

# Global International Waters Assessment GIWA





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Seas, lakes, wetlands, rivers, and groundwater basins not only provide us with water for all human purposes. They also constitute life-support systems, which provide us with fundamental ecological and other services. The character of our planet, physically as well as biologically, is shaped by water. Without water all life ceases.

Even though man is dependent on water in a broad sense, we have degraded aquatic environments and mismanaged aquatic resources at a global scale. Pollution, destruction of habitats, overutilization of living resources and other problems threaten the future development of human societies, especially in developing countries.

Water issues therefore play an important and increasing role in international development co-operation. The Global Environment Facility (GEF) has designated international waters as one of its four focal areas. The Global International Waters Assessment (GIWA) will provide the information needed for GEF's work in this particular area.

When announcing the start of GIWA in April 1999, Dr. Klaus Töpfer, Executive Director of UNEP, stated that "the lack of an International Waters Assessment has been a unique and serious impediment to the implementation of on-the-ground action since there exists

no basis on which to identify areas of global priority for intervention." Dr. Töpfer also noted that "comparable to the assessments of the Intergovernmental Panel on Climate Change (IPCC), the Global Biodiversity Assessment (GBA), and the Stratospheric Ozone Assessment (SOA), spearheaded by UNEP, the Global International Waters Assessment will provide the intellectual leadership in dealing with global environmental problems and threats plaguing transboundary water bodies."

Although a worldwide assessment, GIWA will be executed principally in 66 subregions. It will, to a great extent, be based on the many studies, which either exist or are ongoing at various levels. Close co-operative links to all relevant bodies and activities will be established, encompassing, among other tasks, exchange of data, co-ordination of programmes and joint activities; duplication of work will be avoided. This overall programme will constitute the global GIWA network.

A well-designed network and active participation of relevant organisations in all subregions will be two pre-conditions for the successful implementation of GIWA.

PER WRAMNER  
*Scientific Director*



# GIWA – not just another water initiative

“Why another global water assessment? Don’t we have enough information already to start taking action to address the problems of international, transboundary waters?”

That could be one’s first reaction when hearing of the Global International Waters Assessment, GIWA – a four-year UNEP-led, GEF-funded initiative, executed by Kalmar University. Marine, freshwater and groundwater issues are already being addressed in many contexts and by many international, regional, national and local bodies. There is already a large global water community and a number of programmes, projects and treat-

ties for water issues. So why launch a new body and a new global initiative to cover 66 transboundary marine and freshwater areas all over the world?

There are several answers to that question. One of them is that although we have identified many areas where immediate action on environmental protection is necessary and often overdue, most of our actions focus on removing the symptoms of environmental degradation but neither identify nor address its root causes. The urgent need for an assessment of the causes of environmental degradation was highlighted by the UN Special

*Iguassu Falls, Brazil*



## United Nations Environment Programme

The United Nations Environment Programme (UNEP) was established as a follow-up to the 1972 Stockholm Conference on the Human Environment, as the environmental conscience of the UN system. With the mission to "provide leadership and encourage partnerships in caring for the environment by inspiring, informing and enabling nations and people to improve their quality of life without compromising that of future generations", UNEP has been creating a basis for comprehensive consideration and co-ordinated action within the UN on the problems of the human environment.

UNEP makes a particular effort to nurture partnerships with other UN bodies, as well as to enhance the participation of the private sector, the scientific community, NGOs, youth, women, and sports organizations in the achievement of sustainable development. Today, the challenge before UNEP is to further catalyze, promote and implement an agenda for sustainable development – an environmental agenda that is integrated strategically with the goals of economic development and social well-being.

UNEP has several water-related programmes. The *Regional Seas Programme* was initiated in 1974 as a global programme implemented through regional components. It includes 13 regions involving more than 140 coastal states and territories. It is an action-oriented programme and focuses not only on the mitigation or elimination of the consequences but also on the causes of environmental degradation. The focus has gradually shifted from protecting the marine environment from pollution to striving for sustainable development of the coastal and marine environment through integrated management. UNEP is also responsible for the Secretariat set up to imple-

ment the 1995 *Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities*. The *UNEP Fresh Water Programmes* comprise structured programmes of environmental inventory, analysis, diagnosis and action planning. Such programmes have been or are presently being developed and implemented for a number of large river and lake basins in Africa, Asia and South America. The GIWA regional assessments will contribute to these programmes.

Within the UN system, UNEP is the lead agency for the water resources component of the UN Special Initiative for Africa (UN-SIA). In this capacity, UNEP is chairing the UN Working Group mandated by the Secretary-General to address the critical water problems in Africa. UNEP is, furthermore, one of the implementing agencies for the Global Environment Facility, GEF.

The UNEP portfolio of GEF-funded activities in international waters include global assessments, transboundary diagnostic analyses (TDAs) of shared water bodies, support to the implementation of strategic action programmes for marine and freshwater areas, and support to integrated management of shared freshwater bodies.

### United Nations Environment Programme, UNEP

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Session on the Environment (UNGASS) in 1997, where commitments were made regarding the work of the UN Commission on Sustainable Development (UNCSD) on freshwater in 1998 and oceans and seas in 1999.

Another answer is that actions aimed at resolving environmental problems in international waters frequently fail to identify the geographical boundaries of the problem. Water problems are often trans-boundary, water bodies are often shared between two or more countries. The boundaries of the area where one observes the actual water-related problem are not necessarily the same as the boundaries of the activity causing the problem or the place where it originates.

A third answer is the fact that there is very limited financial support for addressing international waters problems. It is necessary to agree upon funding priorities in order to deal with certain key issues whilst gradually trying to attain a more comprehensive approach towards the others.

Greenland, Arctic



## Global Environment Facility



The Global Environment Facility (GEF) is an independent international financing entity with the long-term goal to ensure progress toward global environmental security. With GEF funds, developing countries and nations transitioning to market economies can carry added costs

of making planned projects environmentally friendly and finance regional approaches to multinational problems. In GEF partnerships governments, non-governmental organizations, the scientific community and the private sector unite behind cost-effective solutions that pave the way for sustainable economic development.

Since its creation in 1991, GEF has funded more than 500 projects in 120 countries. 165 nations participate in GEF and form the GEF Assembly. GEF's Governing Council is made up of 16 representatives from developing countries, 14 from developed countries, and two from economies in transition. All decisions on project funding are made by the Council.

The UN Development Programme (UNDP), the UN Environment Programme (UNEP), and the World Bank are GEF implementing agencies. UNDP is primarily responsible for implementing technical assistance and capacity building programmes, and manages the Small Grants Programme, aimed at enabling NGO involvement. UNEP takes the lead in advancing environmental management at regional and global levels within GEF-financed activities and in catalyzing scientific and technical analysis. UNEP also administers and supports the GEF Scientific and Technical Advisory Panel. The World Bank helps to develop and implement investment projects, seeks to mobilize resources from the private sector, and acts as trustee for the GEF Trust Fund.

GEF funds projects in four programme areas: **Climate change**. **Biological diversity**. **The ozone layer**. **International waters**. GEF is the leading multilateral entity working to reverse the degradation of aquifers, basins, lakes, oceans, rivers, and wetlands of international significance. So far, over 240 million USD have been allocated to international waters initiatives that help address shared problems in a co-ordinated, cost-effective manner in, *inter alia*, China; the Philippines; the Molucca Straits; the Eastern Caribbean; Senegal; Mauritania; the Black Sea; the Danube River Basin; the Gulf of Guinea; the Red Sea; the Aral Sea; the Caspian Sea; the Pacific Coast of South America and Central America; and Lake Victoria.

In the GEF Operational Strategy, four major areas of concern related to international waters are identified: *Degradation of the quality of transboundary water resources; Physical habitat destruction; Introduction of non-indigenous species; Excessive exploitation of living and non-living resources*. Long-term operational programmes within this focal area are a waterbody-based programme; an integrated land and water multiple focal area programme; and a contaminant-based programme. These will ensure that different types of international waters geographic settings are addressed; that the land degradation cross-cutting theme and linkages with other GEF focal areas receive attention; and that a more complete range of imminent threats is covered.

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Red mangrove, Los Roques, Venezuela



Yet another answer is the lack of objective information which could help pinpoint the root causes of environmental problems, as well as the barriers to be overcome in solving them. To obtain such information would clearly be a valuable asset for improving the design of international programmes offering technical and financial assistance to the affected countries.

We urgently need to deepen our current understanding of the root causes of the environmental issues in terms of market failures, inadequacies in policy, governance and resources, and deficiencies in information. A profound interdisciplinary study, bridging social and physical science and integrating seas and associated land catchment areas, is required at a national, regional and global level. This should lead to practical measures to address the root causes of the problems themselves.



Amazon, Brazil

## International assessments on biodiversity, climate change and the ozone layer

### **Biodiversity:**

The objective of the *Global Biodiversity Assessment*, commissioned by UNEP, funded by GEF, and released in 1995 at the second meeting of the Contracting Parties to the Convention on Biological Diversity (the Jakarta Meeting), was to "provide an independent, critical, peer-reviewed scientific analysis of the current issues, theories and views regarding the main global aspects of biodiversity". In this comprehensive report, the critical scientific issues were examined in detail and attention was drawn to gaps in knowledge and issues where uncertainty has led to alternative viewpoints which will require further research to resolve. The Global Biodiversity Assessment could shape the scientific agenda for the next decade and be the starting point for future assessments within the framework of the Convention to provide a sound basis for policy-making. One major conclusion was that biodiversity management must go far beyond simply establishing isolated nature reserves or setting up agricultural seed banks. Instead, it must be fully integrated into all aspects of landscape management, including agriculture, socio-economics, and other relevant fields.

### **Climate change:**

Two international assessments have been made within the framework of the International Panel on Climate Change (IPCC). The *First Assessment Report* was completed in 1990 and played an important role in establishing the Intergovernmental Negotiating Committee for the UN Framework Convention on Climate Change, which was

adopted in 1992 and entered into force in 1994. It provides the overall policy framework for addressing the climate change issue. The *Second Assessment Report* of the IPCC – Climate Change 1995 – provided key input to the negotiations, which led to the adoption of the Kyoto Protocol to the UNFCCC in 1997. The *Third Assessment Report* currently under preparation will be a comprehensive and up-to-date assessment of the policy-relevant scientific, technical, and socio-economic dimensions of climate change. It will concentrate on new findings since 1995, pay greater attention to the regional (in addition to the global) scale, and include non-English literature to the extent possible.

### **Stratospheric ozone:**

The current understanding of ozone depletion and its relation to humankind is discussed in detail by the leading scientists in the world's ozone research community in the WMO/UNEP *Scientific Assessment of Ozone Depletion* 1991, 1994 and 1998. Three Assessment Reports were made during 1998 as part of the information upon which the Parties to the UN Montreal Protocol at the meeting in June 1999 based their decisions considering the need to amend or adjust the Protocol. The reports included the present scientific assessment focus on the environmental and health effects of ozone layer depletion and on the technological feasibilities and economic implications of various mitigation approaches. Altogether there have been eight scientific assessments prepared under the international auspices of the World Meteorological Organization (WMO) and/or UNEP.



We live in a society governed in a very sectoral manner and although the ineffectiveness of this sector-by-sector approach has becoming apparent, a truly holistic approach is particularly lacking in the case of the atmosphere and international waters, the global commons. As they are trans-boundary in nature but provide “free” goods and services to the economies of individual countries, nobody really pays the costs of these services or seeks better practices to avoid using them. In the case of international waters, current usage of the natural systems is unsustainable and there is clear evidence for the decline in fisheries, coastal ecosystems, freshwater quantity and quality, and the quantity and quality of water in aquifers.

### **A basis for decision**

Currently, the Global Environment Facility, GEF, is the only globally accessible incremental funding mechanism. Unlike the other GEF project portfolios, the one on international waters does not address a single global convention. As a result, it has often proven difficult to prioritize projects in these areas, particularly given the insufficient understanding of the nature and root causes of environmental problems in this area.

There is no international assessment comparable with those on climate change, biodiversity and stratospheric ozone. This is a serious impediment to the implementation of the international waters component of GEF, and the Global International Waters Assessment is intended as an effective means of developing well-targeted practical proposals for incremental cost funding. GEF has based its decision to fund GIWA on the fact that there is a necessity for a region-by-region assessment of water systems which, taken together, would place these issues within a global context.

Thus, the overall objective of GIWA is to develop a comprehensive strategic assessment that may be used by GEF and its partners to identify priorities for remedial and mitigatory actions in international/transboundary water bodies, designed to achieve significant environmental benefits at national, regional and global levels. The objective is to produce a comprehensive and inte-

grated global assessment of international waters encompassing the ecological status of and causes of environmental problems of transboundary freshwater basins and their associated coastal and ocean systems.

GIWA will address the scientific gap by assessing the key issues and problems facing the aquatic environment. The assessment will focus on the problems of transboundary waters and is designed not merely to analyze the current problems but to develop scenarios of the future conditions of the world's water resources and analyse policy options with a view to providing sound scientific advice to decision makers and managers concerned with water resources. It is to provide the intellectual leadership in dealing with global environmental problems and threats plaguing transboundary water bodies. The assessment will be undertaken from the perspectives of

- water quality and quantity;
- associated biodiversity and habitats;
- their use by society;
- the societal causes of the regionally identified issues and problems; and
- scenarios of future conditions based on projections of demographic, economic and social changes associated with the process of human development.

### **Information for everybody**

Through the work of GIWA, basic and currently unavailable information will be provided and made available to the public, as a means to help foster a greater understanding of the severity of environmental problems in international waters, their societal causes and the options available for solving them. The material generated will be of great potential use to public education programmes, including formal education. Special care will be taken to present the GIWA results in a manner which is readily accessible and understandable to the public in general, as well as through the strictly technical formal reports.

Page 6: Coralreef, Lake Titicaca, Bolivia. Assuan, Egypt.

Page 7: Wadden Sea, North Sea. River Rapa, Sweden. Biebrza marshes, Poland



# The making of the assessment

The **Global International Waters Assessment** should make a major contribution to policies and actions that will lead to protection and more sustainable use of international waters. The products of **GIWA** are expected to represent the most objective comprehensive assessment of transboundary water issues, and their societal root causes, conducted so far.

They include:

- Strategic assessments of ecological status of transboundary waters for the use of the **GEF** and cooperating donors at a programmatic level through the provision of an assessment of ecological priorities at the regional and global scales concerning issues and problems in the focal area of **International Waters**.
- Provision of a framework for **GEF** projects to decide upon appropriate management interventions, including remedial and mitigatory actions in international waters, of value to the **GEF**, regional international organisations, and governments participating in the **GEF**.
- Identification of more sustainable approaches to the use of water and its associated resources, at national, regional and local levels.
- Protocols for the conduct of causal chain and transboundary diagnostic analyses for use in **GEF International Waters Projects** by the implementing agencies.
- A considerable increase in leveraged co-financing as a result of improved focusing and credibility of future interventions and projects.
- A baseline of information at the regional and sub-regional level which will facilitate the regional task of preparing transboundary diagnostic analyses within new projects and improve the capacity to evaluate projects underway or within the existing **GEF** pipeline.

The **Global International Waters Assessment** will require extensive access and processing of data in all 66 subregions simultaneously. However, **GIWA**

River Ganges, India





**Arctic**

- 1. Arctic

**North Atlantic**

- 2. Gulf of Mexico
- 3. Caribbean Sea
- 4. Caribbean Islands
- 5. Southeast Shelf
- 6. Northeast Shelf
- 7. Scotian Shelf
- 8. Gulf of St. Lawrence
- 9. Newfoundland Shelf
- 10. Baffin Bay, Labrador Sea, Canadian Archipelago
- 11. Barents Sea
- 12. Norwegian Sea
- 13. Faroe plateau
- 14. Icelandic Shelf
- 15. East Greenland Shelf
- 16. West Greenland Shelf
- 17. Baltic Sea
- 18. North Sea
- 19. Celtic-Biscay Shelf
- 20. Iberian Coastal
- 21. Mediterranean Sea
- 22. Black Sea
- 23. Caspian Sea
- 24. Aral Sea

**North Pacific**

- 25. Gulf of Alaska
- 26. California Current
- 27. Gulf of California
- 28. East Bering Sea
- 29. West Bering Sea
- 30. Sea of Okhotsk
- 31. Oyashio Current
- 32. Kuroshio Current
- 33. Sea of Japan
- 34. Yellow Sea
- 35. Bohai Sea
- 36. East-China Sea
- 37. Hawaiian Archipelago

**Eastern South America**

- 38. Patagonian Shelf
- 39. Brazil Current
- 40. Northeast Brazil Shelf
- 40a. Brazilian Northeast
- 40b. Amazon

**Sub-Saharan Africa**

- 41. Canary Current
- 42. Gulf of Guinea
- 43. Lake Chad
- 44. Benguela Current
- 45. Agulhas Current
- 46. Somali Coastal Current
- 47. East African Rift Valley Lakes

**Indian Ocean**

- 48. Gulf of Aden
- 49. Red Sea
- 50. Persian Gulf
- 51. Jordan (land-locked river system)
- 52. Arabian Sea
- 53. Bay of Bengal

**Southeast Asia and the South Pacific**

- 54. South China Sea
- 55. Mekong River
- 56. Sulu-Celebes Sea
- 57. Indonesian Seas
- 58. North Australian Shelf
- 59. Coral Sea Basin
- 60. Great Barrier Reef
- 61. Great Australian Bight
- 62. Small Island States
- 63. Tasman Sea

**Southeast Pacific**

- 64. Humboldt Current
- 65. Eastern Equatorial Pacific

**Antarctic**

- 66. Antarctic



Oahu, Hawaii, U.S.

will make full use of existing assessments and all other available information, incorporate the findings of past water-related programmes, and work in close partnership with ongoing programmes to maximize the overall benefit.

GIWA will depend on access to data and other information from a network of stakeholders in the water sphere, but will in turn provide scientific and other information that may be used by other international, regional and global bodies and activities in the field of international waters. GIWA will only gather data required for a step-by-step, iterative analysis of transboundary water-related problems and their causes. Duplication of work must be avoided.

The successful implementation of GIWA will be dependent on the establishment of efficient co-operation with and effective linkages to relevant actors. These include international and national, intergovernmental, governmental and non-governmental organizations within the public and private sectors, as well as in the scientific community. It is anticipated that the four years of work will be divided

into well defined phases with specific products after each phase.

### Network and an assessment protocol

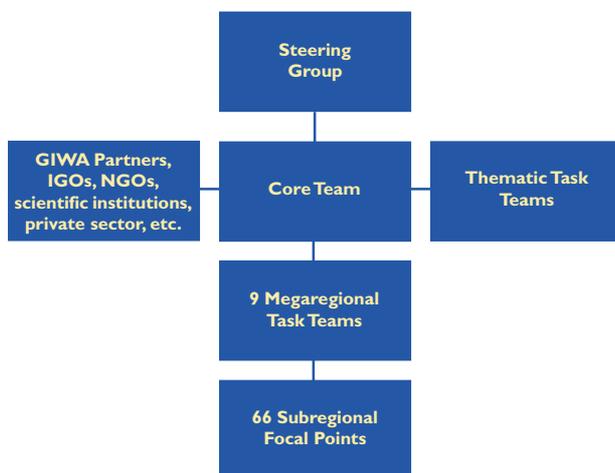
The network established to accomplish the work of GIWA will consist of national experts and institutions, regional and global collaborating bodies organized around the geographic units of assessment and grouped into nine major regions.

Overall co-ordination of the work of the participating individuals and institutions will take place through focal points for each of the subregions who will participate in the work of nine Megaregional Task Teams, supported and assisted by a Core Team of full-time specialists covering both regional and thematic concerns. The Core Team will be advised by and report to a Steering Group of senior scientists and representatives of the major co-sponsoring organizations.

Initially, the primary task of the Core Team will be to establish the major components of the GIWA network for consideration by the Steering Group. The composition of the Megaregional Task Teams, and the links to regional organizations hosting them, will then be decided. In order to provide for an open, democratic and transparent process, the network is intended to be open-ended.

The next step will be to complete a preliminary GIWA Assessment Protocol in close co-operation

### The GIWA Network



## Essential linkages

- The **United Nations Development Programme (UNDP)** and the **World Bank**, with their international waters activities – projects and programmes – will as GEF implementing agencies (like UNEP) be of particular importance in this respect.
- The **UN Commission on Sustainable Development (UNCSD)**, with its mission to co-ordinate the implementation of Agenda 21 (including Chapter 17 on Protection of the Oceans and Chapter 18 on Freshwater Resources) is a major UN body of importance. Other UN agencies with comprehensive international water-related programmes include the **Office of the Law of the Sea Convention (UNCLOS)**; the **Food and Agriculture Organization (FAO)**; the **Educational, Science and Cultural Organisation (UNESCO)**, and particularly its **Intergovernmental Oceanographic Commission (IOC)**; the **International Maritime Organisation (IMO)**; and the **World Meteorological Organisation (WMO)** with its **Global Oceanographic Observation system (GOOS)**.
- The UN inter-agency **Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)** will be another important partner. GESAMP is currently preparing an assessment report, "The State of the Marine Environment: Current Major Issues and Emerging Problems". Preparations are also under way for a global report on the state of the marine environment 2002.
- For the freshwater and groundwater components, GIWA will build on the outcome of the **UN-SEI Freshwater Assessment Project**, "The Freshwater Resources of the World – A Comprehensive Assessment", presented to the UN Secretary General in 1997.
- Within the **UNEP** context, the **Regional Seas Programme** which includes 13 conventions and action plans and involves more than 140 states; the **Global Programme of Action for Protection of the Marine Environment from Land-based Activities**; the programmes for the management of a number of transboundary river or lake basins; as well as a number of conventions for which UNEP provides the secretariat, e.g. the **Biodiversity Convention** with its Jakarta Mandate on Marine Biodiversity, will be of particular relevance to GIWA.
- Non-UN international bodies with programmes of high relevance to GIWA include the **International Council of Scientific Unions (ICSU)** with its **Scientific Committee on Problems of the Environment (SCOPE)**, its **Scientific Committee on Antarctic Research (SCAR)**, and its **International Arctic Science Committee (IASC)**; as well as the **World Conservation Union (IUCN)**; the **International Council for the Exploration of the Seas (ICES)**; and the **North Pacific Science Organization (PICES)**.
- At the regional level, organizations such as the **European Environment Agency (EEA)** and its topical centres for the marine environment and inland waters, the **OSPAR Commission for the Northeast Atlantic**; the **Baltic Marine Environment Protection Commission (HELCOM)**; the **Arctic Monitoring and Assessment Programme (AMAP)**; the **Common Wadden Sea Secretariat**; the **US/Canadian Great Lakes Commission**; and the many regional fisheries management organisations and conventions, will provide linkages of importance to GIWA.
- There are also a number of **transboundary river basin commissions** such as those for Rivers Rhine, Elbe, Danube and Odra in Europe; the Argentinian-Bolivian Commission for the Development of the Upper Bermejo and Grande de Tarija River Basins; and others. The **UN ECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes** provides one strategic example of how regional standards and guidelines for transboundary water management can be developed.
- Major **international programmes** and networks focusing on the sustainable management of freshwater resources include the **World Water Council** and the **Global Water Partnership**.
- A number of major **international and national non-governmental organizations and research institutions** are running programmes and/or information and awareness-raising activities focusing on the coastal, marine and/or freshwater environments. These include the **Advisory Committee on Protection of the Sea (ACOPS)**; the **World Resource Institute (WRI)**; the **Worldwatch Institute**; the **Stockholm Environment Institute (SEI)**; the **Stockholm International Water Institute (SIWI)**; **World Wide Fund for Nature (WWF)**; **Greenpeace**; **Seas at Risk**; **Coastwatch**; etc.
- National agencies, such as **National Oceanic and Atmospheric Administration (NOAA)** and national assistance agencies, e.g., the Swedish International Development Cooperation Agency (**Sida**), and the Finnish Department for International Development Co-operation, as well as national research institutes will also be important GIWA partners.

*W Fayu Island, Federal States of Micronesia*



*For web addresses to these organizations – see the GIWA web site ([www.giwa.net](http://www.giwa.net))*

## Causal chain analyses focusing five problem areas and 23 issues

Causal chain analyses will be one of the important tools used for the Global International Waters Assessment. It will be essential to identify and better understand the causal chains between perceived problems and their societal root causes.

When identifying a water-related problem one must clarify the environmental impact, the socio-economic impact, and the potential transboundary consequences. A causal chain is a series of statements that demonstrate and summarize, in a stepwise manner, the linkages between problems and their underlying (root) causes. It will, thus, include immediate, secondary, tertiary, and quaternary causes, i.e., human activities leading to the creation of the problem. Uncertainties accompanying each linkage should also be clearly stated. The analysis also permits barriers to resolving the problems to be investigated. A causal chain probes the linkages between the problem and its societal causes. In its practical application, it can serve as a model into which regionally relevant information may be inserted. When properly supported with quantitative information, the causal chain can be reversed and used to study the implications of different policy options in the improvement or worsening of environmental problems. Such an analysis may also be used to examine the effects of one policy decision on another, seemingly unrelated issues. The GIWA causal chain analyses will concentrate on five major areas of concern, divided into 23 major issues. (More information about the causal chain analysis methodology, and some concrete examples, can be found on the GIWA web site, [www.giwa.net](http://www.giwa.net)).



### Freshwater shortage

- Reduction in stream flow
- Pollution of existing water supplies
- Lowering of the water table



### Pollution

- Microbiological pollution
- Eutrophication
- Chemical pollution
- Suspended solids
- Solid wastes
- Thermal pollution
- Radionuclides
- Spills

### Habitat and community modification

- Loss of ecosystems or ecotones
- Modification of ecosystems or ecotones including community structure and/or species composition



### Unsustainable exploitation of fisheries and other living resources

- Inappropriate harvesting practices
- Resource/habitat changes
- Habitat destruction
- Decreased viability of stock through contamination and disease
- Man-induced changes in the physical environment
- Biodiversity impacts



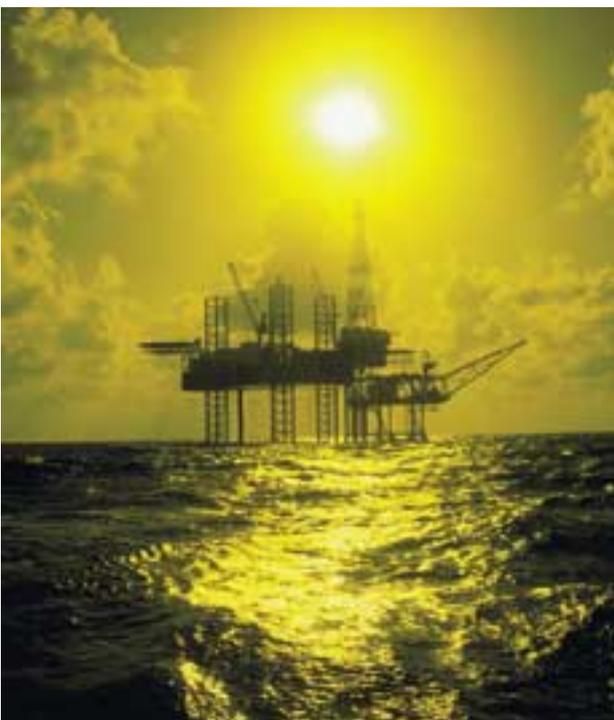
### Global change

- Changes in hydrological cycles
- Sea level change
- Increased UV-B radiation as a result of ozone depletion
- Changes in ocean carbon dioxide source/sink function





Yunnan Province, People's Republic of China



with the Megaregional Task Teams. An approved methodology for conducting causal chain analyses to examine societal root causes of water related environmental problems and guidelines for the conduct of transboundary diagnostic analyses will be designed and offered as a primary GIWA product applicable to GEF International Waters projects. Furthermore, during this phase Thematic Task Teams will be established to identify needs for case studies, particularly in the socio-economic domain.

### **Analyses for subregional application**

National experts and institutions (assisted by the Megaregional Task Teams, the Core Team and the Thematic Task Teams) will gather and analyse the information necessary for applying the GIWA Assessment Protocol at the subregional level. As far as possible, this will lead to the completion of regional assessments based on the products of the subregional assessments. Based on existing information, there will be differences in the approach required in each region.

During this phase, the Thematic Task Teams in collaboration with the Core Team, will also begin the elaboration of a series of global reviews – integrating information from the regional studies and historical information – based on the outcomes of the work of the UN Commission for Sustainable Development.

### **Scenarios and policy options**

At this stage, GIWA will concentrate on scenario development and policy options analyses, and focus upon the evaluation of alternative scenarios. The analyses will incorporate a number of scenarios developed on the basis of projected actions taken to address the identified societal causes of environmental degradation. The initial starting point for these scenarios will be "current trends". In effect, from an economic perspective, these analyses will consider the implications of measures to internalize environmental externalities. Different alternative approaches will be considered in order to reach a given objective. From a social perspective, the analysis will consider the incre-

## GIWA Products

Consistent efforts will be made to communicate effectively both with the global water community and with the public. Throughout the GIWA work period, information and analyses will be produced in a variety of forms, and disseminated widely by various means such as the Internet, CD-ROMs and in print.

GIWA will rely heavily on the use of modern state-of-the-art technologies for continuous dissemination of information about the various activities and for communicating the results. The GIWA web site ([www.giwa.net](http://www.giwa.net)) will possibly be the most important tool in this respect.

Considering the many different target groups and stakeholders concerned, the various and sometimes complex GIWA products need to be tailored to the specific needs of each recipient (the scientific community, policy-makers and decision-makers, the private sector, the public and the media, etc). GIWA products that will be generated during the programme period will include:

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**The Global International Waters Assessment**, a comprehensive and illustrated report comparable to the assessments already made for biodiversity, climate and stratospheric ozone.

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### Products at the scientific-technical level

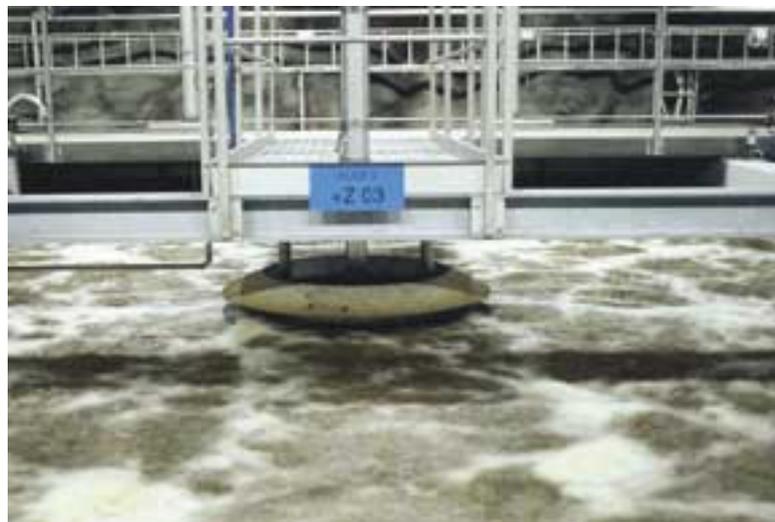
- A comprehensive bibliography and meta-data catalogue of already completed global and regional programmes related to international waters.
- A GIWA Assessment Protocol, including an agreed methodology for conducting causal chain analyses to examine societal causes of water-related environmental problems.
- An agreed methodology for making transboundary diagnostic analyses at regional scales.
- Sixty-six subregional and nine megaregional reviews of the ecological status of transboundary waters and major water-related issues, including analyses of their societal causes.
- Guidelines for the preparation of a causal chain analysis.
- Global thematic reviews.
- Megaregional and subregional scenarios for the future state of international waters based on planning boundaries, trends and rates of change in industrialisation, population growth and development.
- A global analysis of the societal causes of identified major water-related concerns and principal issues; and a global overview of the relative importance of the various major concerns and principal issues by region.
- GIWA reports, databases and information sources available on the Internet and on CD-ROM.

### Products for the educational sector and the public

- Popular information, plain-language technical reports.
- Popular educational and information materials specific to the megaregions and subregions.
- GIWA educational CD-ROM.
- GIWA contribution to the International Waters Distance Learning and Training Project (UNDP/IW-Learn Project) web site.



River Västerdal, Sweden



mental cost of measures to encourage the modification of unsustainable social and economic development trends. The uncertainties in the scenarios must also be identified and clearly stated. The predictive phase of the Global International Waters Assessment will build on the studies and analyses undertaken over the entire GIWA work period.

### Dissemination of the GIWA products

The final phase of GIWA will be dedicated to the preparation and dissemination of the global and

regional GIWA products. Emphasis will be placed on the preparation of reviews that are easily comprehensible to various sectors of society. It is essential that the Global International Waters Assessment does not remain a desk exercise but is made available to the public, to educational institutions and to national and regional authorities. The GIWA meta-database and regional reports will be freely available through electronic communications, on CD-ROM and, where strictly necessary, in hard copy.

## Kalmar University

Kalmar University is the main executing agency of the UNEP-led and GEF-funded Global International Waters Assessment, GIWA. Thus, the university hosts the GIWA Core Team.

Kalmar University is a comparatively small university, but has already full university status in the field of natural sciences. Two of its chairs – in Natural Resources Management, and in Aquatic Ecology – are of particular relevance for GIWA. The same holds true for, *inter alia*, the research and PhD programmes at the Natural Resources Management and Agenda 21 Research School (NRM&A21), and for the strong focus on research in environmental sciences, aquatic ecology, and marine microbiology.

Natural sciences and technology are priority areas which give Kalmar University a unique educational profile compared with the other small universities in Sweden. In addition, the goals set out by UNCED in 1992 inspired Kalmar to the new Agenda 21 research field. Research and education on issues linked to the concept of sustainable development are at the very heart of the activities. The objective of education and research within NRM&A21 is to build interdisciplinary knowledge of and create insight into anthropogenic

impact on environmental systems and natural resources. This includes analyses of measures currently suggested in national and international contexts and settings to mitigate the problems caused. These analyses, which range from the local to the global

level, often start with a natural-science/technological approach, increasingly bringing the societal and cultural dimensions into focus, in particular the aspects of international environmental institutions, environmental communication, and environmental ethics. The cross-disciplinary character of environmental issues places special emphasis on developing doctoral curricula that bridge different sectors of society as well as of the academic structure.

In recent years, Kalmar University has also developed into an important centre for research on the Baltic Sea Region, including issues of environment, maritime affairs, tourism and democracy. The university works in close co-operation with Kalmar municipality, as well as with local and national private enterprises. It also has well developed international networks in academia and institutions.



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**MAP:** Stig Söderlind (p.9).  
**PHOTOS:** **Inside cover, above:** Rice-cultivation in terrasses, Bali, Indonesia: David Austen, FPG/Tiofoto. Irrigation, Rajasthan, India: Ola Jennersten, Naturfotografarna. Ditching, Sweden: Axel Ljungquist, Naturfotografarna. Erosion after clearcutting of rainforest, Madagascar: Minden Pictures, Great Shots. Well in Madhya Pradesh, Kanha. Mukki, India: Ola Jennersten, Naturfotografarna. Dried out Aral Sea, Uzbekistan: Lehtikuva Oy, Pressens Bild. **Mega city Los Angeles, U.S.:** Francois Gohier, Naturbild.  
**Pages 10–16:** Superstock, Great Shots (p.10). Anders Ryman, Naturbild (p.11). Roger Turesson, Pressens Bild (p.12 top). Klas Rune, Naturfotografarna (p.12 bottom). Greenpeace (p.13 top). Stefan Rosengren, Naturbild (p.13 centre). Thayer Syme, FPG/Tiofoto (p.13 bottom). Superstock, Great Shots (p.14 top). Jens Rydell, Naturbild (p.14 centre). Mark Green, FPG/Tiofoto (p.14 bottom). Red Image, Great Shots (p.15 top). P Roland Johanson, Naturfotografarna (p.15 centre). Thomas Henrikson, Orange (p.15 bottom).  
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