under the social sector is also required. Development and operation of irrigation and other agricultural activities are likely to form an independent economic sub-sector based on self-development supported by appropriate legal ownership and by right structures. Catchment-based water management, on the other hand as a scientific, hydrological concept has often failed because of the absence of such factors as sustainable financing mechanism, isolation from administrative contingencies and the lack of risk-based management approaches. Catchment-based management is heavily fact-orientated and is difficult to reconcile with ethical imperatives.

The first priority however should be to secure access to water for use by families, women and children. The enhanced focus at the household level on family farms and small-scale businesses need to be addressed with well-targeted incentives. .

7. Conclusions

Agriculture as the dominant user of flowing water and rain water and of land and as the first traditional economic sector is closely related to a wide range of social and environmental issues that touch on human behaviour and ethical values and involve hard policy decisions, on such issues as: populations , food production and security, natural resource scarcity, social and equity aspects of rural poverty, and fair distribution for equal opportunities. Agriculture has a long tradition and is adapted to produce under conditions of climatological and economic risk. Over the years agriculture has suffered from changing policies and been guided by changing and conflicting paradigms ranging from high input and natural resources development for increased production under the green revolution through sustainable agricultural development and more recently a focus on food security with the current emphasis on intensified production and market liberalisation towards a global agricultural sector, accompanied by growing concerns for the ecological systems and the biodiversity values.

From this wide scope and with many linkages and changing imperatives, agri-

culture has proven to be perhaps be the most difficult sector to reconcile and make consistent with the objectives of globalisation and liberalisation for uniform economic access and growth.

The present attempt to identify issues and review options for ethical-based water use in agriculture has brought forward a number of conflicting matters of ethical dimensions that apparently will not be settled except by building on solidarity, improved access and participation and consistency in policy imperatives at both global and local levels. In this broad perspective of a search for specific and focused conclusions the following selected priority matters on water for agriculture have been identified to be assessed and attended to:

- **The population debate** needs to progress in a positive, deferential and pro-human atmosphere focused on poverty alleviation, improved use of human and natural resources, and a change in global distribution of welfare. In particular the perceived threats of over-population and scarcity crises must not continue to be exploited in order to support vested interest.
- **The approach to natural resources scarcity** needs therefore to change to focus on constructive, pro-active measures on what could be done based on honest purpose and sound scientific base and consideration of the interdependencies of natural resources, society and economy. Water scarcity assessments need to reflect a better understanding of the agricultural and hydrological realities that: (a) all waters in agriculture must be considered; (b) agricultural water demands are decided from total agricultural requirements for water, land and other inputs; (c) most food production is based on rainwater and rainfed production is a strong option to increased production in the water-food nexus; and (d) societies use capacities and resources to adapt to scarcity but the the necessary social resources varies between poor underdeveloped countires and rich industrialised countries.
- The long-outstanding **controversy in water use between agricultural development and biodiversity and nature conservation** represents a real stumbling block to progress in a constructive North-South dialogue that needs to be deat with an unambiguous way and be openly addressed and reconciled at global and local level.
- The differences of **natural resources policy at domestic and global level** need to be balanced and reconciled. In particular it will be necessary to recognize the limitations in what can be done at global level in the absence of jurisdictions, legal mechanisms and institutions and not to leave local policies to be subordinated by global imperatives through economic or other dominance or overriding interventions.
- The **international trade** rounds need to enlarge the scope to consider wider North-South issues and progress on agricultural and food trade to support development and respond to the needs for special and differential treatment to address social

issues concerned with distributional and other environmental factors in developing countries and in particular provide secure unbiased and affordable access to globally produced food,

- Water governance for agricultural water to be effective musst be focused at the national level and be based on actual in-country political and economical rules and practices. Great care should be given to imported policies and political engineering approaches from other political and environmental environments that will not only be hypocritical and ineffective but could also create fundamental problems especially in vulnerable poor agricultural economies,
- One regional priority is to rectify country level short-comings in political economy and legal and institutional frameworks that have left smallholder subsistence farmers, a majority of the populations and representing most of the poor but also the main supporting sector of the national economies, unheard and not attended to at political level, without land ownership and security of water rights.

It is suggested that a critical review and broader dialogue based on the above issues could broaden the understanding especially at the national level to mobilize an ethical-based conduct with effective water governance for improved, efficient and fair access and use of water and land in agriculture.

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