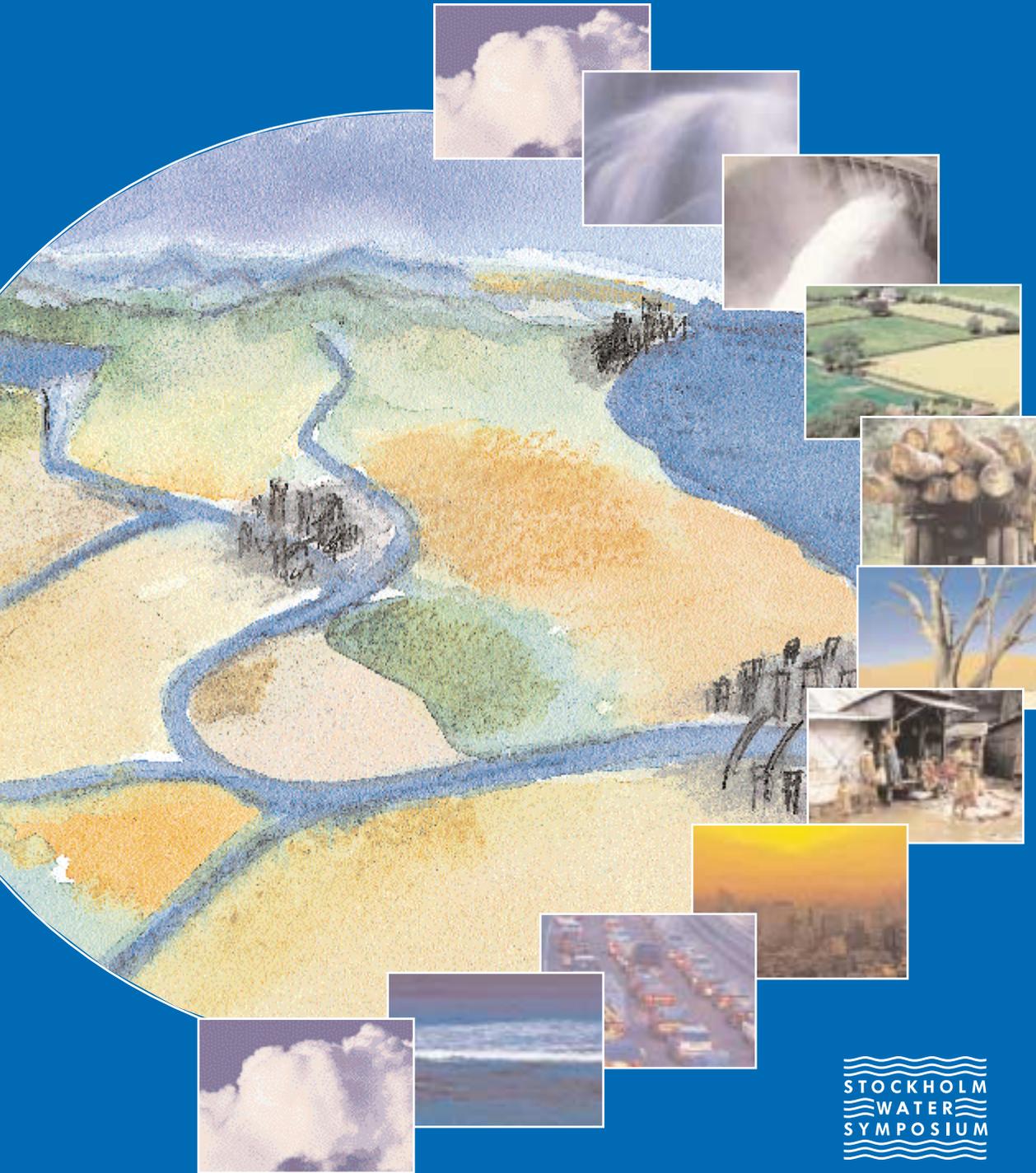


No Freshwater Security Without Major Shift in Thinking

Ten-Year Message from the Stockholm Water Symposia





THE STOCKHOLM WATER SYMPOSIUM is a leading multi-disciplinary forum for discussion of global, regional, national and local water issues. Each August, many of the world's top water experts come to the Swedish capital to participate in the Symposium.

The Symposium is part of an annual series of future-oriented symposia that link practice, science, policymaking and decision-making in the search for effective, long-term water resources management.

The symposia seek a comprehensive understanding of the complex interactions between human society and globally circulating water resources, striving for harmony between the two and for stable governance systems for management of the world's water resources.

Through the Stockholm Water Initiative, findings from the symposia are brought to the attention of the public, and authorities are targeted with practical recommendations for implementation. Thus, the symposia serve as a catalyst in the search for effective and long-term solutions.

The Stockholm International Water Institute (SIWI) administers the Stockholm Water Symposium.

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No Freshwater Security Without Major Shift in Thinking

Ten-Year Message from the Stockholm Water Symposia

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Symposium Scientific Program Committee*

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The first Stockholm Water Symposium was arranged in 1991 as a complement to other distinguished world water meetings. Now, as we celebrate a 10-year jubilee, we have reason to reflect upon years gone by as well as to look forward to coming years.

We believe that our holistic approach, featuring integrated water management as its basis, has worked quite well as the framework for the symposia. The urgent need for more activity and cooperation concerning this approach has been confirmed increasingly throughout the 1990s. This need has also been a key reason why so many noted persons and organizations gather in Stockholm each year to participate in both the official program and in the informal meetings and discussions.

Each year, the symposium has concluded with a summary and recommendations for further initiatives. The cumulative results of those findings are summarized in this volume. As such, they represent an important contribution to the existing body of world knowledge on water resources management and related issues.

In time, it also became clear that these conclusions needed to be followed up with practical activities, an insight that has manifested itself in the symposium-linked, SIWI-administered Stockholm Water Initiative. In this capacity, the symposium thereby functions not only as a yearly meeting point, but also as a think tank where continuity and innovation go hand in hand.

Since 1997, when the Global Water Partnership established its yearly presence, the ever-expanding series of events in August have been a part of an arrangement aptly titled the “World Water Week in Stockholm”. This growth is proof of the importance of the activities and their ability to adapt, a reflection of the strong support received continuously from persons, organizations, companies and authorities, and an obligation to continue in the work.

Looking back, our thanks go to Professor Malin Falkenmark, of the Natural Science Research Council, and Professor Curt Forsberg, of Uppsala University, two close collaborators who made invaluable contributions to developing the symposium idea. Professor Falkenmark, since 1992 chair of the Scientific Program Committee, authored this summary in close cooperation with the committee.

It is only appropriate that we dedicate this publication to you, the symposium participants, whose visions during the last decade are so eloquently summarized here. A warm-hearted thanks go to you all, for you are the symposium!

Sven-Erik Skogsfors
Stockholm International
Water Institute (SIWI)

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The past nine Stockholm Water Symposia have produced a number of fundamental conclusions and clarified that a shift in thinking is fundamental in order to cope with escalating global water problems. The gap is enormous between where we want to be in 30 to 50 years and the undesirable futures towards which present policies appear to be leading. In other words, the present generation of decision-makers is in a decisive phase of choosing the future, but the current water policies are vastly insufficient in safeguarding tomorrow's water resources. Their degrees of freedom, however, differ widely between different regions due to differences both in water resources predicament and driving forces at work.

The water issue is by no means an issue only for experts. It constitutes nothing less than a major question of human survival and is closely related to both the eradication of poverty and the need to secure health as well as adequate food supplies.

In short, the conclusions of the nine Symposia can be summarized under the following six points:

1. Neglecting to Protect Water as a Key Resource

While the water that moves through a landscape mirrors the integrated result of a whole set of parallel societal activities, it constitutes at the same time the life-sustaining bloodstream of the biosphere. The neglect, through past policy making, of the water cycle implications of human activities is difficult to understand.

Pollution is one of the greatest threats to our existence. A fundamental drawback of development is the production of waste that follows the processes of wealth production. Worldwide observations indicate that water quality degradation continues to increase in both severity and scale. The problems are here and threaten humanity now. Unless coped with in time, water quality degradation may turn into a life-and-death issue. Expanding groundwater pollution is especially serious since it tends to be irreversible as seen on the time scale of human life. A contributing reason for groundwater pollution is an overreliance on the attenuation capacity of overlying soils.

2. Challenge of Securing Safe Water for Livelihood

A flow of water through the city is a necessary condition both for human survival and for the functioning of industries, hospitals and other city components. As the city grows, new water sources have to be mobilized from further and further away. Consequently, the city should see the catchment as an asset for development and involve itself actively in its protection.

Due chiefly to the processes of urbanization and industrialization, securing urban



water supply and sanitation is a gigantic challenge. At issue is whether these processes can be systematically designed to reduce water problems. New approaches to water supply include, for example, reallocating water from primarily irrigated agriculture, introducing institutional reforms, improving resource mobilization and cost recovery, and helping those suffering from service deficiencies to participate in decision-making.

The solid and liquid components of wastewater are increasingly seen as a resource that can be beneficially reused after treatment. Water reuse will be fundamental in dry climate countries, but it is constrained by the accumulation of salt in the process. At the close of the 20th century, some three billion people still lack proper sanitation. Both the scale and the fact that water is scarce in many developing countries makes it necessary to give way to dry sanitation so as to create usable fertilizers both from urine and solid fecal matter.

3. Water Management Failures

There is a widespread neglect of how the life support systems function and of the in-

strumental roles played by water in those systems. There has also been a clear tendency in the past to address visible short-term problems rather than creeping, invisible long-term problems. Severe goal conflicts have not been seriously addressed such as upstream livelihood security versus protection of coastal ecosystems; or food production needs versus water needs for downstream aquatic ecosystems. A key question now is how to find the “buttons to push” that will stop the undermining effects of current policies and, ultimately, minimize the side effects of today’s failing water management.

Compartmentalization and fragmentation make administrative structures inflexible; reductionist approaches to water resources make each profession overlook only a partial reality. Single-purpose decisions are increasingly useless – they neglect the larger perspective and consequences for other societal sectors and risk undermining socio-economic development in general.

Many developing countries suffer from large deficiencies in terms of societal ability to cope with water constraints, and a desperate lack of educated water professionals.

4. Strategic Actions

Proceeding from the world we have with its failing water policies to the “Grand Vision” of the world we want – sustainable, equitable and stable – will demand an unprecedented effort of interdisciplinary integration of existing knowledge, and a major effort of institutional and human capability development. There is a need for a fundamentally new approach to total water management with its links to the quality of human life and natural ecosystems. Due to the slow responses in both society and water systems, the highest levels of leadership are essential and must be based on both vision and long-term persistence. Women have to be involved in water management with roles that strongly depend on the conditions under which they live, the culture, the traditions and the education level in society.

Decisive efforts are needed to get out of the water pollution trauma, which is threatening to make the available water unusable due to high pollution levels. The evident way out is by closing the cycles so that nutrients, persistent chemicals and industrial wastes cannot escape to the water system, where they will otherwise be caught and carried by the water cycle. In the end, this produces biological damage and effects human health. The questionable motive of monetary profit as the main objective for industrial development can no longer be accepted in view of the depletion of water usability to other stakeholders that it entails.

Education is crucial for generating the water awareness now needed. Water must be made everybody’s business, and as such there is a huge need for education of water professionals, especially in the developing countries. It is essential that environmental school education focuses on basic under-

standing of man’s life-support systems, rather than on isolated issues. Work in different hydroclimates and distant cultures requires cultural sensitivity. Children have to be engaged and stimulated because they have fantasy, and they represent the platform for societal changes.



5. The Shift in Thinking Now Needed

The major constraint to stable, long-term water resources management is not lack of knowledge, but transfer of that knowledge in a clear and understandable form to policy makers and decision-makers. Decision-makers and politicians have to be given the opportunity to understand the implications of their own decisions. The new paradigm has to distinguish between what man can change – his own behavior, for example – and what he cannot change, such as the laws of nature. Awareness of such distinctions is necessary in seeking the new strategies that will carry us forward in the 21st century.

A major initiative is needed to bring about the changes needed in catchment management, securing proper attention to water/land/ecosystem linkages in an integrated



water resources management, and seeing the catchment as an asset for development. The multidimensional character of landscapes has to be met by treating them as complex, dynamic systems. Well-integrated land and water policies have to build on an ecosystem approach, acknowledging water's role as the bloodstream of the biosphere. Clarification is needed of the water requirements of aquatic ecosystems to fulfill key functions for protein supply, employment and income raising as well as protection of biodiversity and crucial ecological services.

A new social contract is needed with the scientific community. The role of scientists should include also a responsibility of playing a more supportive role in development and policy making. To remedy the poor transfer to policy makers of adequate knowledge and understanding, scientists should learn to produce clear and transparent statements.

6. The Future of the Stockholm Water Symposia

The Symposia have attracted large interest and have grown from 250 attendees to some 800 participants and more than 100 countries. The particular niche – future oriented, interdisciplinary, intersectoral and interprofessional – seems to be well accepted. The Symposium should therefore continue along these lines and persist in its catalytic function. Even more efforts have to be made, however, to reach a truly integrative perspective. For example, a proper balance between participants from the north and the south should be achieved.

Two major fields to be addressed in coming Symposia are environmental debt and socio-economic growth as seen from a water perspective, and water security and the goal conflicts involved.



Many countries in the world are becoming victims of a large-scale depletion and deterioration of their water sources. In others, water shortages have drastically affected living conditions. Strenuous efforts are needed all over the world to alter these tendencies. The compartmentalized and sectorial approaches of the past have been inadequate and insufficient to avert an impending water crisis. A severe undermining of the life support base and the base for continued economic and social development has taken place and remains a prominent challenge. It is essential that a new paradigm distinguishes between what man can and should change – his own behavior, which is negotiable – and what he cannot change – the laws of nature, which are non-negotiable. Awareness of such distinctions is necessary in seeking the new strategies of freshwater security.

Key questions now are 1) how to move away from compartmentalization, and 2)

where to find the “buttons to push” that will stop the undermining and that will minimize the side effects of today’s often failing policies. Single-purpose decisions are increasingly useless: they not only neglect the larger perspective and the consequences for other societal sectors, but they also threaten to undermine socioeconomic development in general. There is a need for a fundamentally new approach to total water management in dealing with environmental problems, with their links to the quality of human life and natural ecosystems.

Two driving forces are at the core of the ongoing large-scale degradation of both freshwater bodies and coastal waters:

- the addition of 80-90 million new inhabitants each year to a world already struggling with worsening water pollution, and with growing water-scarcity in already stagnant regions, and
- the dramatic scale of current urbanization, which calls for societal planners to double, in an extremely short time, the infrastructure in terms of schools, streets, housing, health support, water supply, transport and energy supply.

Two major fields to be addressed in coming Symposia are environmental debt and socio-economic growth as seen from a water perspective, and water security and the goal conflicts involved.

The seriousness of the current situation becomes clear when one considers the gap between where we want to be 30 to 50 years from now and the undesirable futures towards which present policies appear to be leading. These policies are based on sectori-

al and national self-interests, and directed towards goals other than sound water resources management.

While the water that moves through a landscape mirrors the integrated result of a whole set of parallel societal activities, it constitutes at the same time the life-sustaining bloodstream of the biosphere. The neglect, through past policy making, of the water cycle implications of human

activities is difficult to understand. The water issue is by no means an issue only for experts. It constitutes nothing less than a major question of human survival, closely related to eradication of poverty, and the need to secure health as well as adequate food supplies.

This publication gives an integrated overview of the conclusions arrived at in the Stockholm Water Symposia 1991-99.

Getting Out of the Water Pollution Trauma



One of the greatest threats to our existence today is water pollution. World-wide observations indicate that water quality degradation continues to increase in both severity and scale. The problems are here and threaten human safety and health now. Unless coped with in time, water quality degradation may turn into a life-and-death issue.

Wealth Tends to Generate Pollution

Already today, water pollution has enormous dimensions. In particularly bad cases, a river may be seen as a sewer, or even a murderer. While industrial development is generally seen as a crucial key to economic development and income generation, a fundamental drawback is the production of waste and the escalating toxification of freshwater that some of it tends to generate.

In other words, a fundamental dilemma is that processes of wealth in the Third World have (at least in certain stages) tended to generate huge pollution loads, which increase more quickly than the population and the Gross National Product (GNP). While the population has doubled, the pollution load has tended to increase 5-10 times, even more in some cases.

A major mistake has been the indiscriminate transfer of industrial models developed in temperate climates, where plenty of river flow is available for dilution of pollution loads, to regions with a long dry season in the tropics and subtropics. Western principles for water quality management are generally not viable in poor developing countries, where a whole set of economic, legal, administrative, and cultural barriers effectively stand in the way of water pollution minimization.

Even where court orders have ordered closure of heavily polluting industries, the offenders may silently reopen for employment and financial reasons. The situation escalates to the point where spontaneous social mobilization takes place and citizens start marching up the river in search of the

industry polluting their water source. There is broad evidence that water quality destruction is already threatening economic development and long-term urban water security in places such as Sao Paolo, Delhi and Mexico City.

The risk is that with time the available water will get so polluted that it cannot be used for any purpose. While in international meetings much lip service is paid to pollution control, the crucial question is how to implement the agreed recommendations. The threatening situation – termed “hydrocide” because it is a far-reaching water quality degradation that makes accessible water unusable for most purposes – has to be averted by a combination of knowledge and opportunity, and legislation and enforcement. The buttons to push to avoid widespread toxification of the water are not only in the business or water sectors; rethinking in science, of ethics and spiritualism and sense of place may also have to be involved.

Fundamental Regional Differences

There is now an increasing awareness that current water policies are vastly insufficient in safeguarding current and even more tomorrow’s water resources. The present generation of decision-makers is in other words in a decisive phase of choosing the future. Their degree of freedom, however, differs widely between different regions.

In *Western societies*, century-long efforts – sometimes triggered by a major disease catastrophe – have resulted in fairly advanced wastewater treatment programs. However, neither municipal, industrial nor agricultural pollution are brought under sufficient control. Currently, in the industrialized countries, the problems associated with production *per se* are substantially reduced.

But the circulation of goods in society and the gradual leakage from the “wear and tear” and handling of waste products, is a new and mounting challenge. A general dilemma of the *Post-Communist countries* is the large scale undermining that took place during the socialist era and left the countries with massive environmental pollution problems.

The dilemma for the *countries in the South*, finally, is related to the combination of increasing population, increasing waste production, and widespread use of inappropriate technologies. Moreover, in large parts of that region a monsoon climate with a dry season makes the water scarce, which exacerbates the pollution problem due to poor dilution.

There are also considerable differences between coastal seas due to levels of assault, response delays due to constrained water exchange, coping capability and readiness to act towards restoration. In the Chesapeake Bay, Seto Inland Sea and the Western



Baltic Sea, there is an openness and a readiness to act towards restoration. On the east and south of the Baltic, there is also an interest to act, but financial problems are effective barriers to overcome. Both the Baltic Sea and Chesapeake Bay have succeeded in terms of curbed use and outflow of DDT/PCBS, resulting in some restored biodiversity. In the latter example, citizen involvement played a crucial role. In Western countries, industry is increasingly aware of its responsibilities. But threats remain in these systems. The input of traffic-generated pollutants via the atmosphere and of leaching of agricultural nutrients and ammonia, for example, have not yet been addressed or, where they have, the measures taken have not yet resulted in detectable improvements. In the Black Sea and on the south-east side of the Baltic, remediation challenges are hindered by shortfalls in financing and expertise.

In the South, on the other hand, the drainage basins of Lake Victoria and the Gulf of Thailand, for instance, are subject to rapidly expanding population, urbanization and industrialization. The assault, through intensified crop production and economic development, is thus increased rather than decreased. Curbing outflow of pollutants from domestic waste is still difficult to implement.

The unsolved conflict between development of livelihood security in Third World catchments and the coastal ecosystems at the mouth is a fundamental one that has to be addressed with the greatest possible urgency.

A successful restoration of deteriorating coastal seas will demand that a number of fundamental challenges be overcome:



- *scientific problems*: development of methods to distinguish natural changes from human-induced changes in the water system; radical improvement of the communication between different disciplines; bridge-building activities to facilitate this improvement; clarification of limitations in interregional transferability of solutions; shift in conceptual frame of reference from consequences to causes;
- *societal problems*: finding ways to overcome the far-reaching institutional fragmentation of basin countries; finding mechanisms for reconciliation of competing interests; clarification of human rights and human responsibilities, respectively; and
- *remediation problems*: clarifying how to handle the numerous stakeholders; the problems introduced by the slow response of the coastal water system; the technologies available for curbing outflow of pollutants; and the most cost-effective measures for different coastal waters.

Three Main Pollutant Sources to Address

Uncontrolled disposal of human waste causes widespread excreta-derived diseases. Few other causes of human misery can compete in scale and severity with poor health from the inappropriate handling of

human waste. Over the last 150 years, the developed world has produced and implemented water supply and sewerage systems to the extent that water-borne diseases have virtually disappeared. There, an effective barrier to the communication of diseases has been established. In the less developed parts of the world, we have seen decades of development in the water-supply sector with noteworthy successes but not matching up to the original objectives. At the same time we have seen some development of sanitation, but successes have been few. Relatively speaking, we are not getting very far, in spite of the fact that it is well documented that sanitation is equally essential to human health as safe water. There is no single, universally applicable sanitation solution. However, there is a whole spectrum of technical options, but no revolutionary inventions in sight. Thus, there is no technical barrier – the barriers are economic, social and political.

Industrial pollution is an increasingly devastating phenomenon in the Third World. A large part of the problem is linked to the production technology (including the transport system). Because there are significant differences between economic, social and cultural conditions around the world, a tailor-made approach toward increased industrial responsibility/greening is needed. Transplanting technology and legislation from one country to another should be done with great care, taking into account the inherent differences between countries. Law enforcement is necessary to ensure implementation and the creation of a level field for industry. Industry requires long-term, stable environmental objectives.

Increasingly, actors in industry are now more aware of their responsibilities. Awareness is spreading that the use of cleaner

technology often pays dividends rather quickly from economical and environmental points of view. This is particularly true wherever adequate rules and regulations have been promulgated and an enforcement mechanism is in place.

To be successful there is a need to be creative in development of partnerships between government (local and national), the business community, NGOs and universities. International co-operation will be even more important. All parties are discovering that negotiation often provides more cost-effective solutions than traditional command and control systems. The environment improves and the companies find ways of reducing their costs. In many developed countries, some companies are finding it in their own interests to go beyond regulation and do more than is required by law. As a component of an industrial ecology approach in some OECD countries, urban metabolism strategy is slowly developing, involving closed systems for both water and other substances, and industries have joined in symbioses for sequential reuse of water, waste and by-products.



Pollution from agricultural sources causes a variety of unexpected problems that have their origins in the use of chemicals and the water pollution produced when these chemicals leach through the soil on into groundwater aquifers and surface water systems. Increased use of chemical fertilizers and pesticides has been practiced in developing countries, and most of its use is applied to irrigated areas. Through leaching effects and soil erosion, large amounts of harmful compounds are brought in contact with surface and groundwater. At least in developed countries, the awareness of this problem, and of potential and serious health effects, is growing. The goal conflict involved between growth in production and minimizing leaching is particularly difficult to solve in all regions.

Seeking a Way Out

Basically, alternative ways to achieve the necessary minimization of a particular pollution load are few:

- no use, substitution or minimization at source of the polluting substance;
- reuse of polluted wastewater after renovation;
- conversion of wastewater by end-of-pipe treatment;
- dispersion of the pollution in a receiving water body (river or lake); and
- containment of hazardous pollutants.

Since several of these options merely alter the pathways by which a pollutant can reach water systems, the only alternative acceptable from a broader viewpoint is minimization at the source. It is at the same time completely evident that the non-substitutable, life-supporting raw materials of the planet must be used in such a way that they can be recovered

and safeguarded so as also to meet the needs of coming generations. In general, water-borne transport of waste products necessitates systems for the separation of disease transmitters and toxic substances, and the recycling of phosphorus.

New ideas and better approaches to land use planning need to be integrated with water management. The benefits afforded by this kind of integration must be amply demonstrated.

The evident way out of the worldwide water quality degradation is by curbing population growth and by closing the cycles, so that fewer nutrients and persistent chemicals from industrial waste will escape to the environment, where they will otherwise be caught and carried by the water cycle, in the end producing severe biological damage.

The Symposia have addressed a number of identified barriers impeding the implementation of the solutions by which harmful effluents might be minimized. These include the lack of a credible economic rationale for such minimizing, incomplete mechanisms for financing, gaps in the communication between scientists and decision-makers, and a set of policy-oriented water sector barriers (agriculture, industry, municipal water supply and sanitation, etc.). The close relationship between land use and water management has been repeatedly stressed throughout the nine Symposia.

Towards a "Prevention Pays Off" Principle

A proactive approach is needed to water quality deterioration – streams can no longer be allowed to be converted into sewers. The polluter pays principle, which allows pollution, should be complemented by the

prevention pays off principle, PPO. It will be in the interest of a downstream city to invest in the life support system upstream that delivers its lifeblood. The issue of downstream compensation is therefore being raised, and feasible ways are being discussed for resource transfer and ways by which legal barriers be overcome.

The battle for clean water sources has to be won in the catchment. In the search for building up mutual upstream/downstream partnership and solidarity, protocols for shared water resources are an interesting model with confidence-building as a fundamental component. Water should be seen as the common lifeblood of the basin as a whole. Management units for river basins are therefore needed: river parliaments, for example, have been proposed in India where, with its democratic tradition, it is seen as a way to bring upstream and downstream stakeholders together.

The Stockholm Statement, adopted at the end of the Joint Conference in 1997 with EMECS (Environmental Management of Enclosed Coastal Seas), highlights a set of principles aimed at reducing the pollution loads to safe levels:

- Principle 1. Pursue a holistic approach by taking an ecosystem-based approach to the land-sea complex.
- Principle 2. Improve understanding to identify the causal chain between destructive and polluting human activities in the drainage basin and the degradation of coastal ecosystems.
- Principle 3. Develop an active dialogue between major stakeholder groups: scientists, citizens, industry leaders, farmers, fisheries, resource managers and decision-makers.
- Principle 4. Act locally – Think regionally, in implementing the needed technical and legal solutions.





Groundwater Pollution Already Widespread

There is widespread evidence that groundwater is polluted not only in the old industrial nations in the western world but also in post-communist countries, newly industrialized countries and less developed countries. Groundwater quality problems arise from four very distinct causes: naturally occurring problems related to groundwater, soil chemistry and the dissolution of minerals; problems related to inadequately controlled abstraction, including intrusion of saline or polluted water; discharges from human pollution-generating activities and leachates from urban industrial and agricultural activities; and inadequate well construction, which is widely responsible for allowing pollution to penetrate to deeper groundwater layers than should be the case for natural vertical transport.

Many large cities in the developing world still rely upon shallow wells to supply water for the majority of the population. Reports indicate that the shallow groundwater and often also deeper groundwater layers in urban areas are seriously polluted. Some exceptionally serious cases of groundwater pollution are caused by indiscriminate industrial discharges into the ground. Even in urban areas with well-organized municipal wastewater collection there is evidence of pollution from leaking sewers

and from mining and old industrial activities. Polluted groundwater can also impact surface waters.

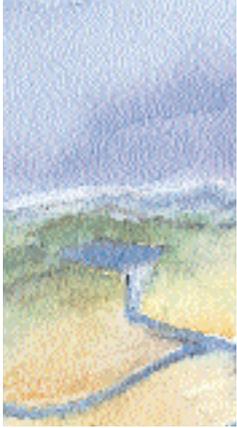
Overreliance on Natural Protection through Attenuation

There is a certain attenuation capacity in the soil and shallow geosphere. This protective capacity seems to have been overestimated, however, because of the effect of the various preferential flow mechanisms that have been proved to occur in many geological materials.

Need for Qualified Knowledge-based Management

Groundwater plays a multiple role: as raw water source for drinking water supply, for irrigation of food production, as regulation of base flows, and as an important determinant of many wetland ecosystems. There are, therefore, competing interests and potential conflicts on the use of exploitable groundwater resources. A qualified management that contains both a technological and a social dimension is crucial for optimal use of groundwater resources. Sustainable use of the resource to fulfill the needs requires a comprehensive knowledge-based approach. It has been agreed that groundwater policies and management have to be seen in the broader context of integrated water resources management, and that perspectives and strategies have to build on a policy framework, including a legal and regulatory framework, an economic framework and a technical framework. In order to protect groundwater from pollution, local action on the community level is often necessary due to the close connection to land use.

Water Mobility Calls for an Integrated Approach to Land and Water



When discussing the causal chains behind water pollution and how to get out of the trauma, the close linkages to land use have been repeatedly stressed. Land-based sources of pollutants play an important role in providing

contaminants that get caught by the water. A better approach to land use planning and management has been highlighted as one essential component of strategic actions. The question is how it might be implemented. Most water in the river has earlier passed land and carries the chemical history from that journey. Therefore, water quality protection has to include land use management as an integral component and within a broader integrated landscape-ecological approach to land and water use planning. The lessons learned from a set of cases on land/water integration include the need for a fruitful mix of bottom-up and top-down approaches, combining local action with higher-level guidance and incentives, the usefulness of computer-based animation to visualize the links between land use and water phenomena, the need for regional integration of institutional arrangements, and education and training to secure a common language between managers with multi-faceted competencies who will lead the process.

Vegetation and Water Partitioning at the Ground

Land/water linkages are equally important when it comes to runoff production in a certain area, and its vulnerability to land use change. The broadened water perspective thus has to include a new focus on the rainwater partitioning at the ground between the vertical green and the semi-horizontal blue water branches, the role of vegetation and soil in influencing that partitioning and how the partitioning can be managed by clearing, reforestation, afforestation, and so on. A megascale, country-wide and long-term water conservation project in South Africa involving six ministries has been initiated and is known as the Working for Water program. It illustrates the potential of vegetation management for increasing blue water availability. The aim is both to capture another 10 percent of the annual runoff and to protect biodiversity through a countrywide clearing of invasive, alien water-consuming plants.



The effects of altered water partitioning are particularly relevant in tropical climates due to the influence of high evaporative demand. As a consequence the basic fresh-water resource should be seen as the precipitation over a river basin, which has to be shared between the water consumed in plant production and returned to the atmosphere (not available for immediate reuse) and the surplus left (recharging aquifers and rivers and put to direct societal use).

Water and Food Security

Crop yields are stagnating in several regions, but the global population continues to grow. The fact that food production is highly consumptive but the available water is a finite resource tends to limit the carrying capacity of a region. The climate-controlled crop/water requirements may in fact involve essential constraints to socio-economic development and have to be entered



into macro-economic models to secure necessary awareness among national planners. Globally, we have no clue about how much of the green water will in the near future be needed to support the expanding world population in rainfed agriculture, as compared to the amount needed to support crucial ecosystem services, forests, wetlands and pastures. Rainfed agriculture covers some 80 percent of the world's agricultural lands, a figure that rises to more than 95 percent in water-short, less developed countries.

The land/water linkages tend to complicate the "water as an economic good" discussion ("commodification of water"). More focus is needed on the green water, especially when the resource base is weak as it is in semiarid environments. It has been stressed that the general situation and the dominating water perspective in society looks different depending on the phase of socio-economic development. Generally, treating water as a purely economic resource has been seen as tricky in view of key differences both between primary and secondary water demands and between green water and blue water demands. In the non-monetary situation, self-sufficiency at the farm level is aimed at, and the traditional approach is supply-oriented ("bring water to the people"). In situations where markets have developed, the strategy is increasingly to secure the best possible use of the available water ("more crop per drop"), or to import food and to use the water for value-adding purposes. Many countries are practicing water transfer from agriculture to industry; in extreme cases this means even excluding agricultural use altogether. However, as illustrated in the Aral Sea region, there is a serious goal conflict in the upstream/downstream dimension.



A flow of water through a city is a necessary condition for the survival of its inhabitants, but it is also critical for the functioning of industries, hospitals and other city components.

Although there is now a general world-wide understanding and acceptance that human health also depends on proper sanitation and hygiene, these factors continue to be treated as separate from the water supply sector. The tremendous speed of the population growth in many developing country cities – doubling, often, in only 10 to 20 years – is much faster than the city authorities can ever manage to run. Growing cities often destroy their own water sources, while mobilizing new sources further and further away rapidly tends to become insurmountably costly. This makes water reuse within the city an interesting alternative.

Securing Safe Water for Expanding Cities

Every city has not only a land address but also a water address. Securing water supply for megacities is often a daunting task, and the current constraints include a lack of accessible water resources, inefficient delivery mechanisms, lack of financial resources and insufficient management and technical skills. Most disturbing, however, is the apparent inability on the part of governments to take the actions required to

address these problems. It seems evident, therefore, that to meet the challenges ahead, antiquated approaches based on government-prescribed solutions will have to be jettisoned.



New approaches needed include reallocating water from primarily the agricultural sector, introducing institutional reforms, improving resource mobilization and cost recovery, helping those suffering from service deficiencies to participate in decision-making, complementing water service with sanitation, and building effective public-private partnerships. Open minds, acceptance of each other's realities (farmers have one reality, industrialists another), and a willingness to try new approaches are also critical.

Towards Dry Sanitation

To close the enormous sanitation gap in the developing world today, where several billions lack safe sanitation, water-borne sanitation has in many areas to give way for dry

sanitation as a tested and valid alternative. The possible solutions differ from one situation to another. For rural, low-density, low-income areas, low-cost solutions starting with the pit latrine or aqua privy are available; in urban, high-density, low-income areas, the problem is the scale, not the availability of solutions: long-term dry solutions, evolutionary solution, and intermediate, dry solutions with high technology. Dry sanitation consisting of urine-separating toilets, with no or little water added, is one way to minimize water use and to create usable fertilizers both from urine and solid fecal matter. Human faeces can be seen as a resource that can be safely reused after reduction of pathogens and heavy metals. At the same time, risk does exist: poorly planned latrines – where insufficient attention is paid to hydrologic conditions – may generate groundwater pollution and make the city an unsafe and insecure place of human activity and residence.

Wastewater Increasingly Seen as Resource

The escalating water pollution calls for anticipative planning rather than reaction to problems. As already indicated, wastewater is increasingly seen as a resource of both water and nutrients that could be marketed after reclamation. City wastewater can be reused both in the city and in the periurban area as a potential resource for food production both for farmers themselves and for the urban market. Some experts claim that the health hazard involved can be mitigated by simple and available treatment methods. In Islamic countries, there has now been a break-through in the sense that wastewater reuse has been judged not to be against Islamic doctrine. The accumulation of salts in soil and groundwater that follows

with reuse, however, puts a long-term limit to reuse for irrigation and other uses.

Financing Urban Water Supply and Sanitation

The world has broad experience with failing public management of community water supply and sanitation. In many developing and former communist countries there has even been an almost total breakdown of public sector systems. As a consequence, private sector participation in financing and management of water supply and wastewater projects in many different forms, from simple service contracts to concession arrangements to outright private sale of assets, is growing. This is not only in Western countries but also in many developing countries, where such development is pushed by many donors and by the World Bank. There are many models of public-private partnership or interaction that can be contemplated. Parameters in these models include determination of tariffs, ownership of fixed assets, control of operation and management systems and the handling of control programs. Efficiency cannot be reduced to a matter of monetary cost per unit of water supplied. In addition, quality of water and, more generally, environmental performance has to be clearly evaluated. When privatization is considered, the objectives should be clearly formulated. The private sector and the public sector have to join forces to work towards providing safe water and sanitation services to the people of the planet. To the extent that private companies limit their goals to monetary profits, privatization becomes increasingly unrealistic as a way of solving broader social and environmental issues. Institutional reform of business companies becomes a consideration.

A Critical Eye on Stockholm Water Symposia

Young scientists/professionals have been entrusted annual seminars of their own during the Symposia in order:

- to facilitate the next generation of scientists to become more active in trying to establish communicative bridges; and
- to allow the leaders of tomorrow represented by young scientists to enter the scene to work together with today's professionals and act as advocates for the future. They should be seen as guardians of change

These seminars have made a number of relevant observations.

First, just bringing people with various backgrounds to the same conference does not necessarily mean that it becomes integrative. In order to reach that goal, and further stimulate a cross sectoral and integrative discussion, the people at a conference *should participate in other workshops than what is normally their field of expertise*, and be encouraged to share their views on the topics discussed. Second, there is an urgent need for a major switch in behaviors and attitudes, based on a new water ethics – today, not sometime in the future, by a not-yet born generation

Going from "knowing to doing" demands bridging from hard science to peoples' perceptions and everyday behavior. This is extremely difficult, but in reality there is no choice: scientists have to feel responsible in making the water cycle a part of everyone's life. This means, evidently, that we have to



admit the urgency of water quality and quantity deterioration.

Third, the Stockholm Water Symposium has the ambition of being a global forum of cross disciplinary interactions bringing together professionals from various societal sectors in different regions of the world, in particular between Western countries, economies in transition and countries in the tropics and subtropics. Although attended by some one thousand participants – the most ever – even the 1997 Symposium was not capable of striking a proper balance between North and South.

Main Gaps Identified by the Young Professionals

Four critical gaps were identified:

- the interactions of the social and natural spheres in water resources management. Inadequate attention is paid to the globalization of our societies and thereby our markets that can be closely linked to water resources through supply and demand patterns;

- the huge, unperceived flows of water not taken into account in water research, where the present focus on the “blue” runoff water represents only a small fraction of the water needed to support the human life-support system. The bulk of the water use is in reality the “green” water flow (flow of evaporating water, vapor flow, etc.) generating rainfed goods and services on which humans depend. Neglected is also the human ability to influence the “green”/“blue” rainfall partitioning, intentionally and unintentionally;
- today’s water quality problems, involving contamination of all water flows in the hydrological cycle. Water quality cannot be seen in isolation from water quantity: river depletion can lead to concentration of nutrients and/or pollutants that result in an aggravated water quality problem; and
- severe intergenerational communication gaps exacerbated by the scientific and institutional fragmentation that characterizes both universities and administration, severely complicating the possibility to take the integrative approaches that are widely needed.

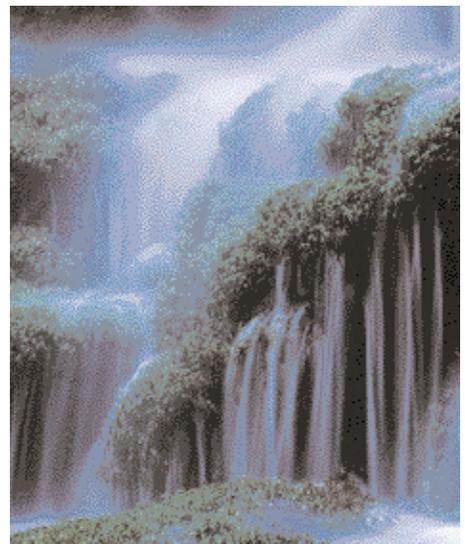
Science in Need of a Social Contract

These gaps originate from the lack of bridging between science and all domains of society. Scientists have difficulties in addressing the system as a whole, with all the physical and socio-economic interactions. Only studying partial realities, on which reductionist-oriented scientists have concentrated so far, will not help in finding solutions to the multidimensional, complex and dynamic problems that face us today. The most urgent challenge is bridging.

Scientists from all disciplines need to take more active roles in inter- and transdisciplinary research. The role of scientists should be redefined to involve also a responsibility of playing a more supportive role in development and policy making.

If lack of political will is a key cause to poor water management, this lack of will relates back to the scientific community. The strong economic focus in society results in a neglect of how the life support systems function. Who are in a better position of being hydrological ambassadors than the water researchers themselves? The scientific community has an important role to play in lifting up the water issues on the political agenda.

Research cannot continue to be carried out in a vacuum. As proposed by Professor Jane Lubchenko, a new social contract is needed within the scientific community with a focus on the responsibility for (1) justification of water resources research within the context of future water challenges and (2) wide dissemination of scientific knowledge and understanding.



Proceeding from Rhetorical to Real Integration

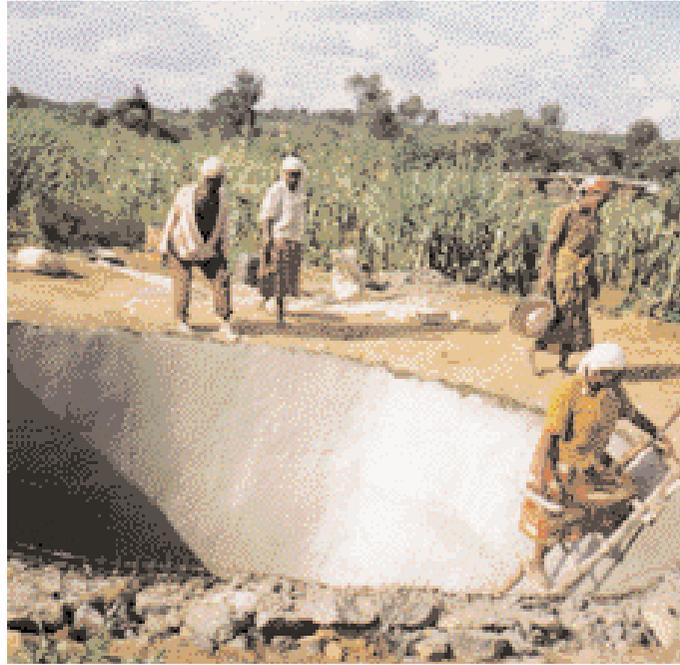
Strategic actions are both preventive against future problems and curative for problems due to past mismanagement. Political barriers to action must be removed, and politicians encouraged to take a stand. Ways to proceed from rhetorical integration to real integration have to be identified. We need to focus on positive developments that have occurred in different parts of the world in the recent past so that they can be more widely replicated.

Proceeding from the world we have with its failing water policies to the "Grand Vision" of the world we want – sustainable, equitable and stable – will demand an unprecedented effort of interdisciplinary integration of existing knowledge, and a major effort of institutional and human capability development.

Today's environmental communication would benefit substantially from a focus on non-negotiable facts, firmly based on natural laws, such as those of thermodynamics. The way for scientists to achieve more influence over today's political decisions and more power over the important issues of tomorrow is by emphasizing common denominators rather than disagreement, although the latter is still necessary and one important path forward. The challenge for the scientific community is to produce unanimous, clear and obvious statements, by which decision-makers can be persuaded to proceed in the right direction.

Social Ability to Cope

In a situation of rapid change, social stability requires adaptation and societal ability



to cope with water cycle constraints in the rivers, the aquifers and the soil from which the crops that should feed the expanding world population get their water. The water crisis that we are facing cannot be averted without innovations and lateral thinking, involving both men and women, as well as the human ingenuity of the young generation. Our task as professionals is to find the tools for that change. A key will be social mobilization, education of the general public, development of adaptive capacity and reference to the spiritual values associated with water. This represents a new paradigm of governance and social mobilization, where government acts in a facilitating and law making capacity, while consumers are made part of the governance system. Only if water use, management and stewardship is made everybody's business is it likely that a stable, yet dynamic and creative urban situation is reached.

Water Management – Increasingly Complex

The present situation is aggravated by broad-based hydroconservatism that is the result of truncated and reductionist ideas about water; a poor general understanding of the complexity of water-related issues; an inability to address this complexity because of fragmented and inflexible administrative structures; an unwillingness to accept radical changes in water management; and cross-cultural difficulties in development work. Such difficulties often originate from a “temperate-zone bias” in transfer of technology, reflected in the introduction of “northern” technologies and water management strategies that are not necessarily viable in the local context in southern countries.

It is evident from the discussions that water management is getting increasingly more complex. Today’s scientists and bureaucrats are generally sitting within their well-defined boxes, looking over a partial reality. The next generation of professionals will have to be able to handle such complexity. This complexity is a major challenge for SIWI in its future work.

It is evident that scientists have clear problems in addressing the man-land-water-waste system as a whole, with all its physical and socio-economic interactions. The problem is not that scientists are unaware of the multidimensional character of landscapes, but more related to the difficulty of practically addressing a complex and dynamic system.

In many cases, the problems are well-diagnosed, solutions are known and yet the progress is minimal. What stands out as extremely clear is the strong social science components in terms of:

- driving forces behind water demands,
- barriers that stand in the way when going from knowing to doing, and
- incentives to influence the behavior of stakeholders.

Fundamental barriers are related to legislation, enforcement, operation and maintenance logistics, difficulties to finance infrastructure and inflexible administration paralyzied by complexity.

Economic Profit as the Highest Business Objective is to Be Questioned

There should be equity in what is adopted in terms of appropriate business behavior in both the developed and developing world. Business should keep its house in order through maintenance and modernization in order to reach the possible levels of eco-efficiency and to refrain from the export of inefficient or outdated technology to the developing world. While business is recognizing that sustainability is essential in water matters, it is important that society and its various government instruments take responsibility for the framework within which business should be allowed to operate.

The classic business approach that elevates profit as the highest objective of business (neo-classical economics) has been seriously questioned. The question raised is if broad issues important to stakeholders, such as consideration of the ecology, societal issues, etc., ought not also be objectives which society imposes on business.

The necessary means to introduce this broader approach – by encouragement, public opinion pressure or inducement by society at large – requires the attention of governments. At the same time the

involvement and engagement of the broad stakeholder base in setting norms and standards for business activity has been advocated. This should form the basis for a future SIWI initiative.

Women and Water – Much Lip Service, Little Implementation

The roles women play and could play in water-related issues depend to a large extent on the conditions under which they live, as well as their cultures and traditions. It is essential to build awareness on general, culturally based and deeply ingrained differences in their tasks in regard to water. Water and gender are two of the priorities in the agendas of many international organizations at present. Unfortunately, gender issues are for the most part subject to lip-service rather than concrete operational activities.

In all water-related activities it is essential to involve women. Men and women tend to see problems quite differently, a difference that society must be able to handle. Which roles women can play strongly depends on the conditions under which they live, the culture, the traditions and the education level in society. The world is not as homogenous as actors in the water profession often believe; global generalizations often give an incorrect picture. Moreover, the mind-sets of gender specialists are very different from those of senior water managers and decision-makers.

It is essential to differentiate between women as water users as opposed to women as professionals. In Latin America, as in many Western countries, women are involved on many different levels already: as decision-makers, managers, operators, etc., and the number of female students continues to expand. In urban situations, women may form powerful pressure groups as they

have in Monterrey, Mexico. In rural areas in the developing world, women tend to play the role as main water providers both for the household and for economic activities.

The World Water Vision – a major effort geared to break through at the governmental level around the world before the water supply and quality destruction makes it impossible to get out of the poverty trap in developing countries – aims at a widely shared vision of the desired world by 2025, and a framework for action how to reach it. Since the Vision as presented at the 1999 Symposium represented the efforts of a large community of senior men, it remained for its second round of consultations to include also the remaining 50% of the world population in the consensus. This predicament shows that the world is still rather far away from the feminization of water management and policies that were recommended at the First World Water Forum in Marrakesh. Empowerment of women is a crucial step to take. When women are more equally represented at the political level and in the private sector, we may expect changes.



The Situation of Rural Women

Both at macro and micro levels, the major contributions of women in water-related issues have been to health and sanitation-related issues, as well as conservation of natural resources and environmental education, which result in improvement in quality of life of the whole society. In rural areas, women have traditionally been considered the main providers and users of water at the household and community levels. Thus, donors and governments have tended to assume that female strategic interest in water is concentrated primarily to having access to safe sources of water for their domestic responsibilities. It has been pointed out that this assumption is not true, at least for Africa, since women also need access to water to undertake work with direct economic benefits for their families and their respective communities.

Most Essential: Long-term Vision, Leadership and Persistence of Efforts

A major switch is needed in both behavior and attitudes to secure action now, not some time in the future by an unborn population. Seeing humans as part of the large-scale ecosystem will be essential. This will demand some conceptual development. The challenge is not development or environment, but development and environment. Crucial ecological services that have to be protected also have to be identified. Problems will have to be addressed at the proper conceptual scale, in time as well as space. Due to the slow responses in both society and natural water systems, the highest level of leadership is essential, and it must be based on both a vision and a long-term persistence. To this end, public understanding and involvement will be essential,

with NGOs as important actors and useful channels of communication. Local identity and a sense of responsibility for the next generation will help to build up awareness and willingness to act. Public advisory committees may be useful in seeking compromises between different stakeholder groups. There is a need for creative development of partnerships that include also the business communities. The development of ecological economics is essential to reduce the current dominance of neo-classical economics in trying to reconcile development with protection of crucial ecological services of coastal ecosystems.

Agenda 21 Planning

Agenda 21 planning might provide an opening, especially its emphasis on building on the enthusiasm of local residents, thus giving substance to the concept of stakeholder participation. Experience from a set of municipalities in some countries has shown Agenda 21 planning to be useful as an umbrella to strengthen thinking, especially as it encourages local participation in an organized manner. It involves ordinary people as well as environmental activity groups in discussions on how to maximize benefits for local residents. The presence of persons who are really experts in complex water issues is, however, essential. Agenda 21 is also an essential tool to combine economic, social and environmental issues in an integrated way for planning purposes.

Education on All Societal Levels – Main Key to the Future

Major efforts have to be put into education on all levels. The development of appropriate management strategies that meet the specific regional needs (such as variations of hydroecological characteristics, climate

conditions, urban and/or rural consumer needs, etc.) require sophisticated knowledge-based approaches and tools. Capacity building and education of engineers and other professionals in the water sector is of crucial importance. In order to meet future challenges, training in interdisciplinary communication and skills in raising general awareness for water-related problems is essential. Education is fundamental as a promoter of change, not only of future generations and end users of water but also of scientists and politicians. Scientists have a moral responsibility to establish bridges both between scientific disciplines and to

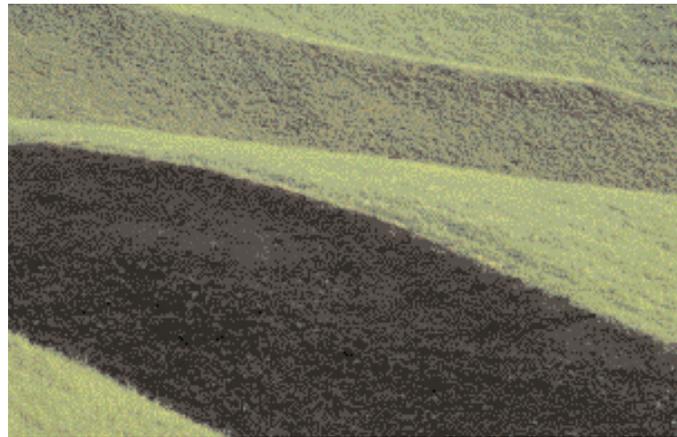
decision-makers, and to educate the public as well as themselves. A well functioning extension system has a crucial role to play, especially in the South. Education naturally includes issues of cultural understanding.

It is essential that environmental school education focuses on basic understanding of man's life-support systems, rather than on isolated issues. Work in different hydroclimates and distant cultures requires cultural sensitivity. It is also essential to engage and stimulate children – they have fantasy, and they represent the platform for societal changes.

Major Shift in Thinking Essential

Where and Which Are the Key Buttons to Push?

An overriding question seems to be the following: Where are the buttons to push that will stop the ongoing undermining of the world's freshwater resources and minimize the effects of today's failing policies? Who needs to be further involved to reach new goals? It is not lack of analysis and diagnosis that generally limits success; the key problem is often a lack of effective strategies for implementation. Moving towards sustainable development is no painfree process. A crucial question, in fact, is how to reduce the implementation difficulties between what is considered desirable from a scientific/diagnostic point of view, and what is seen as politically possible to achieve. More focus has to be put on the original freshwater resource, the precipitation over the river basin. This is the resource divided between highly water consuming plant production and polluting, but less water con-



suming societal water uses in households, municipalities and industry.

Efforts needed to make possible better policies include the following:

- to encourage engagement of all sub-sectors involved, allowing them to interact and take responsibility in trying to jointly protect the resource base;
- to get crucial stakeholders like business, industrial and agricultural sectors – all

contributing in different ways to the current undermining of land and water productivity – to take a greater part in water resources planning and decision making;

- to secure enforcement as a necessary complement to laws and regulations;
- to make use of environmental impact assessment techniques as a tool to ensure the compatibility of sectoral plans; and
- to secure adequate status to freshwater issues. Freshwater still remains “the odd man out” on the international environmental agenda.



Human Right to Understand the Risks One Is Taking

Among the key issues for effective water resources management highlighted is the responsibility of the scientific community. There is an evident need to achieve more than rhetorical bridges between scientific disciplines, between science and policy/de-

cision making and between science and society at large.

It has been agreed that generally the major constraint to long-term stable water resources management is not lack of knowledge but transfer of that knowledge in a clear and understandable form to policy makers and decision-makers. Decision-makers and politicians have to be given the opportunity to understand the implications of their own decisions.

The public also has to be able to understand the risks they are taking. It is therefore urgent to make the general public understand how freshwater controls their life as well as the life of their children and grandchildren and how essential hydrological parameters can be controlled and influenced. To this end scientists, technologists and engineers have to integrate their results and translate them into easily understandable terms and clear messages.

Call for a New Mental Image Based on Ecorealism

The water passing through a country constitutes its very life support and thus represents a natural capital that has to be conserved so as not to erode the future of the country. Consequently, better informed and less irresponsible methods of water quality management in a country are fundamental for its long-term health, socio-economic sustainability, and, indeed, national creditworthiness.

Well-integrated land and water policies have to build on an ecosystem approach, acknowledging water's role as the bloodstream of the biosphere. This necessitates an operationalization of environmental sustainability and a clarification of the

“requirements” of valued aquatic ecosystems in terms of water flow and quality. A level of ecorealism has to be developed, paying due attention to differences between various world regions in terms of priority setting and focus (food security vs. environmental issues, water quality vs. water supply issues) Communication is essential to bridge subsectoral perspectives. Local platforms have to be created for stakeholder dialogue, so-called “tables of negotiation” between sectoral and other interests. It is important to establish situations of interactive learning processes; learning to listen is as essential as self-reflection. A common language has to be achieved through mutual education of scientists, politicians and the public.

See Catchment as Asset for Development

For the long-term development and sustainability of a city, it has to see the catchment of its water sources as assets for development to be protected from upstream overexploitation and water quality degradation from untreated sewage, industrial waste and agricultural chemicals and fertilizers.

Development of human as well as institutional capacity has to be seen as a long-term process with clearly enunciated short-, medium-, and long-term goals. Many poor countries have a desperate shortage of competent water professionals, suffer from an incomplete understanding of their problems, and also lack a realistic assessment of capacity building requirements. At the same time, exchange of experiences and transfer of technology through networks between countries having similar social, economic and technical conditions could complement traditional technical assistance. There are strong indications that water resources will



become a limiting factor for livelihood security and that carrying capacity limits will be reached in large parts of the world. Considering the uneven global distribution of population and of water resources, sustainable solutions require more large-scale considerations and global thinking. The complexity of many water-related issues demands a systems approach. Education has a strategic role in developing an improved capacity among environmental professionals to address and communicate on particularly complex issues. New and more efficient ways of learning must be developed.

Vital Need for a True Freshwater Revolution as Followup of the World Water Vision

The lack of public insight and absence of serious concern about the magnitude of the looming freshwater challenges is devastating. All over the world an undermining of this valuable resource is taking place. Agenda 21 indicates an existing will to act, but we are still failing to implement sustainable solutions. A major initiative is called for to bring about the needed changes in attitudes and behaviors and mobilize public opinion. The challenges are clear and formidable. If effective, the World Water Vision initiative could bring about the necessary pressure on the political as well as the economic systems

at both the national and international level, especially as globalization tends to redistribute political power in favor of transnational corporations. In other environmental fields, conventions have been shown to be effective in changing attitudes and behaviors on an international scale. Given the challenges facing the freshwater sector it is difficult to see what other means could activate the Freshwater Revolution and achieve the needed changes within the available time frame. Virtually all other sectors of the environment are now covered, or soon will be, by a convention, protocol or similar pact. Yet freshwater, the lifeblood of the global ecosystem, has seemingly lagged behind.

It is essential that we stay optimistic and do not give up in front of this intensifying

complexity. We should learn from history and the role that coping with water constraints has had for the development of human civilization, and the lessons that it carries regarding human ability and smartness. There are ample opportunities for human intelligence.



The Way to the Future

The Problem with Water is Not Water But Lack of Societal Stewardship

There is a broad lack of understanding in society worldwide of the consequences for the life support system and the base for socio-economic development of current policies and actions. It seems evident from the above conclusions of the past nine Symposia that the core problem as seen from a global perspective is lack of understanding of the implications of the ongoing undermining of the resource base from the side of the society in general and the industrial sector and the market system in particular, and/or lack of political will to do something about it. The scientific base for problem identification and issuing of warnings is good enough to support decisive action.

The Stockholm Water Symposia are no doubt addressing fundamental questions and filling a niche among the international efforts in the field of water resources development and management. They should therefore continue to work within the identified niche of operation and persist in their catalytic function. Two major fields should be addressed in coming Symposia: environmental debt and socio-economic growth, on the one hand, and water security and goal conflicts involved, on the other.

Environmental Debt and Socio-economic Growth

There is a need to penetrate the weaknesses in current approaches and systems, in particular the general lack of interest in the ongoing deterioration of the life support system. Also, the lack of attention in the busi-

ness sector to limitations in freshwater precondition components or so-called comparative advantages.

A conceptual development is urgently needed that facilitates the realization and mental capability among politicians and policy makers to master the implications for society of the multiple thumbscrews now operating on the world's finite and shared freshwater resource, including:

- escalating pollution reducing the usability of accessible water,
- expanding depletion of river flow and groundwater in response to consumptive use and overexploitation,
- expanding water stress with consequences in terms of growing dispute proneness and implications for national security, and
- growing food insecurity due to expanding water-related deficiencies in crop production.

The driving forces behind these thumbscrews are strong and currently more or less impossible to master: population growth, adding some 30-70 million person every year up till about 2025; urbanization driven by rural exodus and urban fertility; and industrialization as the key to socioeconomic development and improved quality of life.

The problematique around the lack of interest in the industrial sector of deteriorating water resources:

- need to address the reduced usability of available freshwater, and the depletion of freshwater availability and its implications for industry and for the development of wealth in general,
- the fundamental need to identify effi-



ent incentives – such as market forces, consumer pressure, etc. – to reduce a disastrous freshwater deterioration from industrial chemicals and waste,

- clarification of the patterns of human exposure to water-related health hazards from POP's (persistent organic and bio-accumulating pollutants), toxic chemicals and heavy metals, and
- development of risk assessment methods.

Water Security, Hydrosolidarity and Goal Conflicts Involved

- need to delineate a possible future route to move towards the goal “a slow but sustainable development”. This should be understood as satisfying without continued undermining of the resource base, the growing needs of food, health, safe water and sanitation, and poverty eradication.

- the need to acknowledge and identify true goal conflicts in society as the starting point for societal control. Such conflicts should be honestly addressed and analyzed in coming Symposia with minimal diplomatic or political consideration.



- water is to be seen as a social, economic and ecological good. Based on an identification of the multiple dimensions of the concept “water security”, a broadened way of thinking should be stimulated, clarifying the relations between a holistic, integrated approach and its implications for local action in line with the slogan, “Think regionally, act locally”.
- how to increasingly involve the civil society in both provision of water for livelihood security and in finding acceptable ways to cope with fundamental and unavoidable goal conflicts.
- pollution will have to be minimized and constructive principles developed and implemented so that no waste of water should be allowed in the main water-dependent sectors; no toxic chemicals should be allowed used in society that may end up in freshwater systems and as higher order effects in humans and ecosystems; industries will have to be operated with closed systems; and market forces will have to be used in a constructive way (rather than the current destructive way).
- the hydrosolidarity approach should be further developed and the fact that a land use decision is also a water decision be made widely understood, including the significance of the water address of an activity and its relations to and implications for activities with neighboring water addresses.
- crash programs are needed for education and awareness building in order to make water everybody’s business.
- find ways to proceed beyond decade-long lip service to the involvement of women. Clear distinction is needed between female roles as water users (households, hygiene and small-scale agriculture), on the one hand, and feminization of water management (responsible operators, water managers, and planners and policy makers, etc.), on the other.
- find innovative ways to involve the young generation of professionals in discussions of water-related issues of crucial importance for their futures as professionals as well as parents and private citizens.
- awareness has to include two long-term issues that need to be highlighted and addressed: the global implications of the expanding and intensifying regional water scarcity with its implications for, among others, a food trade; and the implications of the proceeding and widespread depletion of storage volumes in existing reservoirs, which are subject to silting.

The Stockholm Water Symposia

2000

Water Security for the 21st Century
– Innovative Approaches

1999

Urban Stability Through Integrated
Water-Related Management

1998

Water: the Key to Socio-Economic
Development and Quality of Life

1997

With Rivers to the Sea: Interaction of Land Activities,
Fresh Water and Enclosed Coastal Seas

1996

Safeguarding Water Resources for
Tomorrow: New Solutions to Old Problems

1995

Water Quality Management: Heading for
a New Epoch

1994

Integrated Land and Water Management:
Challenges and New Opportunities

1993

Integrated Measures to Overcome Barriers to
Minimizing Harmful Fluxes from Land to Water

1992

A Holistic Approach to Water Quality
Management: Finding Life-Styles and Measures
for Minimizing Harmful Fluxes
from Land to Water

1991

Water Resources in the Next Century



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