



Abstract Compendium

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About this Compendium

This document contains the 73 abstract proposals submitted in the leadup to the GEF International Waters Conference, taking place from 24 to 26 September in Bangkok, Thailand. Abstracts were collected here, as well as developed into poster presentations, as well as in some cases, invited for interventions in parts of the conference. Portfolio synthesis speakers as well as external discussants also prepared abstracts. Some abstracts may eventually be channeled into peer-reviewed articles.

Table of Contents

About this Compendium	1
Abstract Submissions from GEF IW Projects.....	5
The Major Roles of Stakeholders for Good Management of Volta Basin - Togo.....	5
Hydrogeologic Characterization and Assessment of Aquifers and Groundwater-Surface Water Interactions Using Isotopes	7
Environmental Education and Collaboration between the US and Mexico in the Gulf of Mexico Large Marine Ecosystem.....	8
Harmful algal blooms and eutrophication in the Gulf of Mexico Large Marine Ecosystem	9
Harmful Algal Blooms Integrated Observing System in the Gulf of Mexico Large Marine Ecosystem: creating MEX US synergies for one regional plan of action.....	10
Hypoxic areas in Southern Gulf of Mexico Large Marine Ecosystem off the Grijalva-Usumacinta Watershed.....	11
The Gulf of Mexico Large Marine Ecosystem: Urbanization, Economic Exploitation and Deterioration of the Great Ecosystem.....	12
Enhancing the Use of Science in Managing and Addressing Complex Issues in International Rivers	13
ORASECOM Survey of Persistent Organic Pollutants in the Orange/Senqu River Basin; Identifying issues and areas of concern in an international river basin	15
Improving the Use of Science to Attain the Vision for Large Marine Ecosystems and Open Oceans	16
Agricultural Pesticide Residues in Caribbean Coastal Waters - Lessons for Policy Makers.....	17
Strategies and Solutions for improved water resources management in the Caribbean. Experiences from the GEF-funded Integrating Watershed and Coastal Areas Management (GEF-IWCAM) Project.	18
Recovery of the living marine resources of the Gulf of Mexico Large Marine Ecosystem; Manatee distribution in Southern areas of the Gulf	19
Challenges of an integrated management of the Transboundary Water Resources in the Amazon River Basin.....	20
Gulf of Mexico Large Marine Ecosystem: Environmental monitoring of two pilot sites and forward steps	21

Framework Program for the sustainable management of the la Plata Basin water resources with respect to the effects of variability and climate change	22
Monitoring and Environmental Evaluation in the Gulf of Mexico Large Marine Ecosystem	23
Spiny lobsters and shrimps of the South West Indian Ocean: sharing networks, surveys at sea and strategies for stock management	24
Demonstrating the adoption and linkages of Best Available Practices and Technology (BAP/T) in Ecotourism, Environmental Management System and Reef and Marine Recreation Management in Kenya, Mozambique and Tanzania	25
Building Resilience: developing adaptive dialogue between policy makers and scientists	26
Enhancing natural habitat conservation in the coastal and marine areas of the Gulf of Mexico LME: Creation of an International Marine Protected Areas Network	27
Management of transboundary basins in West Africa, what lessons?	28
Lessons learned from Guarani Aquifer System Project to replicate in the Framework Program of La Plata Basin.....	29
Promoting the ecosystem approach to fisheries management in Large Marine Ecosystem programmes in Africa: Progress Made and Lessons Learnt	30
TOWARD A GLOBAL LARGE MARINE ECOSYSTEM SUSTAINABILITY-SCIENCE LEARNING AND KNOWLEDGE NETWORK: DEFINING NEW PARTNERSHIPS, CREATING NEW OPPORTUNITIES.....	31
Research for governance reforms in International Waters systems	32
Applying Environmental Flows through BioMonitoring and Rapid Ecological Assessment.....	33
Analysis of the Invasive Species in the Gulf of Mexico Large Marine Ecosystem.....	34
A global analysis of lakes science and transboundary management	35
Water pollution data in Amazon basin	36
GEF Oceanic Fisheries Management (supporting the conservation of the warm-pool of the western Pacific Ocean and its tuna fisheries)	37
Open Ocean Science in the GEF	38
Gulf of Mexico Large Marine Ecosystem Binational Coastal Community Resilience and Climate Change Mitigation and Adaptation Measures.....	40
Sustainable fish stocks and shared responsibilities for an ecosystem approach in the South West Indian Ocean: SWIOFP unites nine countries	41
Genetic Population Structure of Some Small Pelagic Fishes in the Sulu-Sulawesi Marine Ecoregion (SSME)	42
Phytoplankton Blooms in the Western Gulf of Mexico Large Marine Ecosystem: New Initiatives using Remote Sensing and Marine Optics.....	43

Climate Change Effects in the Yellow Sea Large Marine Ecosystem and Adaptive Actions in Ecosystem Based Management	44
Yrenda – Toba – Tarijeño Transboundary Aquifer System, South America: groundwater – surface water interaction	45
Transboundary aquifer resources management: how can science be of help?	46
Transboundary Diagnostic Analysis of the Arafura and Timor Seas	47
From Science to Governance in the BCLME: Twenty years of governance capacity and institution building through science.....	48
HAI RIVER BASIN IWEM PROJECT: DESIGN, PRELIMINARY ACHIEVEMENTS AND PERSPECTIVE	49
Mangrove Ecological Restoration Strategy in the Gulf of Mexico Large Marine Ecosystem; and Participatory Community Approach	50
Introduction to Science Policy Interface and Recommended GEF Processes	51
Abstracts from outside the GEF IW Portfolio of Projects	52
Constructing a multistakeholder platform to control non-point pollution at Lake Chapala basin, Mexico.....	52
The impact of climate change in the Nile basin.....	53
IMPLEMENTATION PROGRESS OF SUSTAINABLE DEVELOPMENT IN VIETNAM SEAS	54
Preliminary Results of the Groundwater Investigation of the Cuvelai-Etosha Basin and Moving towards Transboundary Cooperation and Management	56
CHALLENGES FACING TRANSBOUNDARY AQUIFER MANAGEMENT IN KENYA	57
Transboundary aquifers management: how can science help?	58
Inventory and Mapping of Asian Transboundary Aquifers.....	59
Land Acquisitions: How will they impact transboundary waters?.....	60
Capacity Development for Sustainable Water Management in Rural Area in Cambodia	62
Predicting and Solving the Dangers of Flood in Urban Basins Caused by Torrential Rainfalls: Based on Case Studies of Ansan Stream and Hwajeong Stream	63
Using Social Marketing to Put People at the Heart of Science	64
Groundwater Challenges for Rural Water Supply.....	65
Adaptive Management as a Driver for Change in Central Asia.....	66
The UK Natural Hazards Partnership	67
Alleviation of Potable Water Crisis in Climate Vulnerable areas by Creating Artificial Aquifer using Rain Water Harvesting	68
MINING REHABILITATION IN RTNMC, BATARAZA, PALAWAN, PHILIPPINES: AN INTEGRATED STRATEGY FOR TERRESTRIAL AND COASTAL ECOSYSTEMS RESTORATION	69

Development of WORLDLAKE – global database for wide limnological studies	70
Greywater Management in Egypt.....	71
COMBINED NETWORK SIMULATION-OPTIMIZATION AND MULTI-CRITERIA ANALYSIS IN EVALUATION OF WATER ALLOCATION SCENARIOS	72
Numerical experiments to determine design factor for groundwater dam.....	73
Capacity Development of Rural Water Supply and Sanitation	74
Mollusks Resources in Western Coast of the Tonkin Gulf	75
Is There a Groundwater Pathway Driving the High Productivity of Tonle Sap Lake, Cambodia?.....	76

Abstract Submissions from GEF IW Projects

The Major Roles of Stakeholders for Good Management of Volta Basin - Togo

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Keywords: POPULATIONS, PROBLEMS IDENTIFIED IN THE BASIN, STRATEGY, NATIONAL AND REGIONAL PLAN OF ACTION, TRANSPARENCY OF THE MANAGEMENT OF THE FUNDS, GOVERNANCE, MORE FINANCIAL RESOURCES, PARTICIPATION OF THE STAKEHOLDERS

Abstract Text:

The environmental problems on a worldwide scale forecast conventions and many international conferences in particular the international conference of water in Malta Plata of 1977. The favorable conditions on the initiative creating an Organization of basin and in particular of the Volta Basin and the creation of the Volta Basin Authority (VBA) goes back to international conferences on water and the environment and the development of Rio, 1992. With this conference, it reached a world consensus on a new fashion from action for a better water resources management of the planet. All the countries were appropriate of a joint action based on the guiding principles of water management in accordance with action 21, relating to the protection of the resources and their quality.

Each country had to prepare a national action plan in the sector of water. West Africa by the Ecowas prepared and adopted a Regional Plan Action for the Integrated of Water Resources Management (PAR/GIRE/AO) on 1998 in Ouagadougou, Burkina Faso. The implementation of the program was recommended to all the States of the Community and Burkina Faso was co-opted like pilot country to implement the regional plan. The phenomenon of the development of the national action plans for the integrated water resources management was the leitmotiv in the sector of the water of the States and the basins. The convincing case is that of the Project Transboundary Diagnostic Analysis (TDA) of Volta Basin for an integrated management.

The dependant challenges of the natural resources management of the Volta Basin led the States sharing this basin to a common and concerted management. The drought of the years 1997-1998 caused the hunger and the destruction of the livestock, the decreasing of the agricultural production as well as the water shortage in the six bordering countries of the basin and the loss of the purchasing power of the population, increase in the price of agricultural produce and unballastings.

The strong degradation of these natural resources in particular the water, the lands, the forests, the fauna and the flora which had an environmental impact involved a strong fall of the water level in the Lake Akosombo, hydroelectric energy source provided to four countries. This repeated fall put at severely tested the economies of the six countries and their development for the period of the unballastings caused by a rainfall. The national representation of the Central Bank of West Africa (BCEAO) estimated the shortfall in receipts for six months to more 4 billion FCFA (for Togo Rapport national, Bassin of Volta, 2002) at the end of the unballastings.

Six States under the initiative of the Ghanaian Government and with the financial support of the Program of the United Nations for the Environment (UNEP) and the Global Environment Fund (GEF) proposed on 1999, in Accra, from 20th to September 24th, 1999, a regional workshop during which the six States

adopted the “Declaration of the Volta Basin where they were committed combining their efforts for an integrated management of the water resources of surface and underground of the basin. The major problems identified are: land degradation, water scarcity, water quality degradation, loss of biodiversity, weeds proliferation, water–borne diseases, floodings, and erosion.

The project which must make it possible to build strong foundations for a sustainable management of the natural resources of the Basin of long-term Volta, combines three objectives:

- to develop the capacities and to create a regional institutional framework of icit (1997-1998). The representation
- to develop the capacities and to create a regional institutional framework of effective management of the Basin of Volta;
- to develop a framework political, legal and lawful regional to deal with the Transboundary problems in the Basin and its coastal areas;
- to initiate national measures and regional to fight Transboundary environmental degradations in the Basin, 2000-2003 and the international opinion.

The idea of the creation of an organization of basin also arises from the project of the integrated management of the Volta basin. The convention of Volta River and creation of the Volta Basin Authority (VBA) is signed by the Heads States of the six riparian countries in Ouagadougou, on 19 January 2007, veritable instrument of the cooperation and development for the countries.

Hydrogeologic Characterization and Assessment of Aquifers and Groundwater-Surface Water Interactions Using Isotopes

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Keywords: Groundwater; Nubian; Nile; Guarani; Isotope

Abstract Text:

A lack of adequate scientific information and knowledge of water resources has been recognized since the 1977 United Nations Water Conference in Mar del Plata, but significant gaps continue to exist in resource assessments. The problem is particularly acute with respect to groundwater resources even though more than half of freshwater used worldwide is derived from groundwater. Fundamental aspects of aquifer hydrogeology, including recharge, groundwater-surface water interactions, and the extent and distribution of fossil groundwater remain poorly characterized.

Aquifer assessments at regional or national scales can be conducted more effectively and rapidly by using groundwater isotope signatures and ages. Groundwater age can also be used to develop important information for regional aquifer systems via a parsimonious approach to groundwater modeling where overly-complex representations of aquifer hydrogeology are actively avoided in constructing groundwater models. Simple effective modeling is essential for evaluation of aquifers that lack informative hydrogeologic databases, and interpreted ages are among the more-effective information sources for modeling such systems. Even in large aquifers that lack even minimum hydrogeological data, groundwater ages can be interpreted from isotope samples at a few downstream locations, providing hydrogeologic information from the entire upstream flow path. This methodology has been used to develop a model of the Nubian aquifer system that has been accepted by all four countries sharing the aquifer. In addition, a hydrological model of the Nile basin has been developed that allows the use of isotopes to facilitate water balance estimation and river runoff modeling on a monthly time scale. These and IAEA efforts towards a wider use of isotopes for water resource assessment will be discussed in my presentation.

Environmental Education and Collaboration between the US and Mexico in the Gulf of Mexico Large Marine Ecosystem

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Keywords: environmental education, educators alliance, public participation

Abstract Text:

The Gulf of Mexico Large Marine Ecosystem (GOM-LME) is facing regional environmental problems such as pollution, loss of habitat and biodiversity, stress condition that must be addressed collectively. The GOM-LME project has promoted the formation of a long lasting Bi-national Environmental Educators Alliance (EEA), with solid foundations to protect the Gulf marine resources. The objective of this Alliance is to strengthen environmental awareness and develop coordinated actions across sectors, through research social participation, training, education and communication to develop and sustainable management of natural resources in the Gulf of Mexico.

Recently, the alliance established its mission, vision and strategy in order to effectively address the priorities of the Gulf in both countries. Among main activities are: i) to generate knowledge and build capacity for a sustainable management of natural resources in the Gulf of Mexico; ii) train and professionalize promoters and environmental educators for sustainability, iii) foster environmental education contents to include them as part of institutional programs at different educational levels in the GoM states; iv) promote legal mechanisms to incorporate environmental education with more presence in programs for education in each GoM state; v) Disseminate and Communicate knowledge, experiences and best practices related to the management of marine and coastal ecosystems in the GoM; vi) strengthen identity, social values, and cultural exchange in the GoM region; vii) Fundraising efforts to strengthen environmental education; viii) integrate information about current initiatives, regarding environmental education; ix) link environmental training programs to sustainable productive processes and its respective project.

The GOM-LME facilitated the construction of an on-line course "Wetlands Sustainable Conservation and Exploitation" in partnership with Mexico's Center for Education on Sustainable Development (CECADESU). The Alliance is committed to continue organizing environmental educational activities and strengthen collaboration with the institutions and organizations of the GOM Coastal States. The GOM-LME Project is organizing the third workshop as a follow-up and to reinforce the Alliance's work.

Harmful algal blooms and eutrophication in the Gulf of Mexico Large Marine Ecosystem

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Keywords: harmful algal blooms, eutrophication, pollution

Abstract Text:

HABs events occur more frequently as a consequence of growing development in coastal areas. This widespread expansion of Harmful Algal Blooms (HABs) throughout the US and Mexican coastal waters has led to increasing intervention from government agencies responsible for protecting public health and providing timely, accurate information to citizens, policymakers and businesses dependent on the health of coastal waters. HABs in the Gulf of Mexico Large Marine Ecosystem (GOM-LME) are one of the majors concerns due to the impacts to the economy of many coastal zones. There is a strong gap between the US and Mexico information systems for HABs. This is mainly due to a limited coordination among institutions. The GOM-LME promotes coordination of coastal Mexican states to standardize monitoring and reporting and this is concentrated in a unique database of information, encouraging bilateral cooperation to strengthen the knowledge of the phenomenon at the regional level. The Mexican Ministry of Health through its Federal Commission for Sanitary Risks (COFEPRIS) launched since 1984 the Bivalve Mollusks Sanitary Program, to monitor toxin levels in during red tide events, mainly using the mouse bioassay method and taking adequate procedures to avoid human poisonings. The coastal States owned Laboratories are also in charge of providing field sample analysis and information for decision making regarding HABs ecology and toxicity to coastal managers. The GOM-LME is currently supporting enhancement of technical capabilities for Gulf wide HAB monitoring networks aimed to HABs detection and tracking. Furthermore, support for development and evaluation of methods and techniques for the prevention, control, and mitigation of HABs and their impacts has been provided. The GOM-LME promotes coordination between and among the State Commissions of Health Risk from Gulf Coast states, with an increased participation of the State Laboratories for Public Health.

Harmful Algal Blooms Integrated Observing System in the Gulf of Mexico Large Marine Ecosystem: creating MEX US synergies for one regional plan of action

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Keywords: harmful algal blooms, ocean observing system, water quality, implementation plan

Abstract Text:

The Harmful Algal Bloom Integrated Observing System (HABIOS) for the Gulf of Mexico is being built to provide observations of the potential harmful or toxic algae bloom that can potentially contaminate seafood and threaten public safety in the Gulf of Mexico. HABIOS has started preparing its implementation plan focused on what resource and public health managers need to better protect the public, living marine resources, and the ecosystem. Supporting beachgoers, fishermen, and boaters. HABIOS has three phases: i) HABIOS-NOW, based on existent knowledge, tools, methodologies, and models; ii) HABIOS-NEXT, based on current, on-going, soon-to-be-completed research and technology development; and iii) HABIOS-FUTURE, based on knowledge and technology still to be defined, developed, and deployed. HABIOS initial integration can be accomplished in the near-term. The addition and enhancement of observing assets, products, tools, and forecast capabilities can be achieved over a number of years as the system is built-out, but new funding will be needed for these improvements. Protecting human health and the socioeconomic well being of coastal communities are the primary drivers for the need for HABIOS. The primary threats to human health are through the consumption of contaminated fish and shellfish or, in the case of *Karenia brevis* blooms, the inhalation of toxic aerosols. The HABIOS plan will include elements necessary to monitor and protect the health of animals and ecosystems as well as humans. The primary stakeholders that could potentially benefit from a fully functioning HABIOS, therefore, are beachgoers and associated tourism activities, shellfish industry, fisherman (both commercial and recreational), and recreational boaters.

Hypoxic areas in Southern Gulf of Mexico Large Marine Ecosystem off the Grijalva-Usumacinta Watershed

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Keywords: Hypoxia, harmful algal blooms, nutrients, Mississippi River, Grijalva-Usumacinta Watershed

Abstract Text:

Hypoxia was first documented in the northern Gulf of Mexico Large Marine Ecosystem (GOM-LME) off the Louisiana coast in 1972. The zone off the Mississippi River is the largest hypoxic zone currently affecting the United States, and the second largest human-caused coastal hypoxic zone worldwide. The Mississippi River system is the dominant source of fresh water and nutrients to the northern Gulf, nitrogen and phosphorus concentrations and loading have increased in the Lower Mississippi River, attributed to the increased use of nitrogen and phosphorus fertilizers, nitrogen fixation by leguminous crops, and atmospheric deposition of oxidized nitrogen from the combustion of fossil fuels. Many of these nutrients enter the river from non-point sources, which are much more difficult and complex to control and monitor than point sources of pollution.

In the southern Gulf, off the Grijalva-Usumacinta watershed the GOM-LME suffers from accelerated environmental degradation, further exacerbated by the hypoxia phenomenon and recurrent harmful algal blooms (HABs). The economic effects of these events on natural resources such as wetlands, coastal zones and marine species in general are not reliably known. It is obvious that suitable habitat is reduced for living marine resources, and potential fisheries production is diminished. Human health and the economies of commercial and sport fishing, tourism, and coastal communities potentially are affected negatively. Preliminary data indicate a growing problem, and there is no systematic information on status or plans to assess the effects of management actions. The inadequate or limited treatment of municipal waters, poor agricultural and livestock practices, unplanned urban growth, and tourism are the main causes of hypoxia. Coincident with the increasing frequency of hypoxia is a growing problem of harmful algal blooms in both the northern and southern Gulf of Mexico LME. The current knowledge on coastal hypoxia in Southern Gulf in Mexican waters should be examined and plans to establish monitoring, prevention and remediation are under development.

The Gulf of Mexico Large Marine Ecosystem: Urbanization, Economic Exploitation and Deterioration of the Great Ecosystem

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Keywords: Economic development, population growth, deterioration of ecosystems

Abstract Text:

The Gulf of Mexico Large Marine Ecosystem (GOM-LME) has experienced a profound reorganization of its economic system and population distribution in the territory in the last third of the XX century. This is a new productive order and a new urban organization. The most important economic activities in the region which are: petroleum and industry, tourism and commerce, fisheries and port development, stock and commercial agriculture; have increased the demographic pressure and has generated a change in the landscape, such as: i) Loss of the vegetative cover (forests, mangroves, jungles, wetlands, dunes); ii) Reduction of fisheries and iii) Water bodies contamination amongst others. The population was duplicated and the pressure on resources was incremented in the last 35 years, going from 7,138,668 to 15,833,408 habitants in the Gulf of Mexico only on the Mexican side.

This has to do with the most urbanized areas being the beneficiaries of the globalization in international tourism (Peninsula) and Industrial Development (Northern frontier). In the United States, as in most countries, the number one factor that resource managers will have to deal with is population growth and the associated pressure on resources. The change in population for the U.S. between 1960 and 2008 was 69.6%. 32 of the 56 counties along the Gulf coast have had greater growth rate than the country as a whole. Population projections for the coastal counties don't show this trend reversing. An additional 2.2 million people will be living in the coastal counties of the Gulf by the year 2025, according to the states' projections. This pattern of concentration and dispersion polarization of human settlements will produce new environmental vulnerable situations incrementing the risks associated with climate change, which will be one of the biggest problems to confront in the future. Environmental politics will not be able to dissociate from the economic and energetic politics to improve their capacity to comply with the objective of taking care of the natural patrimony. The challenges that the GOM-LME is facing are multiple and complex, but the protection of the regional environmental values will demand a crescent participation and compromise of local societies to generate a better quality of life and make a possible transition towards a sustainable economy.

Enhancing the Use of Science in Managing and Addressing Complex Issues in International Rivers

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Keywords

Transboundary rivers, social and ecological systems, emerging science issues, engagement of scientific communities, communicating science

Abstract Text:

Understanding the underpinning science behind problems and issues in international rivers is essential in developing and implementing appropriate measures. In an effort to enhance the use of science in International Waters projects of the GEF, the IW: Science project was aimed at assessing how science was and can be used in IW projects to improve results in future GEF projects. The Rivers Working Group reviewed 38 projects implemented in different parts of the globe. Projects reviewed dealt mostly with several other ecosystems (such as lakes, aquifers, coastal areas), with only a few focusing on river basins alone. One of the main challenges in the review was that project documents seemed not designed to highlight the type and use of science in the projects. Nevertheless, substantial information was extracted from the project documents and recommendations were made.

Results of the review indicate that science played an important role in IW projects, mainly as the foundation or basis of project designs and implementation activities. While the use of science helped in achieving project outcomes, several gaps were also identified that need to be considered in future projects. Substantial efforts were observed to cover the coupling of social and ecological systems in addressing river basin issues. However, addressing complex transboundary river issues is even made difficult by the regional and global drivers (climate change, land use change, population and economic growth, varying economic conditions and political systems, trade and globalization, etc.). Local and international scientific entities were engaged in various ways, yet social and policy scientists seemed underrepresented, not to mention the local communities and universities. The preparation of stakeholder involvement plan and appropriating corresponding budget seem promising to address this. The importance of the dissemination of project results is manifested in the use of data and information in other GEF projects and even in national programs. This also indicates the significance of generating and wide dissemination of robust scientific information, along with project ownership and implementation of pilot projects, to influence policy formulation.

In view of the above, it is imperative that in order to enhance the use of science in future projects, GEF needs to develop a mechanism to capture science in all its projects from the beginning to implementation, explicitly include such information in the project deliverables, and widely disseminate these documents to the stakeholders. There is an increasing need of social science integration with

natural sciences. Apart from recommendations by the Rivers Working Group, this presentation also includes additional recommendations on addressing emerging issues on rivers including innovative solutions in view of the current science and understanding.

ORASECOM Survey of Persistent Organic Pollutants in the Orange/Senqu River Basin; Identifying issues and areas of concern in an international river basin

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Keywords: POPs, Southern Africa, ORASECOM

Abstract Text:

Lesotho, South Africa, Botswana, and Namibia share the international catchment of the Orange-Senqu River Basin and are Parties to the Stockholm Convention on Persistent Organic Pollutants (SC-POPs). Currently, the SC targets 21 chemicals and classes of chemicals. We undertook a survey and assessment of POPs and PAHs (polycyclic aromatic hydrocarbons). ORASECOM manages the basin. Sediment was collected at 61 sites in September 2010. Fish and wild bird eggs were collected at four sites each. In general, the levels of all compounds except PAHs were fairly low, but with indications that both industrial activities and combustion processes contribute. The high levels of benzo(a)pyrene was deemed to pose high cancer risks at some sites. The sources of the PAHs at all these sites were pyrogenic in nature, but the exact type of activity needs on-site investigations. Dioxin TEQ (Toxic Equivalence Quotient) and indicator PCBs (polychlorinatedbiphenyls) were associated with industrial activities in Gauteng and possibly mining or residential combustion in the North-West Province. The relatively high TEQ in and close to Lesotho cannot be explained. The generally low level of organochlorine pesticides (OCPs) in sediment is a positive finding. However, detectable levels of OCPs found at Blesbokspruit, Suikerbosrand, Potchefstroom, and Klerksdorp need careful monitoring. Levels of organic compounds do not reflect the levels in sediments. The pollution patterns do not quite agree with what was seen in sediment. The levels of PFOS are quite high compared to European levels. The high levels of PFOS in fish at Boegoeberg and Rooipoort, and in bird eggs from Bloemhofdam and Barberspan, suggest sources other than urban. It might be linked to unknown releases from agriculture or unknown uses in mining in the drier, central parts of the catchment. PFOS sources and environmental distribution needs more scrutiny. This project shows the potential of a general survey to identify issues and areas of concern when dealing with International catchment management.

Improving the Use of Science to Attain the Vision for Large Marine Ecosystems and Open Oceans

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Keywords: Large Marine Ecosystems, Land-based Pollution Sources, use of science, adaptive management

Abstract Text:

The Global Environment Facility has supported management of Large Marine Ecosystems (LMEs) to address the stressors that originate from the coasts, where human settlements and economic activities are concentrated, and from commercial activities in offshore waters and open oceans where economic activities are increasing. The Land-based Pollution Sources Science and Transboundary Management Working Group and the Large Marine Ecosystems and Open Oceans Working Group have found that secondary scientific data and information were generally used in preparing the Transboundary Diagnostic Analysis but targeted research for management is few. The emerging issues of climate change, atmospheric changes, and acidification, insufficient recognition of transboundary stocks, persistence of microplastics and lifestyle compounds in marine waters, the interaction of multi-stressors, the tipping-points, and the resiliency of ecosystems were not yet studied in depth. Scientific findings from applied research and resulting from projects as well as formulation and implementation of the Strategic Action Program, were not well-documented and disseminated. Monitoring of stress reduction and outcome/impact indicators were not conducted systematically by the relevant agencies. Some of the practices that were identified, that can enhance the use science for LME management, are: 1. establishing a scientific advisory group; 2. establishing integrated information management system; 4. conducting regional scientific conferences; 4. conducting dialogues between scientists and policy-makers. The challenge to achieve short-term and long-term objectives and to attain the ultimate goal of the improvement of LMEs is the execution of regulatory actions at the scale of the coasts and hotspots and the scaling-up of the outcomes to the (regional) LME-level. The incorporation of behavioral science with natural and social sciences in formulating and implementing management and monitoring plans is one innovation to explore, especially at local scales. The linkage of two concepts in financing for environmental work and community development, i.e., payment for ecosystem services and corporate social responsibility, can be explored (for local to regional scale) and advanced to co-finance, with governmental agencies and regional institutions, the needed monitoring of stress and impact indicators, support for applied and targeted research and multi-causality of environmental problems, and the dissemination of scientific results in regional conferences.

Agricultural Pesticide Residues in Caribbean Coastal Waters - Lessons for Policy Makers

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Keywords: Caribbean, LBS Protocol, Pesticides, UNEP

Abstract Text:

The Global Environment Facility-funded Reducing Pesticide Run-Off to the Caribbean Sea (GEF-REPCar) Project was implemented between 2007 and 2011 in Colombia, Costa Rica and Nicaragua. The project was implemented by UNEP and executed by UNEP's Caribbean Regional Coordinating Unit. The GEF contribution to the project was approximately US\$4.3 million with co-financing from governments and the private sector totaling an additional US\$11.1 million. The project successfully implemented national coastal pesticide monitoring programmes in each of the three countries with the summary of results published as a regional report supported by a geo-referenced regional data repository. Project activities were carried out within the framework of the Land-Based Sources of Marine Pollution Protocol of the Cartagena Convention which identifies agricultural non-point sources of marine pollution as the major non-point source of marine pollution in the region. The GEF REPCar project strengthened environmental laboratory diagnostic capacities and accreditation in terms of training and education, equipment, determination of new contaminants, analysis of new environmental matrices and the implementation of analytical quality assurance and control measures. The paper presents a summary of the monitoring results which includes a pesticide pollution baseline in some of the most important rivers, coastal lagoons and marine areas in the south western Caribbean Sea. It concludes that overall pesticide levels in coastal areas in the Western Caribbean are low and do not pose an immediate environmental threat with only 1.9% and 3.8% of the residue determinations having a quantifiable signal in water and sediment respectively. The paper concludes by recommending the need for expansion of monitoring to include other pesticides, areas and countries in the Wider Caribbean Region and the need to develop interpretation guides for pesticide residue concentration in freshwater, sea water and sediments typical of the region. It emphasizes the importance of having national data on the types and quantities of pesticides used on each crop and it reiterates the importance of strengthening links between the private sector, environmental research institutes, growers, distributors, pesticide users and governments to further develop strategies and implement actions for the reduction of pesticide runoff to the Caribbean Sea.

Strategies and Solutions for improved water resources management in the Caribbean. Experiences from the GEF-funded Integrating Watershed and Coastal Areas Management (GEF-IWCAM) Project

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GEF IW Project Affiliation: Caribbean Coastal Management IWCAM

Keywords: Caribbean, GEF IWCAM, Watersheds, Coasts, SIDS

Abstract Text:

The Global Environment Facility-funded Integrating Watershed and Coastal Areas Management (GEF-IWCAM) Project was a major ground-breaking initiative within the Caribbean region that was implemented between 2006 and 2011 in the Bahamas, Cuba, Jamaica, the Dominica Republic, Haiti, Antigua and Barbuda, Saint Kitts and Nevis, Dominica, Saint Lucia, Saint Vincent and the Grenadines, Barbados, Grenada and Trinidad and Tobago. The project was implemented by UNEP and UNDP and executed by the Caribbean Environmental Health Institute and UNEP's Caribbean Regional Coordinating Unit. The GEF contribution to the project was approximately US\$14 million and was supported by co-financing contributed by governments and other parallel projects and programmes. The project successfully implemented national on-ground interventions in most of the participating countries aimed at the improvement of coastal and fresh water resources management, with particular emphasis on reducing the influx of land-based sources of pollution to the receiving waters of the Caribbean Sea within the framework of the Land-Based Sources of Marine Pollution Protocol of the Cartagena Convention. These national demonstration initiatives focused on demonstrating best practices that ranged from municipal waste water, industrial and farm effluent management, to community-based solid waste management, to land and coastal ecosystem rehabilitation and sustainable farming practices. The project built significant capacity from community up to professional levels in policy, legal and technical aspects of water resources management, and strengthened environmental laboratory diagnostic capacities in labs across the Caribbean. The project amassed a comprehensive suite of knowledge products that will not only serve the Caribbean but will be of value to SIDS regions at the global level. This paper discusses the important lessons learnt from the project and will preview a major successor initiative also to be funded by the GEF, titled the Integrating Water, Land and Ecosystems Management Project in Caribbean Small Island Developing States. Upcoming regional initiatives on water, land and coastal/marine protected areas management supported by the German Government and other contributors that will advance solutions based on the work of the GEF-IWCAM Project, will also be highlighted.

Recovery of the living marine resources of the Gulf of Mexico Large Marine Ecosystem; Manatee distribution in Southern areas of the Gulf

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: Living marine resources, large marine ecosystem, manatee, genetic populations

Abstract Text:

The Antillean manatee, *Trichechus manatus manatus*, is one of the priority living marine resources of the Gulf of Mexico (GOM-LME) and the Caribbean. In Mexico their distribution is wide, fragmented and associated to the rivers, bays and lagoon systems covering from Veracruz State in the Gulf to Quintana Roo State in the Mexican Caribbean. In these sense, the conservation of wetlands is critical to the survival of the manatee which is a key species in the nutrient cycling of mangrove ecosystem. Historically, manatees were abundant in Mexico, but today their population has been significantly reduced due to hunting since the pre-Colombian period. The population is estimated to be 1000-2500 manatees, which about 500-1500 occur in the Gulf and 250 in the Mexican Caribbean. The genetic structure, using microsatellites, shows the presence of two populations: the GOM-LME and the Caribbean coast, with a zone of admixture in between. Both populations show low genetic diversity (GOM-LME: $NA = 2.69$; $HE = 0.41$ and Caribbean: $NA = 3.0$; $HE = 0.46$) and the evidence indicates that the genetic flow is from the GOM-LME to the Caribbean. To address management issues, two distinct genetic populations, one along the Caribbean coast and one in the riverine systems connected to the Gulf must be considered. Mexico has established several academic research groups that in close collaboration with the government have drawn up an action program for manatee conservation in Mexico. The program includes management actions, generation of scientific and technical information, environmental education activities and the community involvement in conservation of this species that is in danger of extinction.

Challenges of an integrated management of the Transboundary Water Resources in the Amazon River Basin

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GEF IW Project Affiliation: Amazon River

Keywords: IWRM, Amazon Basin

Abstract Text:

In recognition of the hydrographical unity of the Amazon Basin and in order to address the need for coordinated action, the Basin countries (Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname, and Venezuela) members of the Amazon Cooperation Treaty Organization (ACTO) decided to submit and execute the GEF project "Integrated and Sustainable Management of Transboundary Water Resources in the Amazon River Basin Considering Climate Variability and Change" (ACTO/GEF/UNEP).

The project seeks to strengthen the institutional framework to effectively initiate integrated water resources management issues within the world's largest hydrographic basin, through planning and executing coordinated activities for the protection and sustainable management of the land and water resources of the Amazon River Basin, in the context of climate variability and change. The project will employ an innovative participatory mechanism as the basis for understanding current and expected IWRM challenges and issues. Such an understanding is the foundation upon which a sustainable and responsive Strategic Action Program (SAP), comprising program of capacity building, institutional strengthening, application of feasible economic instruments, and meaningful social and economic advancement, can be developed.

The challenges of the Amazon Basin region are numerous to the sustainable utilization of land and water resources as the region experiences exponential socio-economic growth and intense internal migratory flows and immigration. The complexity of the issues, coupled with a rapid rate of change in an environment requires the implementation of a process that will help minimize risks associated with deforestation, climate variability and change, and conflicts regarding the use of water and natural resources, while creating a strong foundation upon which to build a Strategic Action Program (SAP) that will address transboundary water resources management concerns shared by Basin countries.

Gulf of Mexico Large Marine Ecosystem: Environmental monitoring of two pilot sites and forward steps

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: Gulf of Mexico, Terminos Lagoon, Monitoring, Ecosystem health

Abstract Text:

As one of the components of the Sustainable Management of the Gulf of Mexico Large Marine Ecosystem, the pilot project on monitoring and environmental assessment selected Terminos and Celestun lagoons as sites to study. The aim of the pilot project is to strengthen capacities for joint monitoring assessment and evaluation of the coastal environment in support of the Gulf of Mexico management. Results of five modules are shown: water quality, sediment quality, contaminants and biomarkers in fish, benthic community, and habitat degradation. The results are categorized as good, fair or bad according to pre-established criteria. Adequate indicators for the southern Gulf were added to contaminants in fish, water quality and benthic community modules. Sampling was probabilistic stratified, using the zones determined from hydrology as a basis for stratification. Results show that in general pollutant concentrations in sediments are low, and have been decreasing at least since 2005. However, mercury levels exceed Mexican advisory levels in the muscle of fish in Terminos about 20 % of the fish. A number of stations were found to be in "bad" condition for water quality and benthic community in Terminos. Loss of mangroves forests is decreasing in both lagoons. Analysis of two different ecosystems in the same region gave the opportunity to compare results and among other things to establish a sampling density which is more adequate to the Mexican portion of the Gulf of Mexico. Results indicate that sampling density can be decreased, thus allowing costs and analysis time to decrease also. Fish biomarkers can differentiate between the two sites that we have the results available, and most of the indicators are orthogonal. These results are encouraging and a good example of focused research. With experience in the monitoring of these sites some challenges to overcome for successfully implementation of this scheme in the Mexican portion of the Gulf have been identified. However, the pilot project activities have had a very good acceptance between academia and government promoting the joint assessment of health condition in the Gulf of Mexico.

Framework Program for the sustainable management of the la Plata Basin water resources with respect to the effects of variability and climate change

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GEF IW Project Affiliation: La Plata River Basin

Keywords: IWRM, TDA and SAP, water resource governance

Abstract Text:

La Plata Basin is one of the world's largest river basins, draining approximately one-fifth of the freshwater of the South American continent. It includes the systems of the Paraná, Paraguay and Uruguay rivers and the La Plata River itself and is a strongly attractive region due to its natural resources that translate into an important percentage of the GDP of the five countries (Argentina, Bolivia, Brazil, Paraguay and Uruguay).

A "Framework Program for the sustainable management of the La Plata Basin water resources with respect to the effects of variability and climate change" is being developed within the scope of the Intergovernmental Coordinating Committee of La Plata Basin Countries (CIC) through IW-GEF financing and DSD-GS/OAS technical and administrative support through UNEP as its implementing agency. The global objective of the Program is assisting the governments of Argentina, Bolivia, Brazil, Paraguay and Uruguay in the integrated management of the La Plata Basin water resources in terms of the effects of variability and climate change with a view towards an environmentally sustainable economic and social development through the institutional strengthening of the CIC.

During the ongoing period 2010-2015 (Stage 1), the Strategic Action Program "SAP- based on the Transboundary Diagnostic Analysis "TDA- is under development. It considers (I) Strengthening Basin-wide Cooperation Capacity for Integrated Hydro-climate Management, (II) Integrated Water Resources Management, with emphasis on the integrated surface and groundwater resources management and their adaptation to variability and climate change and (III) La Plata Basin's Hydroclimate Prediction System and adaptation to hydrological effects of variability and climate change.

The project execution methodology promotes a greater and better conscious involvement and participation -through thematic groups for each subcomponent of the project- of different ministries and organizations from the five countries. The connection between the decision-makers, the executing thematic groups and the scientific community is incipient in some subcomponents such as hydrological model associated to water management forecasting systems and groundwater resources management. Furthermore, a special Fund for the Promotion of Public Participation will involve stakeholders (universities, NGOs, etc) into the SAP definition process. Results from the implemented execution process will be shown in the near future as part of water resources governance challenges.

Monitoring and Environmental Evaluation in the Gulf of Mexico Large Marine Ecosystem

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: Monitoring; Gulf of Mexico; Sediments; Benthos; Sampling; Biomarkers

Abstract Text:

The demonstration project on monitoring and environmental evaluation of the Gulf of Mexico Large Marine Ecosystem aims to provide the basis for the joint monitoring of the Gulf of Mexico (GOM-LME) between the United States and Mexico. The project is roughly based on the National Coastal Condition (NCC) report by the USEPA-NOAA-USGS, and it consists of five modules: Habitat degradation, water quality, sediment quality, fish, and benthic fauna. For each module different parameters are measured, and categorized as being in "good" (score of 5), "regular" (score of 3) or "bad" (score of 1) condition according to pre-determined criteria. The Coastal Condition Index is calculated as the mean of the scores for all modules. Results are presented to stakeholders and environmental managers as maps with "street lights" indicating the status of each sampling station and parameter. The project had a single site, Laguna de Términos, as the pilot site. However, extra funds have been procured and two other sites have been monitored, Celestin and Sistema Arrecifal Veracruzano (Veracruz Reef System). This last site is important because it allows us to gain experience by replicating the approach in reef ecosystems and also in watershed analysis. The approach has also been used also in three oceanographic cruises on the continental shelf of the Yucatan Peninsula to establish the environmental baseline of the region.

The project aims to adapt the NCC to conditions in Mexico, and changes to the approach used in the United States have been adopted. For example, fecal enterococci have been added to the water quality module and biomarkers to the fish module. The TRIX index is used in water quality and the BENTIX index for benthic fauna. Statistical analysis of the data will allow us to determine whether sampling density can be decreased to reduce costs, to see if the added parameters allow us to distinguish the different sites, and finally if the parameters used are orthogonal (that is, if we are not measuring the same thing more than once).

Spiny lobsters and shrimps of the South West Indian Ocean: sharing networks, surveys at sea and strategies for stock management

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GEF IW Project Affiliation: Southwest Indian Ocean Fisheries

Keywords: SWIOFP, fisheries, regional management, shared stocks, developing region

Abstract Text:

Artisanal and industrial fisheries for shrimps (prawns), spiny lobsters, langoustines and crabs are ever-present along the margins of the South West Indian Ocean, extending from eastern South Africa to Kenya, and around Madagascar. Most of the landings reported from the region come from Mozambique and Madagascar shallow-water prawn fisheries, however industrial deep-water trap and trawl fisheries are important off South Africa and Mozambique. The South West Indian Ocean Fisheries Project (SWIOFP) supports a multi-national collaborative approach towards assessing the regional status and fisheries potential of crustacean resources, and whether they are shared or localized. Existing data on fishing effort and catches spanning back many decades were sourced from governments and the private sector, and compiled in retrospective analyses to identify data gaps and historical trends. Research surveys using chartered fishing vessels were undertaken in the waters of Mozambique, Madagascar, Tanzania and Kenya to collect abundance, distribution and biological data of priority species, and observers were deployed on commercial vessels to collect fisheries information. The survey data supported six masters degree studies as a scientific capacity building initiative in a developing region. Several of these studies focused on the genetic connectivity between trans-boundary stocks - an important aspect when deciding on regional or local management strategies. Strong networks were formed among scientists of the region, to cope with the large geographical scale and multi-national nature of the research. Experiences and preliminary results are presented.

Demonstrating the adoption and linkages of Best Available Practices and Technology (BAP/T) in Ecotourism, Environmental Management System and Reef and Marine Recreation Management in Kenya, Mozambique and Tanzania

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GEF IW Project Affiliation: Coastal Tourism

Keywords: Best Practice, Ecotourism, LME

Abstract Text:

The United Nations Industrial Development Organization (UNIDO) Collaborative Actions for Sustainable Tourism (COAST) Project is a five-year project on its third year of implementation. It is a Global Environment Facility (GEF) funded project with the United Nation Environment Programme (UNEP) as the implementing agency; UNIDO as executing agency in partnership with the United Nations World Tourism Organization (UNWTO). Its main objective is to demonstrate and support adoption of best practice approaches for sustainable tourism that reduces the degradation of marine and coastal environments of trans-boundary significance.

It has been working in nine countries in the sub-Saharan Africa to facilitate the uptake of Best Available Practices and Technologies (BAP/T) in the field of Ecotourism, Environmental Management System (EMS) and Reef and Marine Recreation Management (R&MRM). In the experience of East and South African countries mainly Kenya, Mozambique and Tanzania; the Ecotourism activities link directly into the local communities, informal business sector and civil society organizations, the EMS focus is with the private sector and the R&MRM activities have more inclination toward the local government.

The project is establishing cross cutting linkages within each thematic area through science based tools such: formulation of biodiversity indicators and activities for ecotourism projects, which promotes or directly pays for biodiversity conservation; spatial mapping of the demonstration site especially reef ecosystems to prioritize conservation and management and; participatory resource assessments including basic environmental monitoring systems done by local stakeholders. The project seeks to produce BAP/T adoption models that can be replicated in national and regional scale. This is being done through preparation of thematic project briefs that emphasizes the importance of baseline data, institutional partnerships, capacity building and monitoring exercises.

Building Resilience: developing adaptive dialogue between policy makers and scientists

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GEF IW Project Affiliation: Governance Tools

Keywords: adaptive dialogue, policy makers, science

Abstract Text:

Alterations in climate and increased pressure placed on our marine and freshwater resources demand that these resources are utilised in the most effective way possible. International waters are, arguably, even more important as decision making can be obfuscated due to national interests, different cultures, variable information, amongst others. Moreover, scientists often lack hard and clear understandings of complex systems and consequently messaging to policy makers can be ambiguous. On the political side institutions need to be developed that are geared to the proper geographical and temporal scale of the resources being managed to give managers and scientists the mechanisms to provide decision makers with the best available knowledge. At the same time scientists need to develop clear messaging to policy makers even in the face of uncertainty and lack of conclusive information. Techniques such as expert judgement are tools that could be employed to enhance the ultimate understanding of complex systems for decision makers. This article explores institutional arrangement in international waters where management and science are designed for the resource and forward the use of innovative expert judgement techniques to enhance adaptive dialogue.

Enhancing natural habitat conservation in the coastal and marine areas of the Gulf of Mexico LME: Creation of an International Marine Protected Areas Network

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: marine protected areas (MPAs); coastal ecosystems; restoration; international coordination

Abstract Text:

Recently, initiatives in the scientific community have been underway to explore the concept of a network of marine protected areas (MPAs) in the Gulf of Mexico based on critical habitat sites. In 2010, The Harte Research Institute for Gulf of Mexico Studies at Texas A&M University Corpus Christi (TAMUCC HRI) and the Gulf of Mexico Large Marine Ecosystem Project co-organized an international educational initiative that aimed at analyzing the institutional and legal frameworks of Mexico, Cuba and the U.S. related to the establishment of MPAs to generate knowledge and recommendations in order to demonstrate the need for international coordination and consistency in federal policy to create a network of MPAs in the region. Furthermore the development of a Gulf regional Marine Protected Areas (MPA) implementation plan is currently underway in the United States. MPA managers from around the region met to discuss strategies for Gulf MPAs to increase communication, coordination and collaboration to maximize efficiency and effectiveness of addressing targeted issues of mutual concern to the community and the Nation. The implementation plan will serve as a catalyst for achieving a new level of regional ocean and coastal resource management. Next steps and efforts will focus on implementing the key elements of the newly created Gulf of Mexico Regional MPA Plan focusing on managing climate change, catastrophic event response, and outreach/training about the value of MPAs. The GOM-LME currently promotes identification of priority needs for improving MPA management planning, tools for effective communication among MPA site managers, specific analytic design parameters to maximize efficiency, effectiveness, and benefits of a Gulf-wide network of MPAs.

Management of transboundary basins in West Africa, what lessons?

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Keywords: River Basin, transboundary basin, management, West Africa

Abstract Text:

In the framework of water management at the international level, the GEF has supported major projects sub-regional meeting the challenge of managing water resources.

In West Africa, some basins (Niger, Senegal, and Volta in particular) have been diagnosed, and results are so mitigated. The results of the project in this basin show that the need for integration is probably obvious but the problem of the involvement of some key players in management.

In the Volta river basin for example, policymakers do not adequately address the concerns of local residents. The organization of human activities around the resource is weakly hierarchical. In addition, the project results do not demonstrate a genuine involvement of local, national, scientific, etc.

Most often, these are political bodies that are in place. The latter struggle to foster a dynamic global integrated regional dimension as was found in the realization of the transboundary basin of the Volta.

The existence of the Management Authority has failed to put enough consistent aspects of governance, and social impact of scientific knowledge.

This discussion attempts to analyze the experiences of transboundary basin management in Africa with the advent of several regional or sub regional projects that can be strengthened by making contributions to other sectors.

What is special about the management of transboundary basins in Africa? What are the policies and tools that are developed? Have been successful examples? What are the challenges?

Lessons learned from Guarani Aquifer System Project to replicate in the Framework Program of La Plata Basin

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GEF IW Project Affiliation: Guarani Aquifer/La Plata River Basin

Keywords: International Waters, IWRM, Groundwater, Surface and groundwater integrated management, GEF project.

Abstract Text:

La Plata Basin (Argentina, Bolivia, Brazil, Paraguay and Uruguay) is one of the largest catchments in South America, -extending over 3.1 million km²- and has enormous economic and social importance for the region.

The Intergovernmental Coordinating Committee for the La Plata Basin Countries (CIC, in Spanish) was created by the governments of the five countries who agreed to carry out a joint and integrated study of the area. The agreement was consolidated in 1969 with the signing of the La Plata Basin Treaty, providing a basis for further bilateral and multilateral agreements concerning jurisdictional matters, navigation, fishing, pollution prevention, scientific research, etc.

Currently, the CIC has a â€™Framework Program for the Sustainable Management of the Water Resources of the la Plata Basin with respect to the Effects of Climate Variability and Change (FP)â€™. This FP is an ongoing project that is being implemented through a participatory process between the countries, with the support of the Global Environment Facility (GEF), through United Nations Environmental Program (UNEP) and the Organization of American States (OAS), between 2010 and 2015. The FP was organized in 15 subcomponents in order to facilitate its implementation. One of them is the Integrated Management of Groundwater, in the framework of IWRM.

There are substantial transboundary groundwater aquifers in the region, such as Guarani, Serra Geral, Cauia-Bauru, Pantanal, among others. The Guaraní Aquifer System is the most important groundwater reservoir, due to its extent and volume with an area of approximately 1.2 million km², in which there are almost 15 million inhabitants. A joint project, supported by GEF until January 2009, expanded and consolidated the knowledge about the aquifer.

This paper draws mainly upon lessons learned from the Guaraní Aquifer System (GAS) project, which would be considered into the FP of the La Plata Basin, such as university and civil society involvement through public participation funds, empowerment of local actors on pilot projects implementation, national public institutions involved on project implementation, regulations should not include provisions that weaken or relegate the State sovereign rights, regulations and management are of little use if the resource being managed is unknown.

Promoting the ecosystem approach to fisheries management in Large Marine Ecosystem programmes in Africa: Progress Made and Lessons Learnt

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Keywords: Ecosystem approach, fisheries management, Africa

Abstract Text:

In 2003 the member States of the Food and Agriculture Organization of the United Nations (FAO) adopted the term 'ecosystem approach to fisheries' (EAF) and also endorsed the approach as an appropriate framework for the management of fisheries. This followed the adoption in 1995 of the FAO Code of Conduct for Responsible Fisheries which provides principles and standards applicable to the conservation, management and development of all fisheries and the 2001 Reykjavik Conference on Responsible Fisheries in the Marine Ecosystems one of the objectives of which was how ecosystem considerations can be included in fisheries management. The EAF is a sector-based approach that ensures that fisheries are managed in a way that is consistent with overall sustainability principles and objectives agreed at ecosystem level, as compared to ICM (Integrated Coastal and Ocean Management) or EBM (Ecosystem Based Management) that address governance at the multi-sectoral level. Working with four LME projects in Africa, the FAO's EAF-Nansen project has promoted fisheries management in line with the ecosystem approach and within the general framework of the large marine ecosystem concept. The paper discusses the progress made and the practical problems encountered. It is clear that the ecosystem approach to fisheries which is based on three pillars of a fishery system, namely ecological sustainability, social and economic outcomes and ability to achieve management objectives (made up of governance and external factors) is fully consistent with and complements the five-module approach of the LME concept, namely productivity, fish and fisheries, pollution and ecosystem health, socioeconomic and governance. The experiences gathered from the work with the LME projects and their constituent countries indicate that the underlying issues and priorities are generally well understood by the marine resources managers and that the most critical problems being encountered are typically insufficient management and scientific capacity, the need to engage stakeholders more effectively, and conflicts between the long term goals of sustainability and urgent short-term social and economic needs. This notwithstanding, many countries in Africa are committed to implementation of EAF and are making some progress which is also contributing to the achievement of objectives of the large marine ecosystem projects.

TOWARD A GLOBAL LARGE MARINE ECOSYSTEM SUSTAINABILITY-SCIENCE LEARNING AND KNOWLEDGE NETWORK: DEFINING NEW PARTNERSHIPS, CREATING NEW OPPORTUNITIES

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GEF IW Project Affiliation: Global Large Marine Ecosystem Community of Practice

Keywords: Ocean and Coastal Governance, Global LME Knowledge Network, Sustainability Science

Abstract Text:

This presentation introduces an alliance driven approach to building a global LME knowledge network.

We face a crisis of ocean governance. In part, this is a consequence of lack of knowledge regarding complex and dynamic marine systems. We know less about the deep seabed than we know about the surface of the moon. But the crisis is also a reflection of the inability of all stakeholders to work together effectively to frame critical questions, provide adequate support for efforts to answer these questions, and bring the answers to bear in processes of policymaking.

Institutional responses to this crisis are occurring at multiple scales. Prominent among these are the UN Blueprint for Ocean and Coastal Sustainability which calls for the reform of Regional Ocean Management Organizations and expansion in the Global LME Network as well as the World Bank's new Global Partnership for Oceans which brings science, advocacy, the private sector, and international public institutions together to advance mutually agreed goals for healthy and productive oceans.

The Global Scientific Community is also calling for governance reform through initiatives such as the World Council of Science's Future Earth initiative. International funders such as the Belmont Forum are currently soliciting proposals addressing coastal vulnerability as well as the advancement of knowledge networks through an International Opportunity Fund. Additional responses are emerging in a variety of regional and national settings.

The mission of the Future Ocean Alliance is to build a network joining those associated with all these initiatives into an effective community. Applying the principles of sustainability science and drawing on recent advances in informatics, the Alliance seeks to engage producers and consumers of knowledge in an active process of co-producing and implementing an integrated research agenda that advances the priority objectives outlined in the UN Blueprint for Ocean and Coastal Sustainability. Critical to the success of this interactive process is the engagement of policymakers, civil society and the private sector, scientists, administrators, and funders from beginning to end, starting with the framing of key questions, rather than addressing the issue of collaboration only at the stage of applying knowledge to action.

Research for governance reforms in International Waters systems

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GEF IW Project Affiliation: Caribbean Sea Large Marine Ecosystem

Keywords: governance, assessment, scale, regime, architecture effectiveness

Abstract Text:

Improved governance is a major focus of the GEF International Waters (IW) Program. To achieve this there is the need to see governance as a researchable topic and to develop programs for governance research. There has been considerable recent conceptual development of governance frameworks that are relevant to IW systems, e.g. those of the Earth Systems Governance Project, the Institutional Assessment Framework (Ostrom), the Interactive Governance Approach (Kooiman) and the work of the Resilience Alliance. We now the need to move beyond conceptual frameworks to operational frameworks that can guide assessment of governance and the development of interventions to improve governance. We propose an operational framework that incorporates key characteristics derived from the conceptual frameworks.

The proposed operational framework takes actual or potential issues as the basis for governance action; transboundary issues in the case of IW systems. Each issue must have a "governance arrangement" which must have certain common characteristics to be effective. The arrangement must have a complete policy process with mechanisms for uptake of data and information, generation of advice, decision-making, implementation and review. It must also have functionality in three modes: (1) a meta-mode for articulation of principles, visions and goals; (2) an institutional mode that reflects agreed ways of doing things reflected in plans and organisations) and (3) an action mode for day-to-day activities. Similar issues may be covered by similar arrangements, which may be clustered for efficiency and linked for integration as is needed for ecosystem-based management. The entire framework, which encompasses the governance regime or architecture in an IW system, consists of all the arrangements needed to cover the issues and may involve multiple organisations at several geographical and institutional scale levels.

This framework provides for addressing the governance regime as a whole and for breaking it into components that can be assessed and for which interventions can be designed. Assessments conducted within the CLME Project illustrate the approach. They have focused on: the national-regional interface; the gaps, overlaps and networking among regional organisations; arrangement architecture and policy processes; and visioning and principles at the level of the whole system.

Applying Environmental Flows through BioMonitoring and Rapid Ecological Assessment

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GEF IW Project Affiliation: Kura-Aras River

Keywords: environmental flows, biomonitoring, rapid ecological assessment, Kura river basin, project-to-project learning

Abstract Text:

Applying environmental flows through rapid ecological assessment and biomonitoring in the Kura River Basin The UNDP/GEF Kura-Aras project is executing a demonstration project component focusing on helping the project countries – Armenia, Azerbaijan and Georgia – to develop guidelines for establishing environmental flows, in view of increasing socio-economic demands for water as well climate change. To date, a four-day Capacity Raising Training has been organized for regional governments, science and NGO representatives, increasing their understanding of the key principles of Rapid Ecological Assessment, Environmental Flows and Bio-monitoring as well as options for their application in the Kura-Aras basin. Field surveys were initiated in the three countries to collect integrated data on the state of the abiotic and biotic riverine wetland zone. The data aim to allow the evaluation of scenarios of both flow change (i.e., change in the volume and timing of water) and non-flow related impacts in terms of: effects on overall downstream river ecosystem condition, including; changes in key biophysical components of the riverine ecosystems; changes in the availability of resources used directly by the people living alongside the river; and possible impacts on the health of people. The project actively benefits from best practices experiences from the Nile river basin, based on shared project-to-project learning as well as GEF IW:LEARN resources. This paper explores the methodology, challenges and lessons learned from developing an applied environmental flows methodology in the South Caucasus. More information can be found at www.kura-aras.org, or obtained from Dr. Mary M. Matthews, CTA/Project Coordinator (mary.matthews@kura-aras.org), Mr. Harald J.L. Leummens, Demonstration Project Coordinator / Science Office (harald.leummens@kura-aras.org), and Eng Ahmed Abou Elseoud, Senior Biomonitoring and Environmental Flow Expert (ahmed.abou.elseoud@kura-aras.org)

Analysis of the Invasive Species in the Gulf of Mexico Large Marine Ecosystem

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: invasive species, nuisance species, pathway analysis, risk analysis

Abstract Text:

Alien species that have been moved, intentionally or unintentionally, as a result of human activity, into areas where they do not occur naturally are considered invasive species. Many of them perish in their new environment but some thrive and start to take over native biodiversity and affect human livelihoods. According to the Convention on Biological Diversity (CBD), an "invasive alien species" refers to an alien species whose "introduction and spread threatens native ecosystems, habitats or species with socio-cultural, economic and/or environmental harm, and/or harm to human health". A major environmental problem that is just beginning to be considered at a bi-national level (Mexico-US) is the presence of invasive species in shared ecosystems. A pathways analysis of aquatic invasive species occurring in the Gulf of Mexico was performed in order to gain understanding of this driver of change in biodiversity.

An index to categorize the invasiveness of species was applied in order to know the pathways through which the most dangerous species are being introduced to the Gulf of Mexico Large Marine Ecosystem. An extensive assessment in the Gulf of Mexico and search through authoritative sources of information was made (e.g. NAS- USGS, Conabio, Conanp, GSMFC- NNAS, ISSG, SEMARNAT) official management plans, and other specialized sources (journal articles, theses, books, etc.), for reports on aquatic exotic and invasive species within the extent of the proposed ecological region (Gulf of Mexico), which includes the US states and Mexican coast in the Gulf of Mexico. The methodology for the Pathways Analysis was adopted from that proposed by the Aquatic Nuisance Species Task Force (ANSTF) and the National Invasive Species Council (NISC) Prevention Committee via the Pathways Work Team (2007). This approach involves Multiple Pathways Triage and Threat Level Assessment, Single Pathway Definition, Coupling with Inclusive Invasive Species Listing and Ecosystem Scope and Single Pathway Risk Analysis. Based on prior analyses, the degree of invasiveness was assigned considering: 1) impact category (i.e., human health, economy or ecosystem impact), 2) pathway ecosystem scope (i.e., from local to international range) and 3) pathway risk.

A global analysis of lakes science and transboundary management

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GEF IW Project Affiliation: IW Science

Keywords: lake ecosystems, transboundary waters, policy development, social and economic linkages

Abstract Text:

The GEF: IW Science Project Lakes working group reviewed 58 projects distributed across Europe (21), Africa (13), Asia (8) and the Americas (8). Due to the nature of the projects, most study areas had some overlap with the rivers working group. Lake ecosystems have some challenges that were not always recognized or dealt with effectively, transboundary lake ecosystems are less linear than river systems, and in general often have higher economic, social and political frictions. Lakes were not often considered as specific ecosystems, and many projects did not consider lake physical processes as a component of the system or as a possible modifier of impacts. In addition to the differences in physical processes, lakes are often more dependent on external drivers such as changing land use, aerial deposition, and climate change. Furthermore, the temporal scale of lake responses are often affected by retention times that result in response time frames longer than project durations. There were some clear factors that improved the success of projects, including the use of pilot projects, rigorous peer review, and international science teams linked to policy development. Climate change affects all ecosystems, and lakes may experience future changes in salinities, water quality, food web structure and biodiversity, fisheries (alternate species, new invasive species), navigation patterns and use of waterways. Developing issues that will continue to affect lake ecosystems include changing agriculture and energy policies, water diversions, biofuels and resource extraction. The emerging science challenges included the need for increasing the focus on the ecosystem level, improving the development of proxy indicators, developing strategies for climate adaptation, and improving our understanding of long-range transport of contaminants, changing chemical use patterns, and the impacts of habitat rehabilitation, including reforestation. The over-arching actions which are needed include effective capacity development and training, planning processes which include policy development and harmonization, and the development of strong regional collaboration. There is an increasing need to strengthen the linkage of science to economic incentives, policy frameworks, and the development of adaptive management capabilities that leads to optimal use of water resources while sustaining ecosystems on which social and economic systems depend.

Water pollution data in Amazon basin

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Keywords: water pollution, inventory, Amazon basin

Abstract Text:

The present project focuses on pollutant sources in the Amazon Basin in order to identify and map the pollution hotspots for formulation preventive measures and control of water quality in the Amazon Region. Data quality and compatibility, organization and classification of water quality and pollution sources will be displayed under proper database criteria. To build the databank the literature research will concentrate on projects about on-going and past water pollution information in the Amazon basin. Revision, compilation and evaluation of water quality and pollution control data and assessment of their quality, compatibility and impact analysis across the Amazon basin countries are the basic activities of the project. The main results are a report and publications comprising an inventory of references on water quality and pollution sources of the Amazon basin, data of water quality and sources of pollution, method and techniques of data collection, treatment and analysis, identification of water pollution hotspots and their impacts on ecosystems and human health, and the evaluation of the current trend in river pollution as well suggestion of preventive measures to environment protect.

GEF Oceanic Fisheries Management (supporting the conservation of the warm-pool of the western Pacific Ocean and its tuna fisheries)

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GEF IW Project Affiliation: Coral Triangle Initiative West Pacific

Keywords: international waters, tuna, ecosystem structure and function, biodiversity, adaptation

Abstract Text:

The objective of the OFM was to "support new institutional arrangements for the conservation and management of trans-boundary fish stocks and associated national capacities". The project focused predominately on providing the capacity for participation in the Western and Central Pacific Fisheries Commission by project members and focused on three distinct components (1) Scientific Assessment and Monitoring Enhancement (e.g. establishing/improving fishery data monitoring, collection of independent data on the impacts of fishing, national and regional synthesis of stock status); (2) Law, Policy and Institutional Reform, realignment and Strengthening (e.g. compliance (MCS), CMM development); and (3) training and technical support (e.g. data management training, summarising of data to contribute to international responsibilities). The project had the significant advantage of being imbedded in the work programs of the participating Countries and the Forum Fisheries Agency and the Secretariat of the Pacific Community. The integration has meant that the engagement of local and wider science communities as occurred from the onset of project. The project has significantly advanced the scientific data and resources for managing this international waters ecosystem for fisheries and biodiversity. Important outcomes that can be drawn from the project are the critical emerging issues of "how to manage for sustainability into an uncertain future", particularly in reference to climate change and "managing for compounding impacts and competing objectives" and "reconstructing lost ecosystem properties".

Open Ocean Science in the GEF

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The GEF's portfolio of dedicated open ocean projects is relatively small and focuses on governance activities and supporting the environmental dimensions of other initiatives, more than science. This focus, and because most of the Large Marine Ecosystem projects (which include ocean areas) concentrate on coastal waters, means that, overall, there is comparatively little open ocean science being funded by the GEF.

The GEF funds science that answers management questions and the scientific activities in the open ocean to-date have been modest and involved routine methods relating to developing species inventories, modelling ecosystems; and investigating ocean hydrography and productivity. While it appears that no topic of scientific investigation is off the table at the GEF - as long as it answers a critical question for management, the high cost of ocean research and the long term commitments needed for such research are likely to be a major factors limiting the GEFs involvement in funding open ocean science activities.

The forthcoming 'Areas Beyond National Jurisdiction Programme' will be one of the largest single GEF investments in the open oceans to date and it is probably a blue print for future open ocean projects. The programme involves a range of well considered scientific activities that support the governance objectives and includes basic ecological and bycatch data collection, risk assessments of critical habitats. However, it also includes technological development of electronic compliance techniques and bycatch mitigation; and the relatively new areas of ocean science pertaining to social and economic analyses.

The science that supports the GEF Project Documents in general is often not comprehensive and is poorly analysed in the context of the project being proposed; moreover, the Project documents rarely prescribe specific scientific methods or the production and nature of the scientific outputs. However, the design, implementation and outputs of the open ocean scientific activities following project implementing appear to be sound as most projects use appropriate experts and include processes involving working groups and review panels for technical oversight (e.g. technical working groups). Overall, the best practice comes in the form of ensuring that the science is relevant, performed well and contributes to answering a management question.

Several scientifically credible data sharing systems are available for ocean information systems and GEF projects contribute to these. On the other hand, the publishing of GEF funded science in the peer reviewed literature is not usually prescribed in the Project and this may mean that some important findings are not readily available to the scientific community.

The IW Science Project's global analysis of large marine ecosystems and the open ocean science and transboundary management recommended that the three most pressing critical science issues relate to:

climate change, acidification and atmospheric change; life history, ecology and conservation of transboundary stocks; and multiples stressors, tipping points and resilience of coupled social ecological systems.

This list of (management) topics is of limited use to those project designers that seek GEF open oceans funding as the GEF does not appear to have restrictions on the nature and extent of the science it funds - the major criterion appears to be that the science will answer a critical management question. Notwithstanding this, there probably needs to be a marked increase in the amount of work being done in socio-economics science compared to other disciplines.

There are several issues related to non-research activities that also deserve some consideration. These include the need to set up processes to ensure that the science purported to be the basis of project documents and TDAs is comprehensive and interpreted correctly; to better coordinate and integrate the scientific activities undertaken in the open ocean by different agencies; and improve the communication of scientific outputs to policymakers and managers.

Finally, it appears ironic that the GEF does not fund long-term monitoring and observation programmes, yet it relies on such information to establish baselines, assess the impacts of its investments and derive ecological indicators. Perhaps the GEF might better facilitate the integration of different focal area funds e.g. those relating to international waters, biodiversity and climate change to enable some of the more expensive open ocean activities, such as ocean observation programmes, to be supported. Also, perhaps more ways can be found for GEF to indirectly support the agencies that undertake such programmes of work for their mutual benefit, or require beneficiaries to commit to funding this work as part of their cofinancing and commitment to being part of a GEF project.

Gulf of Mexico Large Marine Ecosystem Binational Coastal Community Resilience and Climate Change Mitigation and Adaptation Measures

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: Community Resilience, climate change

Abstract Text:

Extreme variations in the hydrologic cycle associated with climate change in the Gulf of Mexico Coasts often result in costly environmental damage to coastal ecosystems and economic burden to residential communities. Mexico and the United States of America share the productive coastline bordering the Gulf of Mexico where many communities are sustained by revenue from marine and estuarine industries such as fisheries, shrimp and shellfish harvesting, and eco-tourism. Residual effects from weather events such as storm surges, high-magnitude precipitation events, hurricanes, and drought can be immediately destructive and extremely costly for local inhabitants and government agencies in both countries at the local (municipal), state, and federal levels. Without solid infrastructure, disaster preparedness, and advanced environmental planning, the result of severe climate variability may result in resilience loss or community devastation. Such damage that has already resulted from severe weather is well documented by stakeholders from both countries, but transboundary climate change mitigation tactics have not been sufficiently established.

The Gulf of Mexico-Large Marine Ecosystem (GoM-LME) and the Gulf of Mexico Alliance (GOMA) both suggest the need to prioritize coastal community resilience methods (Alvarez 2011) (Sempier et al. 2010). Adopting a binational approach to coastal community resilience will maximize investments, improve information sharing, enhance transboundary climate change mitigation tactics, and further develop existing programs in both countries. A multidimensional approach to resource management for the transboundary coastal region of the Gulf of Mexico will endorse the health of all elements of an ecosystem, including humans. The GoM-LME proposes a specific strategy for using this initiative to create a binational partnership to promote improved coastal community resilience methods at the transboundary level. Expected collaborative results will enhance local environmental stewardship tactics, increased education and technological resources for community leaders, and establishment of a framework to assess and improve transboundary coastal community resilience.

Sustainable fish stocks and shared responsibilities for an ecosystem approach in the South West Indian Ocean: SWIOFP unites nine countries

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GEF IW Project Affiliation: Southwest Indian Ocean Fisheries

Keywords: South West Indian Ocean, ecosystem approach, fisheries, management

Abstract Text:

The GEF Large Marine Ecosystem Programme in the western Indian Ocean consists of three inter-linked projects, for fisheries (South West Indian Ocean Fisheries Project or SWIOFP, funded by the World Bank), productivity (ASCLME, UNDP) and for land-based influences on the marine environment (WIO-Lab, UNEP). The SWIOFP assists nine member countries to: a) gather information about fish stocks and fisheries; b) build capacity in marine science and resource management; c) mainstream biodiversity conservation in fisheries policies; and d) support a regional framework for managing shared marine resources. The six components of SWIOFP address data and information technology, crustacean, demersal and pelagic fish resources, impacts of fishing on biodiversity and a fisheries management component. Strong collaborative links have been forged between fisheries scientists at a regional level leading to management of fisheries, which is reflected in many shared research projects that span international boundaries along the southeast African coast and the islands of Madagascar, Mauritius, Seychelles and Comoros. A retrospective analysis of past research surveys and fisheries catch and effort trends have been completed as a TDA baseline. Between 2008 and the present, SWIOFP facilitated numerous research surveys using chartered fishing vessels, trained and deployed fisheries observers at sea, funded 21 masters degrees, and set in motion institutional support to national management entities and the regional Commission for fisheries management in the SWIO. The project has successfully bridged the gap between the science and management of fisheries through developing in each country an EAF management plan. The project is in its final year and will leave a legacy of shared responsibility for shared stocks in the region and the Ecosystem Approach to Fisheries institutionalised.

Genetic Population Structure of Some Small Pelagic Fishes in the Sulu-Sulawesi Marine Ecoregion (SSME)

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GEF IW Project Affiliation: Sulu-Celebes Sea Large Marine Ecosystem

Keywords: SSME, small pelagics, stock structure, mitochondrial DNA

Abstract Text:

Pelagic fish dominate the world's fisheries, constituting one of the few major food sources harvested from wild populations. They likewise are the major food source in the Sulu-Sulawesi Marine Ecoregion (SSME) bordered by Indonesia, Malaysia and Philippines. The management of this resource is thus of prime importance, though basic biological information, especially relating to population structure, is often lacking. In this study, the genetic population structure of some commercially important small pelagic fishes sampled from SSME countries using a total of 309, 305, 326, and 364 base pairs (BP) of the mitochondrial DNA region was investigated for frigate tuna (*Auxis thazard*), Bali sardine (*Sardinella lemuru*), Indian mackerel (*Rastrelliger kanagurta*) and Big-eyed scad (*Selar crumenophthalmus*), respectively. High percentage of variation, low overall F_{ST} value, high haplotype diversity shown in a scattered Median-Joining haplotype network are indicative of panmixia in the Sulu-Celebes Seas. Therefore, any management practice to be implemented in the area should consider that the three countries (Indonesia, Malaysia and Philippines) are sharing the said stocks. Indeed, mtDNA data indicate that management plans for these pelagic fishes require SSME-wide cooperation and governance.

Phytoplankton Blooms in the Western Gulf of Mexico Large Marine Ecosystem: New Initiatives using Remote Sensing and Marine Optics

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GEF IW Project Affiliation: Gulf of Mexico Large Marine Ecosystem

Keywords: phytoplankton, harmful algal blooms, remote sensing, marine optics

Abstract Text:

Economic impacts of Harmful Algal Blooms (HABs) in the Gulf of Mexico Large Marine Ecosystem (GOM-LME) are estimated to be in the millions of dollars every year, in addition to being a potential threat to marine ecosystems and public health. There is little knowledge in the Western GOM-LME about the frequency, distribution and impacts of HABs. The most controversial question is about HABs frequency and potential increases over the last decade. Satellite remote sensing combined with in situ monitoring and oceanographic buoys can provide a synoptic and historical perspective to the problem that traditional oceanography fails to, by increasing both temporal and spatial coverage. A good understanding of the system would take into consideration the spatial patchiness of the phytoplankton bloom, location in the water column, availability of nutrients, light, and ocean circulation patterns. Can we develop a HABs monitoring system based on satellite remote sensing observations and a network of oceanographic buoys? Here, we present the results of two multidisciplinary initiatives. The first one is a project called: "Monitoring the Mexican seas using satellite remote sensing and in situ sensors to develop a red tide early alert system". The main goals of this project are to generate and integrate historical in situ and remote sensing data to improve HAB detection techniques; improve knowledge of the dynamics of HABs in Mexico and develop an early alert system for HABs in the Mexican states along the GOM. The second initiative is the: "Study of the bio-optical properties of algal blooms in the Yucatan Peninsula". The main objectives were to conduct an initial analysis of the bio-optical properties of algal blooms in the Yucatán Peninsula to improve HAB detection techniques and develop a monitoring protocol. This last initiative consisted of two sampling events in 2011 that collected bio-optical data, phytoplankton ecology data, as well as taxonomic data. These results provided a good understanding on the local capacity and infrastructure, as well as an initial assessment of the bio-optical properties and auto-ecology of the blooms. This information will help improve the use of satellite remote sensing to better monitor HABs in the Western GOM-LME and provides the guidelines for future research, capacity building, infrastructure improvement and increase collaboration at the local and bi-national level.

Climate Change Effects in the Yellow Sea Large Marine Ecosystem and Adaptive Actions in Ecosystem Based Management

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GEF IW Project Affiliation: Yellow Sea Large Marine Ecosystem

Keywords: large marine ecosystems, climate change, ecosystem-based management, integrated multitrophic aquaculture

Abstract Text:

The Yellow Sea is a typical large marine ecosystem with distinctive bathymetry, hydrography, productivity, and trophically dependent populations. Shallow but rich in nutrients and resources, the Yellow Sea Large Marine Ecosystem (YSLME) has productive and varied coastal, offshore, and transboundary fisheries. Over the past several decades, the resource populations in the YSLME have changed greatly with the variable states of productivity and biomass yields under the influence of climate change and anthropogenic forcing. Many valuable resources are threatened by unsustainable exploitation and by the effects of climate change. Promoting sustainable development of the sea and implementing effective management strategies is an important and urgent task. In order to replace the loss of capture fisheries in the YSLME, the UNDP-GEF supported YSLME program initiated a pilot project using an innovative integrated multi-trophic aquaculture (IMTA) approach. The IMTA technology includes the production of algae (kelp), mollusks (abalone) bivalves (bay scallop), and echinoderms (sea cucumber) to help close the fisheries protein gap, while capture fisheries recover to sustainable levels. Preliminary results suggest that the IMTA pilot should be expanded throughout the YSLME and into other Asian LMEs, where applications could provide job opportunities as well as food security. The IMTA pilot project proved to be highly energy efficient and optimized the carrying capacity of coastal embayments while improving water quality, increasing protein yields, and, through carbon capture, contributing to mitigation of the effects of climate change. To reduce stress and promote the sustainable development of Yellow Sea LME and its watershed, the establishment of joint research programs for monitoring and assessing the YSLME using ecosystem based management is very necessary. Suggestions for adaptive actions in ecosystem-based management in the YSLME will also be discussed.

Yrenda – Toba – Tarijeño Transboundary Aquifer System, South America: groundwater – surface water interaction

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Keywords: conceptual model, mathematical model, transboundary aquifer, South America

Abstract Text:

This paper presents the results of the activities carried out for the hydrogeological assessment and subsequent mathematical modeling of the groundwater flow in the transboundary aquifer system located beneath the alluvial fan of the Pilcomayo River between Ibibobo and Misión La Paz – Pozo Hondo (Argentina, Bolivia and Paraguay, South America). The aquifer system has an area of about 300,000 km², fact that should be corroborated, since its limits should still be verified. For elaborating the preliminary conceptual groundwater model, the geologic formations of the Tertiary and Quaternary period were taken into account as the stratigraphic sequence of hydrogeological interest. Jointly with the groundwater table map, available from previous works, the piezometric surface was quantified. Hydraulic gradient, hydraulic parameters, and groundwater velocities and flows were estimated. Using the analyses of both the geologic and hydrodynamic information, the preliminary conceptual groundwater model was defined, and it was possible to corroborate that the aquifer system behaves hydraulically as a multiunit. The construction of the mathematical model required a careful selection of the data because of the scarce basic information available according to the extension of study area and the purposes of the work. The calibration is well-considered because of the normalized root square error obtained (approximately 5%). The groundwater flow was clearly defined and it was also possible to quantify the bidirectional relation between surface water and groundwater. This fact had not been considered so far in earlier studies. Continue working on these bases will be essential to generate the plans for regional development and appropriate legal tools for the utilization and sustainable management. As a result of that, it will be possible to protect biodiversity, prevent desertification, and identify and prevent the effects of the climate change. All of this will be a genuine benefit to the inhabitants of this vast region.

Transboundary aquifer resources management: how can science be of help?

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GEF IW Project Affiliation: IW Science (Groundwater Portfolio)

Keywords: Groundwater; Transboundary aquifer management; GEF IW:Science project; Groundwater science.

Abstract Text:

Science and management are completely different fields of human activity, guided by different principles (objectivity versus preferences). The differences may easily lead to a lack of interaction between these fields of activity, or “if interaction does occur” to a lack of mutual understanding between scientists and managers, and even to conflicting views. A more optimistic vision is that science and management can be seen as complementary activities, with a potential for synergy. Exploring how synergy can be established and enhanced then becomes an issue. This paper focuses on such options for synergy in the context of transboundary aquifer management.

Making use of science for optimal policy development is certainly an ambition of projects like those in GEF's IW portfolio. The GEF IW: Science project was launched in 2009 to assess the use of science in these projects, to explore options for enhancing the use of science and to create a learning network for the benefit of IW projects and the wider water science community. This paper will summarize the findings of the Groundwater Working Group in that project and reflect on their relevance for improved results of transboundary aquifer projects.

The GEF IW: Science project has been structured around a limited number of themes and questions. The emphasis was on aspects that are shared between the different IW components, of which groundwater is only one. This should not deter us from paying attention to other important scientific questions that are highly relevant for underpinning transboundary groundwater resources management. Are all parties speaking the same scientific language? Are policies being built on solid ground? How to deal with differences in exploitation and protection strategies at different sides of the borders? Which part of a transboundary aquifer is really relevant for transboundary aquifer management? Questions like these will be briefly reviewed.

Transboundary Diagnostic Analysis of the Arafura and Timor Seas

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GEF IW Project Affiliation: Timor and Arafura Seas Large Marine Ecosystem

Keywords: Transboundary Diagnostic Analysis (TDA), Arafura and Timor Seas

Abstract Text:

The Arafura and Timor Seas Ecosystem Action (ATSEA) Project is a GEF-International Water Project and was designed to contribute directly to the prevention and management of regional threats in the ATS. The objective of this project is to ensure the littoral nations to work cooperatively to sustain shared living resources, conserve marine and coastal biodiversity, and improve sustainable socio-economic conditions and opportunities for coastal peoples.

The ATS Transboundary Diagnostic Analysis (TDA) was to identify transboundary priority environmental concerns, their direct and indirect drivers, and impacts on ecosystem services and human well-being. In developing the TDA, ATSEA has conducted several baseline studies and joined cruises which involved international scientists from Australia, Indonesia, and Timor-Leste. These studies include: Biophysical Profile Analysis, Socio-Economic Analysis, Governance Analysis, and Stakeholder Analysis.

The TDA identified the following transboundary environmental concerns: (1) Unsustainable fisheries and decline and loss of living coastal and marine resources; (2) Decline and loss of biodiversity and key marine species; (3) Modification, degradation and loss of coastal and marine habitats; (4) Marine and land-based pollution, and (5) Impacts of climate change.

Those priority transboundary environmental concerns were then discussed by ATSEA Regional Scientific Committee/Technical Task Group from ATSEA Countries to define drivers (direct and indirect) from each concern, and then score its rank. Results from this scoring were then used as input for the causal-chain analysis study. Based on the causal-chain analysis of sectoral drivers of environmental degradation in the ATS, possible options for actions in key sectors were identified. Key direct drivers of many of the priority environmental concerns included unsustainable fishing practices, oils spills and land-based pollution, coastal development, unsustainable agricultural practices and deforestation. Key indirect drivers included lack of regulations, compliance and enforcement, overlapping mandates between sectors, low public awareness, and lack of livelihood alternatives.

The TDA is currently being used as key reference to develop the Strategic Action Programme (SAP) and its associated National Action Programmes (NAPs) for Indonesia and Timor-Leste.

From Science to Governance in the BCLME: Twenty years of governance capacity and institution building through science

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GEF IW Project Affiliation: Benguela Current Large Marine Ecosystem

Keywords: governance

Abstract Text:

In the mid-1990s, the Governments of Angola, Namibia and South Africa, with support from international donors and the United Nations Development Programme, initiated collaboration and cooperation in scientific research and monitoring to better understand the Benguela Current Large Marine Ecosystem (BCLME). Active collaboration commenced under the auspices of the Global Environment Facility (GEF)-supported “BCLME Programme” which introduced the LME concept in the region and supported a Transboundary Diagnostic Analysis (TDA) to determine what the key threats and root causes are of observed negative effects and impacts on transboundary areas and resources. Using the results of the TDA, the countries consultatively developed and later endorsed, at ministerial level, a Strategic Action Programme (SAP) as a mechanism to address the key threats and root causes through specific planning, management and policy actions. The GEF-funded TDA-SAP process terminated in April 2008 with a key milestone of having mobilised an Interim Benguela Current Commission (IBCC) as the proposed permanent mechanism for the coordinated monitoring, assessment, planning and management of the LME. In August 2008 the Benguela Current Commission secretariat opened its doors in Windhoek Namibia with the appointment of the Executive Secretary and in June 2009, the BCC started with the implementation of its SAP with further generous support from the GEF-UNDP. This paper reviews the role of science as evidence for the need to implement an integrated transboundary LME management approach and, it presents information on capacity and institution building in the region to enable such an approach. It concludes with a presentation of lessons learned and good practices especially from a SAP implementation perspective.

HAI RIVER BASIN IWEM PROJECT: DESIGN, PRELIMINARY ACHIEVEMENTS AND PERSPECTIVE

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GEF IW Project Affiliation: Hai River Basin

Keywords: global environment facility, Hai River Basin, water resources and environment, integrated management

Abstract Text:

In this paper, design objective, concept and technology of 'Integrated Water Resources and Water Environment Management (IWEM) Project in the Hai River basin supported by the Global Environment Facility (GEF) are introduced, together with current progress of the project. Significance of this project in guiding future regulations in other river basins is also discussed.

Mangrove Ecological Restoration Strategy in the Gulf of Mexico Large Marine Ecosystem; and Participatory Community Approach

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Keywords: Mangrove, restoration, rehabilitation

Abstract Text:

Mangrove restoration pilot project is located in Isla del Carmen, Laguna de Terminos, Campeche, Mexico, including five lines of action: 1) forensic mangrove ecology and diagnosis, 2) restoration plan of action, 3) monitoring of success indicators 4) socialization and public involvement and 5) training and environmental education.

Mangrove environmental diagnosis in Isla del Carmen identified areas that need restoration. The main cause of mangrove degradation by erosion and siltation of tidal channels is due to changes in the hydro-period. The pilot site is located in the Bahamitas estuary and around 120 people (men and woman) from the community of Isla Aguada participate in this program, supported by the temporary employment program of the Federal Government. The program includes 125 hectares of restoration of the degraded mangroves during 2010 and 2012. The main activity is based in hydrological rehabilitation strategy. Training activities towards the "Isla Aguada" community were held, and mangrove, importance, goods and services, problems in the region and appropriate measures for their conservation and recovery were highlighted. Sharing lessons learned of restoration and training activities has been important for this program, aiming to forge mangrove restoration as a refreshing experience from planning, implementation and evaluation of success so it can be replicated in other degraded areas around the Gulf.

The protocol used for mangrove restoration in the GoM-LME is not a recipe for the recovery of all mangroves in the region, but it presents an innovative technical and systematic procedure. Among the main achievements of this proposal are the continuity of the restoration actions carried out with the participation and integration of the institutional group of mangrove restoration, the empowerment of local stakeholders and strong community participation.

Introduction to Science Policy Interface and Recommended GEF Processes

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Keywords: Science Policy Interface, Improved Decision-making, Participation, Social Sciences, GEF International Waters Processes, TDA, SAP

Abstract Text:

The GEF International Waters (IW) focal area represents \$1.3 billion in GEF grants along with over \$7 billion in co-financing for projects addressing transboundary surface, ground water, and Large Marine Ecosystems and their coasts. 170 countries, 149 of the GEF eligible, have worked together on their shared transboundary concerns and opportunities over the 20 years of the GEF. More than any GEF area, IW is so very complex, politically charged, and in need of processes that harness the science community so that complexity can be broken down into manageable chunks and governments do not politically skew nor ignore important transboundary issues. The aim of this Science/Policy Interface Session is to promote discussion among GEF IW practitioners about the recommended processes and key factors that can help to inform management decision-making at all levels from the multi-country transboundary scale to national sector scale to subnational entities ranging from provinces and watersheds to communities. What has worked, what can be useful? Another overarching scale--the global scale--is also discussed with the GEF Secretariat commissioning a number of initiatives. This keynote outlines processes and key factors associated with GEF IW projects over the years to bring science, developing country scientists, and science processes to help engage transboundary waters. The processes range from: the Transboundary Diagnostic Analysis (TDA) to science advisory bodies for the TDA, science advisory bodies for transboundary basin and LME institutions, transboundary science conferences in IW projects, activity centers, GEF targeted research projects, M & E indicator development and sampling requirements, co-management based on scientific extension services, and adaptive management strategies utilizing periodic TDAs or state of the water environment reporting to catalyze action. On the global scale, global assessments such as GEF GIWA or the GEF TWAP, effectiveness reviews such as undertaken by the GEF EO or the GEF IW Science Project, global social science learning and capacity building like GEF IW:LEARN, GEF global targeted research or methodology development IW projects, and work of the GEF STAP all help put a focus on science. Key features can also be listed and include first and foremost a project manager/CTA with credibility, fearlessness, and political savvy as well as GEF agency backstopping expertise with a stubborn streak to enforce GEF recommended processes, adequate budget from all sources, and stronger commitments from ALL GEF agencies to participate in the GEF IW Task Force and in GEF IW events. If GEF agencies and their project managers don't walk the talk, inherent complexity and political interference in transboundary projects will ensure that science and the local science community will be missing from projects and decision-makers will throw their hands up in confusion and not move from the status quo.

Abstracts from outside the GEF IW Portfolio of Projects

Constructing a multistakeholder platform to control non-point pollution at Lake Chapala basin, Mexico

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Keywords: Non-point pollution, governance, stakeholders

Abstract Text:

Sources of agricultural non-point pollution (pesticides and chemical fertilizers) were identified through polls and field visits in Lake Chapala basin, composed by 3215 km². Information was gathered and organized by agriculture-types: irrigated, rain-dependant, slope-based and greenhouses. In each one of these, products, types, quantities and characteristics of pollutants were defined. The list of products was crosschecked with national and international regulations to verify its toxicity and legal condition and an expert consultation was done to identify their effects on ecosystems and human health. Complementarily, a description of socio-economic features was elaborated for each type of agro-producers, in order to verify their particular problematic and points of view about the issue. Volumes, source areas and flows of agrochemicals in streams, rivers and Lake Chapala were introduced in a SWAT model to create predictive patterns and images to be presented to the groups of agro-producers and thematic related authorities (environment, health protection and food production). Late mentioned groups were also characterized to put them together with farmers' sub-groups in a Multistakeholder Platform that presents in comprehensive form interactions between them, identifying cooperative and conflictive possibilities. The platform includes Lines of Action, timeframes and specific responsibilities, with goals to be achieved, mainly to ban highly toxic products and reduce significantly volumes of other pesticides and N and P entering into water bodies. Special attention was put to relate platform goals to Integrated Lake basin Management governance pillars.

The impact of climate change in the Nile basin

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Keywords: climate change, Nile River, Runoff Impacts, Service Downscaling Modeling

Abstract Text:

The Nile basin represents a critical freshwater resource to most of the riparian countries. This resource is under considerable stress with rising levels of water scarcity, high population growth, watershed degradation, and loss of environmental services and these water resources are critically sensitive to climate change. Many past studies have demonstrated that modeling current and future changes in river run-off presents a number of challenges; the large size of the basin, the relative scarcity of data, its geographical location and the corresponding dramatic variety of climatic conditions and diversity in hydrological characteristics. On top of these hydrological challenges, the current generation of global models does not provide a single consistent scenario for the future climate of the region. In this paper we present the methodology followed in the UNEP project "Adapting to climate change induced water stress in the Nile River Basin", funded by SIDA. The main objective of this project is an assessment of climate change impacts and adaptation potential for floods and droughts within the basin. This project is being carried out as collaboration between DHI, the UK Met Office, and the Nile Basin Initiative (NBI). The project exploits a novel perturbed physics ensemble of climate models recently developed at Met Office. A complex selection procedure was followed to identify a suitable sub-sample representative of the whole distribution. Such a selection was informed by the model's ability to reproduce the key climatic processes in a number of key regions of Africa. The selected ensemble members were then dynamically downscaled to 50km using PRECIS model. This is a limited area version of the global climate model developed by the Met Office Hadley Centre and it includes the description of a number of surface processes relevant for hydrology. The outputs of these high-resolution simulations were bias-corrected and are being used together with a regional hydrological model to assess the impacts of climate change on the floods and droughts.

While the details of the implementation maybe region-dependent the basic design can be easily replicate for any part of the globe where there is an interest in studying flow changes in large basins in other part of the world.

IMPLEMENTATION PROGRESS OF SUSTAINABLE DEVELOPMENT IN VIETNAM SEAS

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Keywords:

Abstract Text:

With over 3260 km of coastline (except the island coastline), a large sea and over 3000 different islands, the Vietnam seas are rich in coastal and marine biodiversity and ecosystem, as well as mineral resources which are potentials for marine economics development. Based on the advantage, in the past years, Viet Nam has expended the development activities in the coastal areas and on marine waters. In fact, coastal and marine economics have importantly contributed to Vietnam economy and will play very important role in the country's development in the future. The development of industry, tourism, aquaculture, agriculture, port and shipping, urban expansion in Viet Nam have generally been concentrated in the coastal areas. These development activities are likely to increase strongly in the coastal areas in the near future due to unchecked population growth and expected developmental needs of the country.

Administratively, Viet Nam is divided into four levels: central, province, district and commune. In total 64 provinces of Viet Nam, there are 28 coastal provinces with over 125 coastal and 12 island districts in which over half of Vietnam's major cities located and more than 50 per cent of Vietnam's population (86,000,000 as of 2009) lives. Vietnam's coastal areas are one of the most densely populated regions in South East Asia and as a consequence, the areas have been and being exploited in a manner not compatible with sustainable resources management initiatives. About 20 millions of Vietnamese people have their livelihoods depending to the coastal and marine resources and 18% of them are still poor, most of them are living in coastal communes in Central Viet Nam.

Although Vietnam seas have the above mentioned potentials, however, its coastal areas and marine waters are also known as hotspots of adverse human impacts caused by industrialization and increase of urban population. Other serious impacts include natural hazards with uncontrolled damages, including climate change and sea level rise impacts. These have led to the unexpected influence for sustainable development purpose in Vietnam seas.

To overcome the challenges, the Vietnam Government has emphasized the integrated manner in managing coastal and marine areas. In the same time sustainable development for seas and the institutional framework for coastal and marine governance in the country has been formulated in the last 4 years (since 2008) with Vietnam Administration of Seas and Islands (VASI) appointed by the Government. The VASI is conduct the function of integrated and unified state management for coasts, seas and islands in Viet Nam.

The Sustainable Development Strategy for Seas of East Asia (in short SDS-SEA) has been implemented in Viet Nam since 2003 after signed the Putrajaya Declaration in Malaysia. In 2004, the Sustainable Development Orientations for Viet Nam has also been approved by Vietnam's Government (in short Agenda 21 for Viet Nam), includes marine component with priority for coastal and marine fisheries. Recently, the VASI with the PEMSEA's support decided to review the SDS-SEA implementation progress in Viet Nam during 2003-2010 period. The review has provided baseline results to develop a framework

plan for the SDS-SEA implementation in period 2010-2015 in Viet Nam. The gaps and constraints of the SDS-SEA implementation process in Viet Nam have been analyzed, and the relevant plans, programs, projects of Viet Nam and of the international organizations/donors which will be conducted in Viet Nam for 2010-2015 period, have also been collected for comparison and incorporation.

In the period of 2003-2010, Viet Nam has promoted the SDS-SEA implementation and reached to the important achievements in some key fields, such as: participated in regional sea coordinating mechanism, upgraded the institutional and policy for coastal and marine (including island) governance and management, strengthened awareness and capacity, promoted integrated coastal management (ICM), improved marine resources and environment, responded to coastal and marine hazards and man-made environmental consequences, coastal and marine economic development, improved coastal community livelihoods and poverty reduction, and promoted sustainable financing, namely:

- An adequate number of laws and regulations concerning environmental protection and marine and island sustainable development have been developed such as: Law of Environmental Protection, Law of Biodiversity, Law of Fisheries, Law on Water Resources, Law of Oil and Gas, Code of Navigation, Law of Tourism and Law of Mineral Resources,...The Law of Vietnam Seas and Law of Marine Resources and Environment Protection are in preparation.
- Viet Nam has developed (2007) and implementing the Strategy of Vietnam Seas towards 2020 focusing the major concepts, directions and tasks of marine environmental protection, conservation and resources management, about marine sciences and technology to maintain effectively and sustainably marine economic development.
- The Governmental Decree No.25/2009/ND-CP on Integrated Marine Resources Management and Environmental Protection dated 6 March 2009 (in force in May 2009) is first integrated governance policy in the field of coast, sea and island management in Viet Nam.
- ICM is currently being implemented in over 20% of Vietnam's total coastline length and about 4% of the local governments in the country have established coordinating mechanism for ICM implementation. Since last year, the ICM has been scaled up towards 2015 under international donors (PEMSEA, GIZ, AusAid, France and Jica).
- 100% of the local governments in Vietnam have disaster risk management programs. 100% of Vietnam's coastline has been mapped in terms of climate change vulnerability. Almost 100% of Vietnam's coastline has been mapped in terms of oil spill sensitivity.
- An integrated land and sea-use zoning plan has been developed in 2.8% of Vietnam's coastline and currently being developed in 5% of Vietnam's coastline; coastal and marine spatial planning currently being developed in 10% of Vietnam's coastline.
- About 50% of local government or almost all provinces with mangrove forests and some provinces with coral reefs and other wetlands have habitat management programs; almost 70% of important coastal habitats has been mapped and assessed.
- A national system of 16 MPAs has been planned and approved by the Gov. in 2010 to cover some 0,3% of Vietnam seas.
- About 100% of local governments in coastal areas have prepared and implemented management plans covering food security and livelihood management.
- Capacity building is considered as a high priority in state policy and Viet Nam has actively participated in regional and global coordinating mechanism such as: PEMSEA, COBSEA, GPA, IW-SCS, MMF, GFO, IUCN, WWF, etc.

The paper also emphasizes on the weakness and lessons learnt from the implementation of sustainable development in Vietnam seas, especially in the case of transboundary environmental issues, cross-sectoral management and collaboration, as well as local participation in GEF international waters programs.

Preliminary Results of the Groundwater Investigation of the Cuvelai-Etosha Basin and Moving towards Transboundary Cooperation and Management

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Keywords: groundwater, Cuvelai-Etosha Basin, transboundary, cooperation, small-scale irrigation

Abstract Text:

Preliminary Results of the Groundwater Investigation of the Cuvelai-Etosha Basin and Moving towards Transboundary Cooperation and Management G. Christelis, C Lohe, M Quinger, B. Van Wyk, Manuel Quintino, and K Villholth, Department of Water Affairs and Forestry, Namibia; German Institute for Geosciences and Natural Resources; National Institute for Water Resources - Ministry of Energy and Water, Angola, International Water Management Institute, South Africa Abstract The Cuvelai-Etosha Basin, which is straddled by the Kunene River Basin in the west and the Okavango River Basin in the east, is situated in the central-northern part of Namibia and extends northwards into Southern Angola. Around 37% of the population of Namibia lives in the Cuvelai-Etosha Basin, but the quality of the groundwater in the aquifer's central parts is generally not suitable for domestic use and surface water is imported through an extensive network of canals and pipelines from the Kunene River. The Ohangwena multi-layered aquifer, which covers a large part of the eastern extent of the basin, forms a TBA system across the border between Namibia and Angola. It has currently been delineated on its Namibian portions, while information and understanding of the Angolan part is still outstanding. Advanced drilling techniques uncovered the existence of the Ohangwena II freshwater aquifers in the sedimentary succession below the saline water. However these studies were to date, only carried out in Namibia and the overall understanding of the hydrogeological system, crucial for the sustainable management, is still at a preliminary stage. Results however show a very high potential for the development of currently poorly supplied areas. As part of transboundary cooperation, the utilization of this source for improved rural water supply coverage and as a back-up for bulk water supply to the urban centers as well as for the development of sustainable small-scale irrigation, to increase food production and to alleviate poverty, will be further explored, both locally and within a transboundary context. Major policy, legal, and institutional measures regarding the joint utilization and management of this transboundary groundwater resource will be encouraged through transboundary cooperation.

CHALLENGES FACING TRANSBOUNDARY AQUIFER MANAGEMENT IN KENYA

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Keywords:

Abstract Text:

The increasing demand for water as a consequence of population increase, socio-economic growth and climate variations together with the deterioration in water quality from various pollution sources, has resulted in upgrading the role and importance of transboundary waters including transboundary aquifer resources. In particular Kenya which has over 50% of its waters shared with the neighbouring countries has been left with no alternative rather than seeking dialogue with the neighbours on how best they can manage the shared waters. Kenya's Transboundary aquifers though not geographically mapped is not left out as it is the only source of water in the northern part of the country. Among the biggest challenge is the management of these transboundary aquifers for they are believed to be recharged from other countries and utilized in other different countries.

Transboundary aquifers management: how can science help?

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Keywords: Groundwater; Transboundary aquifer management; GEF IW: Science project

Abstract Text:

The paper addresses two key issues related to the management of international waters and particularly transboundary aquifers. The first issue is related to the differences of approaches and methodologies between science and management and the difficulties to transfer the scientific know-how into policy. This can be illustrated in the field of groundwater where the development of the resources has been rapid, generally unregulated, leading to falling water tables and little understood problems of pollution from both natural and man-made impacts. Numerous scientific investigations have drawn attention to these problems, yet their impact has not resulted in significant institutional actions. Is this the fault of science community to communicate effectively or is it an institutional failure - or both? The understanding and resolution of this issue is urgent and the framework of the projects like those in the GEF's IW portfolio has been thought to be a good opportunity to build synergies between science and management. The second part of the keynote presentation elaborates on the findings of the Groundwater working group established for GEF IW: science project to assess the use of science in these projects. It clearly appears from the review of the implemented GEF transboundary groundwater projects that science has played an important role, particularly the hydrological sciences including groundwater hydrodynamics, water quality and application of other tools such isotope hydrology and modeling. Science has provided understanding of water occurrence in most of the projects, great benefits and opportunities but also carries a warning. Yet, deficiencies still remain in scientific knowledge, data, and understanding of the functioning of the aquifer systems under investigation. Disequilibrium still exists between discovery and application, science and practitioner, know-how and end-user, mostly due to lack of methodological holistic approaches involving not only the physical aspects of groundwater systems, but also the management processes in terms of water shares for the different users including the ecosystem and potential impacts (quality and quantity) on the neighbouring countries sharing the resources.

Inventory and Mapping of Asian Transboundary Aquifers

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Keywords: Asian Transboundary Aquifers Inventory Mapping

Abstract Text:

Transboundary aquifers as part of groundwater resource systems are important for Asian countries. The updated regional inventory of Transboundary aquifers will form a basis to create awareness among the political leaders, policy makers and planners to improve scientific knowledge and to develop a toolkit for management of TBAs. The Asian Hydrogeological Map in 1:10 million scales as a base and update the preliminary inventory Asian Transboundary Aquifer Map. Those TBAs will also be classified in to two types: regional and local grade. Groundwater resources assessments have been taken in most countries of Asia. The hydrogeological survey on a medium scale has performed regional quantitative assessment of natural groundwater resources in most countries of Asia. However groundwater assessment, monitoring, and data management activities are operated regularly in China, India, Japan, Korea, and Thailand etc. The groundwater could be differentiated into eleven groundwater systems and 36 sub-systems. Those provide groundwater data and information over large area. There are several transboundary aquifers, involving two or more countries in Asia. Transboundary aquifers in Asia are based on groundwater systems analysis. We have collected the essential and the missed transboundary aquifers data. The Transboundary aquifers in Asia have been classified into two grades. The regional Transboundary aquifer extension is more than 2500 km². The situation of the regional TBAs will identify as the actual shape of the aquifers. The Local Transboundary aquifer extension is less than 2500 km². Most transboundary Aquifers are inventory according the published achievements in the last several years. Some TBAs are inventory with the analyses on the Asian groundwater resources map. The updated regional inventory of Transboundary aquifers will form a basis to improve scientific knowledge and to develop a toolkit for management of TBAs. On the update Map, 67 Transboundary Aquifers are inventoried. The Draft 2011 is the Achievement of the first step for detail mapping of Asian Transboundary aquifers. Those aquifers in Asia are important for building a society where all civilizations coexist harmoniously and accommodate each other. We are very appreciating for them who give the modified or corrected suggestions on the map.

Land Acquisitions: How will they impact transboundary waters?

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Keywords:

Abstract Text:

International land investments in Africa, Latin America and parts of Southeast Asia for the production of food and biofuel is a trend that has increased in recent years, not least after the food price crisis 2007-2008. The rising cost of food, coupled by water scarcity in countries in the Middle East and North Africa (MENA) region and in parts of Asia, motivated number of countries dependent on imported food to lower their vulnerability to future food price hikes by investing in agricultural land in foreign nations where they could produce food and agricultural goods (IFPRI, 2009). This has led to an increased international and domestic interest in farmland, primarily in Africa and Latin America (World Bank, 2010), but has also raised a series of concerns. Some claim domestic food security in host countries may be under threat (Matondi et al, 2011), while others fear that local populations with customary access to land are often evicted or excluded when large scale agricultural development projects are ushered in (Deininger, 2011). As land rights are being put into question, water rights are also coming to the fore. Most of the focus in the research to date has been on the terms and conditions of the contracts for investment and leasing of land. This information is usually not made public or is left ambiguous when available (Cotula, 2011). The effect that these investments will have on the domestic water situation in countries as well as on shared waters has not yet been analysed. The investors (whether governments or private sector) will want reliable access to water to grow crops on the bought or leased land. Such irrigation also requires energy, some of which needs to come from hydropower. Potential conflicts around land and the increased water utilisation in the countries where investments are being made can influence transboundary relations.

The aim of this exploratory report is to explore how the current surge in land acquisitions and investments by foreign countries, sovereign wealth funds and private corporations, as well as domestic investors, will affect transboundary water management. It will outline some key questions in relation to the nexus between land acquisitions and transboundary water management, such as:

Will the countries where the investments are being made become less powerful than some of their riparian neighbors, or will this instead lead to an increase of their bargaining power (Jägerskog and Zeitoun, 2009)? Will they be squeezed between a strong riparian protecting its own interest and a strong foreign government (e. g. India and China) seeking to safeguard its food security?

To shed some light on this intricate nexus, this report will provide overview and analysis of transboundary water management; trends in land management and land acquisitions; global food and land dynamics; and the local, national and regional level implications of land acquisitions. It will then provide some case illustrations from the Nile and Niger basins. Though the issues discussed occur in multiple regions, this report focuses on sub-Saharan Africa (SSA), which is the region attracting the largest quantity of land investments. The report does not claim to provide a comprehensive answer to the issues raised here but instead seeks to identify key areas in need of improved and more extensive research.

The key messages of the report are:

- Land investment is a water investment. Water is often presumed to be included without explicitly being mentioned in land lease agreements.
- Regional Economic Communities (RECs), River Basin Organisations (RBOs) and regional organisations have little or no role in the land acquisitions on record to date. Large land deals will, however, very likely impact their mandate and ability to function.
- The type of water (green water or blue water and the intensity of its use) used for the land investments determines its effect on transboundary water management.
- Water that is being used for irrigation in land leased by foreign parties does not feature in the transboundary discussions in many, if not all, shared basins.
- Water needs should be put into the land acquisition contracts in order to clarify the water requirements of the investors' projects and to regulate their water use.
- Sustainable water use should be acknowledged explicitly in the international standards for responsible agro-business investments.

Capacity Development for Sustainable Water Management in Rural Area in Cambodia

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Keywords: capacity development, sustainable water management, Cambodia, enablers

Abstract Text:

This presentation proposes a method for capacity development for water management in rural areas of Cambodia and towards the sustainable development of the society. In recent years, it has become apparent that Cambodia is one of the developing countries in Asia whose economy is rapidly growing, while it must deal with environmental problems. This is especially challenging for people in rural areas who are still poor, but are facing environmental pollution, such as water pollution, solid wastes, etc.

First of all, we review the overall situation of rural areas and governmental development policies in Cambodia, and lay out the existing problems from the perspective of sustainable development. In general, it was observed that the people in rural areas are not only ignorant of the governmental decisions but are also unaware of their basic rights. Whereas, the approach of the governmental decisions are rather top down, perhaps with emphasis on "people need to know and understand".

Secondly, we consider two villages in rural Cambodia, Trapeang Snao and Run Ta Ek Eco-village, as case studies in order to assess their strengths and weaknesses for sustainable water management. According to our survey, they use drinking water from wells and are trying to live a sustainable life, but in some cases their self-independence is constrained due to low economic profile, geographical remoteness, and "basic technical know-how" and sometimes due to lack of public facilities and schemes such as appropriate waste management system etc. At the same time, there is a potential for the villagers to improve their own lives by learning basic methods of creating infrastructure such as irrigation canals for year-round production of crops and creation of simple drinking well devices.

Finally, we propose the bottom up approach of "enablers" as a community leader of capacity development in rural areas for sustainable water management. This system of creating "enablers" is a grass roots and participatory capacity building program that will create local knowledge and motivational leaders to start building the basic community-improvement infrastructures. In detail, we make our proposal on education scheme for training of "enablers" and action plan.

Predicting and Solving the Dangers of Flood in Urban Basins Caused by Torrential Rainfalls: Based on Case Studies of Ansan Stream and Hwajeong Stream

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Keywords: urban flooding, Ansan Stream, impervious surface, saturated water content, hydraulic conductivity

Abstract Text:

Recently, Korean urban areas have been suffering from frequent flooding disasters caused by abnormal climate that increased the frequency of heavy rainfalls. Therefore, this research was conducted to assess the vulnerability of the urban areas to heavy rainfalls and to propose a viable solution in preventing floods. The target of this research was Ansan City, an urban area with Ansan and Hwajeong Streams and their river basins. First, in order to determine the status of Ansan City's flood precaution, a simulation of heavy torrential rain was run on Ansan urban basins using a model named CAMEL. The result showed that 35% (18.01km²) of the urban basin, which is mostly the downtown areas of Ansan City, is flooded within 30 minutes of rainfall. After 60 minutes of rainfall, even though flooding areas stayed approximately the same, flooding exacerbated in terms of its depth, with approximately 1.2km² of Ansan's already flooded area experiencing water level higher than 1m. Even after rainfall stopped, there were no signs of improvements in flooding conditions. The simulation also showed the six regions of Ansan City that showed that are most vulnerable to flooding. To prepare flood prevention measures for Ansan City, this research has drawn up scenarios to improve the infiltration capacity of the soils and to reduce impervious surfaces in urban areas, which would help to drain rainwater in the basins, by adjusting saturated water content and hydraulic conductivity. After comparing the efficiencies of different scenarios, it was discovered that reducing only the impervious surfaces have only negligible effects in preventing flooding. Only when the water content and the hydraulic conductivity were adjusted together, did Ansan City see a significant reduction in flooded areas by a percentage between 2.24% and 7.28%. However, these methods alone are not sufficient enough to allow a complete control over flooding issues in the urban basins because of the regional and topographical characteristics of Ansan city. Thus, apart from the previously proposed solution to increase infiltration and decrease impervious surfaces, an upgrade on the artificial water discharge system is indispensable for Ansan City to prevent flooding disasters. In other words, simultaneous projects such as expanding the rainwater discharge pump facilities and improving processing capacities of pipe networks mainly around the vulnerable regions, and replacing the rainwater sewerage with a larger system must be conducted all together to see more improved flood precaution for Ansan City.

Using Social Marketing to Put People at the Heart of Science

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Keywords: social marketing, behaviour change, hypoxia

Abstract Text:

Social marketing is management approach that uses audience research to design cost-effective interventions to change the way humans behave in ways that benefit individuals, communities and wider society. Science can help us to identify and measure environmental problems such as coastal hypoxia, but social marketing has a proven track record in changing damaging behaviours such as over-use of fertilizers by farmers in developing countries. The discipline that has helped to reduce HIV and tobacco use worldwide has important lessons for resource management.

Groundwater Challenges for Rural Water Supply

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Keywords: rural communities, water services, water sources, groundwater resources, water infrastructure, boreholes, wells

Abstract Text:

South Africa's rural communities are geographically located in water scarce areas where surface water resources are either not available or they are contaminated. For municipalities as water institutions responsible for providing this service, installing and maintaining infrastructure necessary to take water from rivers to the sparsely located rural areas is expensive. Consequently, the assumption is that groundwater is the only realistic solution since it can be accessed cheaply, is generally of excellent natural quality and requires no prior treatment. While this may be true, the study shows that municipalities still fail to deliver water to such communities as promised. Infrastructure is put in place but cannot provide water on a regular basis. Boreholes often dry up, leaving communities with no alternatives but to rely on hand dug wells which are mostly prone to contamination due to being sited next to latrines or rubbish dumps. In some cases the problem is complete lack of maintenance of water infrastructure by institutions. One other challenge in the country is however that there is not enough information or data in terms of groundwater availability and utilisation. Thus boreholes are often sited at random, or by socioeconomic criteria alone, or under the assumption that water supplies are safe and sustainable without prior water quality testing or understanding of the nature of the resource. In some rural communities groundwater availability is completely inadequate but the municipalities are not well equipped or empowered to realise and address these problems. Whatever the problem, the study concludes that the process and costs associated with providing water services to rural communities is often underestimated due to the assumption that groundwater is accessed easier and cheaply. Thus water services are often left to groundwater resources to sort without thorough investigations into the availability and sustainability of groundwater resources, and no proper planning in place to ensure continual operation of infrastructure such as boreholes or hand pumps. Consequently, rural water supply projects fail, and communities have no alternative but to rely on unsafe water sources for survival, which contribute to poor health and exacerbate conditions of poverty. The study is part of a government project seeking to identify areas in South Africa that are currently having challenges accessing water services with the intention of coming up with technologies as solutions to speeding water service delivery in water scarce areas. The study uses a qualitative approach, and will use a small rural community in South Africa as a case study to demonstrate how dependence on groundwater resources with no proper understanding of the resource can cause failures in water service provision. The study will also highlight the impact of such failures on the rural communities being serviced.

Adaptive Management as a Driver for Change in Central Asia

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Keywords: Adaptive Management, Central Asia, Water Planning, Cross-Cutting, Regional and National

Abstract Text:

A 2-year long EC-funded technical assistance project, "Water Management in Central Asia", began in July 2008. Previous international aid to improve water management in CA had achieved relatively little success, albeit that much of this assistance had been directed towards improved agricultural practices/management (accounting for some 90% of water abstraction). As with most projects, the ToR for this project were result-orientated, but few restrictions were placed on how those results were to be achieved. Working in close co-operation with the EC Project Manager, this allowed the project to be adaptively managed, ensuring that the work undertaken dovetailed optimally with projects funded by other donors and took account of developments in the beneficiary countries. The project evolved as beneficiary priorities changed, with stakeholder training customised to the needs of individuals, different organisations and specific countries.

Excellent communication was maintained with stakeholders at all levels, with the project focusing on the adaptation of IWRM and EC Water Framework Directive approaches. Recommendations and pilot projects were based heavily on evolution, rather than revolution. Thus, pragmatism was a more important driving factor than technical excellence, taking account of the range of socio-economic situations in the beneficiary countries. Nationals with expertise in particular areas were provided with more advanced techniques/training than they currently employed and those individuals were then used to develop the ideas further in pilot projects. The work included economic, legal, institutional reform and water management issues (drinking water, sewage collection/treatment, ecology, water use, monitoring - quality and quantity - and classification). The Project Team was also key to the development and operation of a donors' forum to prevent duplication of tasks and to re-assess priorities in the light of other on-going and planned work.

Project results have fed into numerous Central Asian initiatives at the national and regional level including the development of the Swiss Development and Cooperation Agency's water strategy for Central Asia, the WB Central Asia Energy and Water Development Programme, and national IWRM strategies in Kyrgyzstan and Tajikistan. The importance of national interpretation of complex conceptual ideas, such as IWRM, has been recognised and the need for gradual, bottom-up institutional change accepted.

The UK Natural Hazards Partnership

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Keywords: Natural Hazards, resilience

Abstract Text:

An extreme weather event or other natural hazard such as flooding, drought, cold, heat, earthquakes and volcanic ash has the potential to cause adverse impacts on human health along with the impacts on utilities such as electricity and water, and transport. Sharing information effectively between different partners should enable organisations to provide an early warning of potential incidents, offer a specific technical response to a major incident and provide consistent, coherent information to the wider community.

The Natural Hazards Partnership aims to bring together expertise across the UK's leading Public Sector Agencies to provide responders with a focal point for hazard information and advice. The Partnership is currently developing ways to work together to provide joint multi hazard services. These include a pilot for a daily Multi-hazard Strategic Assessment sheet, offering responders at a glance, a forward look summary for a range of hazards. We are also creating a Hazard Impact Model.

Building resilience in our infrastructure is important to reduce our vulnerability to hazards and threats. This can be achieved, once the hazards and threats are understood, by for example: improving protection; encouraging ability in organisations and their infrastructure networks and systems to absorb shocks and recover; and enabling an effective local and national response to emergencies.

I will describe the setting up of the UK Natural Hazards Partnership and discuss the important role as it starts to develop tools to help organisations across many sectors to fulfill their responsibilities in building and maintaining resilient infrastructure.

Alleviation of Potable Water Crisis in Climate Vulnerable areas by Creating Artificial Aquifer using Rain Water Harvesting

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Keywords:

Abstract Text:

Rain water harvesting is a popular idea to mitigate potable water crisis in different climate vulnerable areas of Bangladesh as well as in the world. But surface or rain water harvesting through artificially made underground sand reservoir (Aquifer) can be a new concept or technique to address as an alternative solution regarding this issue. In this action research, it has not only included the artificial recharge phenomena but also include artificially developed isolated underground sand reservoir like an isolated natural aquifer. This isolated sand reservoir has been composed artificially by coarse sand with gravel (preferably 0.7 to 1.2 mm sized materials) because it will provide best storage capacity and specific yield and it has also been protected from surrounding hydro-geological environment through developing hydrological barrier by placing impermeable materials like clay. There would be very low possibility to drain water from this reservoir except surface recharge or discharge point. Water will be stored in this reservoir through recharge well or shaft and the source of water will be mostly rain water and in some areas surface water (e.g., river water, pond water, lake water etc.). Recharge period will mostly be wet season but this reservoir would provide potable water through the year with the certain optimum conditions. The mode of discharge can be discharge well or dug well. Proper design and development of artificial aquifer and maintaining recharge and discharge water quality (physical, chemical and biological) would be main concern of this intervention. This technique could be applied in existing dry pond, low lying areas and in the slope of a hill and thus useful in some places of coastal area, drought prone area and in hilly areas of Bangladesh where potable water scarcity present.

MINING REHABILITATION IN RTNMC, BATARAZA, PALAWAN, PHILIPPINES: AN INTEGRATED STRATEGY FOR TERRESTRIAL AND COASTAL ECOSYSTEMS RESTORATION

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Keywords: Mining rehabilitation; Biodiversity conservation; Agro forestry; Ecosystems restoration

Abstract Text:

Rio Tuba Nickel Mining Corporation (RTNMC) is operating in the Municipality of Bataraza, in the island of Palawan, in the Philippines.

This report describes the innovative approach of operationalization to shorten the lag time of establishing significant vegetative cover in a totally mined-out area, at the same time addressing such concerns as biodiversity conservation and post-mining ecosystems restoration, food production through agro-forestry combinations, and empowerment of the Indigenous People in preserving their cultural heritage, among others.

Photo-documentation are shown covering the different aspects of site preparation of mined-out areas, planting stock preparation and nursery operations, outplanting activities, as well as observed recolonizing faunal populations to include invertebrates, amphibians, fish, reptiles, birds and mammals.

Development of WORLDLAKE – global database for wide limnological studies

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Keywords: WORLDLAKE, global database, natural lakes, manmade lakes

Abstract Text:

Global database, abbreviated as WORLDLAKE, was developed over past ten years for wide limnological studies (Ryanzhin, Straskraba 1999; Ryanzhin, Ulyanova Ryanzhin et al. 2001). WORLDLAKE comprises vast geographical, morphometrical, hydrological, thermal, climatologic, limnological etc. literature data for "limnologically studied" lakes of the world, i.e. lakes where any limnological studies have been ever carried out. At present the database contains vast data on more than 51,000 natural (glacial, tectonic, volcanic, karst etc.) and 8,100 manmade (river dam lakes, excavated ponds, mining lakes etc.) lakes located in more than 150 countries, as well as more than 5,600 references. By continents and countries these data are distributed as following. Natural lakes: Europe (20,700 lakes), Asia (15,190), North America (11,870), Australia and Oceania (1,200), South America (1,080), Africa (700), Antarctic (230), Russia (9,821), USA (6,744), Canada (4,829), Kazakhstan (3,378), China (3,009), Poland (2,998), Germany (1,887) etc. Manmade lakes: Europe (4,093 lakes), North America (1,690), Asia (1,417), South America (585), Africa (351), Australia and Oceania (291), USA (1,399), Belarus (1,306), Russia (793), Germany (612), India (530), Brazil (450), Australia (243), Spain (221) etc. Currently, WORLDLAKE encompasses approx. 270 Mb. WORLDLAKE is presently enlarging and improving through new published and early not accessible data. Data from WORLDLAKE were previously analysed. The first results derived from the data accumulated in WORLDLAKE are global power statistical function of distribution of natural lake surface area distribution, and estimates of total lake surface are (2,7 ml sq.km) and volume (179,6 thousand km²) (Ryanzhin 2005, 2006). Currently, among others, we are going to calculate global statistics for morphometrical features of world lakes.

Greywater Management in Egypt

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Keywords: greywater, management, domestic water, reuse

Abstract Text:

In Egypt water is becoming an increasing scarce resource so the utilization of low quality water “greywater” - for specific purpose saves conventional resources. Greywater is generated from domestic usages including showers, bathroom sinks, kitchen sinks, dishwaters and washing machines. It is distinguished from blackwater- sewage - which is regarded as heavily polluted wastewater generated from toilet and contains large concentrations of fecal matter and urine. Greywater can be reused after appropriate treatment in myriad activities such as crop production, irrigation green spaces and golf courses, groundwater recharge, influent for industrial cooling systems and domestic cleaning. The objective of this research is to study the possibility of greywater reuse management and highlight the main obstacles and requirement for its reuse. This study covers greywater management system, greywater generation, potential for reuse and water balance. Moreover, cost / benefit, positive and negative impacts of greywater reuse are covered.

The study revealed that the application of greywater management strategy saves fresh water but needs building capacity and awareness, modification of wastewater networks and codes of building.

COMBINED NETWORK SIMULATION-OPTIMIZATION AND MULTI-CRITERIA ANALYSIS IN EVALUATION OF WATER ALLOCATION SCENARIOS

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Keywords: water systems, simulation, optimization, multi-criteria analysis, water allocation, scenario

Abstract Text:

River basin simulation models are commonly used to simulate water system's performance and help the decision makers to evaluate alternative scenarios of water allocation. If the number of scenarios is large, it can be extremely difficult to follow system's operation and get a valuable picture on its spatial and temporal behavior. In most cases the decision maker is overburdened by quantity and complexity of information generated by model, particularly if system operation is repeatedly simulated for multiyear periods. Related problems are how to organize assessment and evaluation process, which model(s) to use for simulation and multi-criteria analysis, and finally how to select the scenario with most desired long-term consequences. Possible approach is to use selected parts of simulation model's output and interpret system behavior by means of performance indicators, create decision matrix and perform multi-criteria analysis to rank alternative scenarios. However, it is well-known that most of academic and professional software in this field does not permit manipulation of its output, simply because software performs as a black-box: user can get what the developer offered. In other words, the end user can not intervene in the source code to adjust an output. Therefore, end user is faced with a problem how to directly use available output for multi-criteria analysis. We define a procedure to overcome the problem: (1) combined multiyear simulation/optimization of water system operation; (2) computing spatially and temporally distributed system performance indices such as supply reliability, resiliency and vulnerability; (3) weighting the performance indices by the decision maker; and (4) ranking the simulated scenarios by means of multi-criteria analysis. The core parts are network model MODSIM, while the multi-criteria analysis module uses an ideal-point-distance methods TOPSIS and CP. A case study application will be briefly presented for selected regional system in Serbia.

Numerical experiments to determine design factor for groundwater dam

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Keywords: Groundwater dam, Thickness and depth of wall, Hydraulic conductivity of wall, Sensitivity analysis, Visual Modflow

Abstract Text:

A Groundwater dam is generally designed and installed at the sites where alluvial aquifer is formed widely to store groundwater for the resource of drinking water or agricultural use. The groundwater dam is planned to be constructed at Namwon-Si, Sandong-Myeon in Korea . The 3 installation candidates (site 1, site 2, and site 3) are being considered as an appropriate construction site. In this research, numerical modeling was performed to investigate the effect of (1) dam's location, (2) wall thickness, (3) hydraulic conductivity, and (4) wall depth on aquifer storage capacity using conventional groundwater modeling program, Visual MODFLOW. Also, a factor considered most significantly was discussed through sensitivity analysis. Based on the result of sensitivity analysis, optimum installation location, hydraulic conductivity, thickness, and optimum wall depth of groundwater dam were found out. Conclusively, the optimum location is site 3 since it has the widest alluvial distribution among that of other two sites. Also, it was found out that the installation location and wall depth give more significant influence in obtaining large storage quantity than wall thickness and hydraulic conductivity. For wall thickness and hydraulic conductivity, there are critical points where storage shows almost no more increase although the wall thickness and conductivity increase. Finally, when the groundwater dam will be constructed, rather than increasing wall thickness and hydraulic conductivity, it is more important to select the location where alluvial unit has wide distribution and large thickness.

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Capacity Development of Rural Water Supply and Sanitation

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Keywords: water

Abstract Text:

Safe water is an essential element of every life. Available resources and using of safe water is considered as one of the important indicators for the development as well. Since the working areas of SEDS are close to the coastal area therefore access to safe drinking water is a very big challenge for the communities living here. Arsenic contamination in the underground water has complicated the situation even more. The Deep tube wells are very expensive to install in the coastal area. Promote alternative source for safe drinking water for community people.

Mollusks Resources in Western Coast of the Tonkin Gulf

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Keywords: mollusk, Tonkin Gulf, Gastropod, Bivalve, Scaphopoda, Cephalopod, Amphineura, Standing stock, resource, suitable aquaculture, conservation

Abstract Text:

It has been classed 856 species of the mollusks which belong to 120 families and 5 classes living in western coast of the Tonkin Gulf. The class Gastropod was the most abundant, with 449 species, the Bivalve with 368 species, the Scaphopoda with 10 species, the Cephalopods with 19 species, and the Amphineura with 8 species. Standing stock was estimated about 366,749 tons, that annually caught 80,000 tons. The causes of the resource depletion were human and natural, but the human factors played a key role. The fundamental orientations for developing the resources include: exploiting during harvest seasons, planning suitable aquaculture, moderate exploitation for the resources restore themselves; combining exploitation and conservation.

Is There a Groundwater Pathway Driving the High Productivity of Tonle Sap Lake, Cambodia?

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Keywords:

Abstract Text:

Tonle Sap Lake (Cambodia) is the largest freshwater lake in SE Asia, and is reported to have one of the highest freshwater fish productions anywhere. The lake's biology is influenced by its very unique hydrologic cycle. During the dry season the lake drains through a tributary to the Mekong River. During the wet monsoon, the flow in the connecting tributary reverses, adding huge volumes of water and increasing the lake area about 4-fold. Lake waters are thought to be phosphate limited, but there have been few studies concerning nutrient delivery pathways.

We hypothesize that nutrients are at least partially delivered via groundwater discharge, a direct consequence of the annual flood cycle. Water seeps underground during flood stage (depth ~10 m), accumulating nutrients in the subsurface from decaying organic matter, and returns to the lake during the transition to the lower stage (~1 m). Results of two field expeditions showed that there were portions of the lake that showed significant enrichments in radon, a groundwater indicator, and dissolved nitrogen. These same areas were generally characterized by very low electrical conductivities. Samples collected from nearby groundwater wells also showed this inverse relationship between radon and conductivity. Our results thus suggest that groundwater pathways are likely important and larger-scale surveys, including the area around the confluence of the Mekong River with the Tonle Sap tributary, should be undertaken. This is practically important now as accelerating development of dams and diversion projects in the Mekong basin now pose unknown threats to the lake's ecosystem.