FOCUS ON: NATURAL DISASTERS

InterCoast Network

INTERNATIONAL NEWSLETTER OF COASTAL MANAGEMENT

Coastal Resources Center, University of Rhode Island
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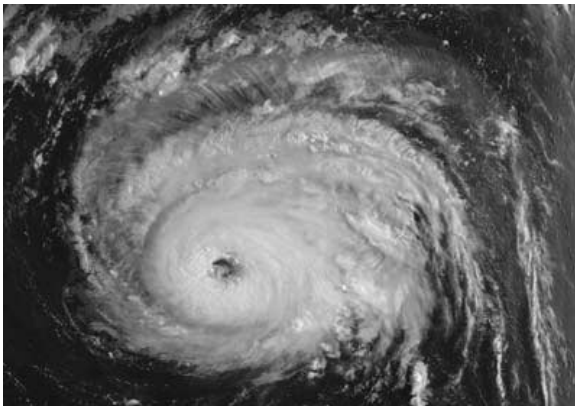
Complacency or Action: Which Way to Deal with Natural Hazards?

By Pamela Rubinoff and Noëlle F. Lewis

Natural events become natural disasters when peoples' lives, properties and ways of life are threatened. The occurrence of a natural disaster cannot be considered an individual event; natural disasters are a conglomeration of many different earth processes, sometimes enhanced by human influences, each having its own cause and disastrous effect. Natural hazards affect man in the form of earthquakes, hurricanes, typhoons, severe storms, volcanoes, avalanches and more. Man feels the effects as loss of life and property manifested in erosion, flooding, drought, mud slides, avalanches, etc. Civilization has explained natural disasters in many ways: punishment by the gods, voices of demons, or loss of luck. Today, communities have accepted that Mother Nature, a force that cannot be tamed, causes natural hazards worldwide affecting both rich and poor.



Eye of a Hurricane

As the earth's population grows, reaching 6 billion in 1999, and the population density grows in areas of frequent hazards, even a small natural hazard event can be considered a crisis. Nevertheless, civilization as a whole has not heeded nature's warning and moved from these vulnerable areas to safer grounds. Instead, we have tried to defy Mother Nature, to withstand her forces. Our attempts include building huge coastal defenses, designing better buildings to survive her wrath, or buying insurance to subsidize our losses. In some regions the chosen solution is evacuation, where extensive efforts are made to save peoples' lives while accepting that property can be reclaimed and rebuilt. In other regions, those that do not have the resources for such alternatives, there is only hope for survival. No community is immune to that one event that causes huge loss of life and property, months and even years of disruption, and millions to billions of dollars spent to re-build or re-locate entire villages, towns and cities.

Though not a new concept, recent emphasis has been placed on This issue of InterCoast looks at various tools of hazard mitigation and disaster management including prediction, planning and management, infrastructure development, partnerships and public education. Hazard mitigation can not be considered a luxury—it is an essential component of community planning and economic development. Mitigation strategies should be incorporated into permitting decisions, infrastructure design, and long-term economic development schemes. The "menu" presented here offers decision-makers a selection of pre-disaster proactive initiatives and post-disaster recovery actions from which to build a comprehensive strategy.

Prediction is a critical tool for understanding hazards and risks.

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Hazard Mitigation

1. Sustained action to reduce risk to property, human life, natural resources and economic health of our communities
2. Actions that have long-term impacts and benefits

Theme Advisor: **Pamela Rubinoff**

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COASTAL RESOURCES CENTER
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Improving Hurricane Forecasting

By Isaac Ginis

Tropical cyclones are among the most dangerous of our natural hazards. Each year communities suffer devastation, destruction and often-severe casualties from tropical cyclones. Today, the coastal United States is occupied by millions of people who live and vacation along the coast. This makes the United States more vulnerable now, than ever before, to the effects of tropical cyclones (hurricanes).

Improvements in forecasts, warnings, communications and public awareness have greatly reduced the loss of life associated with hurricanes. Nevertheless, storm-related damage has increased significantly as coastal population growth in the United States outpaces the rate of improvement in official hurricane track predictions. In addition, hurricane preparation costs have increased eight-fold in the past nine years from US$50 million per storm in 1989 to an estimated US$300 million per storm in 1998, or about US$640,000 per mile of coastline warned.

In recent years, new research tools have contributed to improved hurricane prediction. But the most important advances have been made in developing new hurricane forecast models. Computer modeling is the basis for all United States National Weather Service forecasts, including hurricane predictions. New computer models are continually being developed to improve weather predictions for all types of weather events.

Improving the Forecast Model

In the 1995 hurricane season, the National Weather Service (NWS) began using a new forecast model developed at the National Oceanic and Atmospheric Administration's Geophysical Fluid Dynamic Laboratory (GFDL). This model predicted the path of a hurricane with approximately 20 percent more accuracy than its predecessor. In addition to predicting where the hurricane would go, the model predicts where the heaviest rain would be located, the wind and air pressure patterns and other parameters.

While hurricane track prediction has been improved significantly, there is little new skill in forecasting of storm-intensity change. This shortcoming greatly impairs forecasters' ability to provide timely hurricane warnings. Given the expense and inconvenience of hurricane evacuations and emergency preparations, the public benefits greatly if unnecessary hurricane warnings can be avoided. Furthermore, residents are likely to take hurricane warnings more seriously if the intensity forecasts are shown to be more reliable. The Federal Emergency Management Agency requires coastal communities with limited escape routes to have evacuated before the arrival of gale-force winds, typically 24-48 hours before landfall. Errors in wind, storm surge and rainfall sometime prevent accurately defining the most vulnerable regions to expedite preparations well in advance of the projected landfall. With potential damage from a single storm exceeding US$25 billion (e.g., Hurricane Andrew in 1992), reliable short-term preparations, while expensive to undertake, can result in large net savings.

One potentially significant constrain on the GFDL hurricane-prediction model is lack of

knowledge about air-sea interactions. Physical oceanographers at the University of Rhode Island, Graduate School of Oceanography, Rhode Island, USA, have conducted studies of the effects of air-sea interaction on hurricane behavior. Coupling the GFDL hurricane model with an ocean model can identify positive and negative feedback mechanisms that exist in the hurricane-ocean system and are important for accurate prediction. To account for air-sea interaction in hurricanes, a new coupled hurricane-ocean prediction model (coupled model) has been developed.

Hurricane Opal in October 1995 offers a good example of the improvements in the hurricane intensity forecasts using this new model. Opal was the most destructive hurricane to hit the U.S. mainland since Hurricane Andrew, inflicting about US$3 billion of insured property damage and nine deaths. The operational model did not predict the rapid increase in speed and intensity, approaching Category 5 status, within 12 hours of landfall, giving no time to alert the public. Fortunately, the storm quickly weakened; yet, it still caused extensive damage.

Simulations using the new coupled model have been conducted for Opal and other hurricanes in the Gulf of Mexico and Atlantic Ocean. In each case, inclusion of ocean coupling led to substantial improvements in the prediction of storm intensity.

Real-Time Testing of the Coupled Model

During the 1998-99 hurricane season, the new coupled model was run in near real-time mode. In total, 135 forecasts were performed: Tropical Storm Alex (8 cases), Hurricane Bonnie (23), Hurricane Danielle (18), Hurricane Earl (6), Hurricane Georges (42), Hurricane Ivan (3), Hurricane Jeanne (10) and Hurricane Mitch (25). The new model predicted certain parameters significantly better than the operational GFDL model.

Some of the best forecasts made by the coupled model were for Hurricane Bonnie and Danielle. On August 23, 1998, Hurricane Bonnie was moving toward the U.S. East Coast. The GFDL model forecasts largely over-predicted storm intensity. However, the intensity prediction by the coupled model was more accurate than the GFDL prediction. Similar results were found for Hurricane Danielle.

The coupled model is being tested at the National Centers for Environmental Prediction during the 1999-2000 hurricane season. If the model validations are successful, the coupled hurricane-ocean model will be implemented as an official prediction system at the National Weather Service.

Conclusions

At the same time that model development has progressed, emerging technologies have matured to a state where observations and models can be integrated, thus improving both our understanding and prediction of hurricanes. The NWS has nearly completed its observation network modernization. In addition, a mobile observing system is being developed that will be positioned in front of any hurricane reaching land within 24 hours of landfall. This will further improve predicting hurricane landfall.

This hurricane-ocean model being developed by physical oceanographers at the University of Rhode Island is about more than just science and technology. This translates directly into saving lives, property and millions of dollars in evacuation costs. This new model is expected to more accurately forecast where a hurricane will strike land, thus allowing better predictions of coastal areas needing evacuation.

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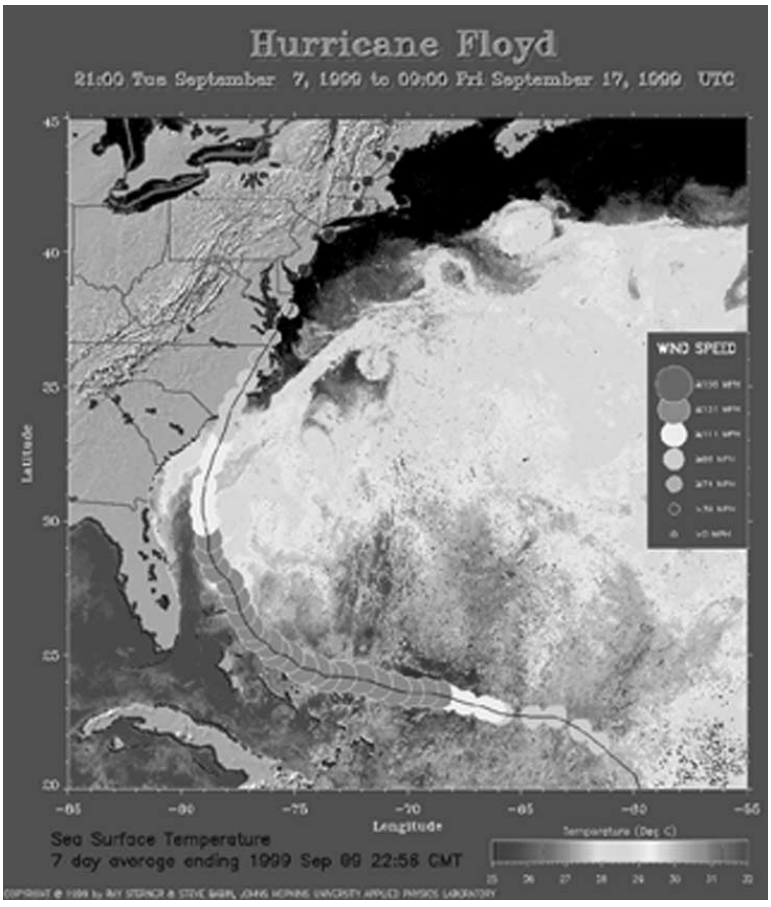

Mitigation Efforts After Hurricane Mitch

By Henrik Franklin
Photos by David Mangurian, Inter-American Development Bank

Central America is one of the most natural hazard-prone regions in the world. Every year hundreds of small- and medium-scale disaster events affect the region. In 1998 Hurricane Mitch resulted in direct and indirect damages estimated at US$6.3 billion and caused more than 10,000 casualties. Industries such as tourism and agricultural exports, which are largely coastal based, suffered greatly.

The extensive coastline makes Central America especially vulnerable. Coastal areas are affected by the direct threats from the ocean (waves, wind and flooding) and the indirect impacts from inland precipitation (increased low-lying coastal area flooding and sedimentation). Extreme events such as Hurricane Mitch are even more devastating due to factors such as poverty and social exclusion, as well as unsustainable exploitation of natural resources and inadequate coastal management.

The connection between disasters and other social factors is not always clear and, to a large extent, has not received enough attention in this or many other regions. For example, the need to integrate watershed and coastal zone management is evident. Coastal and marine ecosystems, such as mangroves, wetlands and coral reefs, play a vital role as protection barriers for inland areas. Nevertheless, these important resources are suffering from over-exploitation and deterioration due to unsustainable mariculture, salt production expansion, uncontrolled tourism development, and poor water quality due to sedimentation and pollution from land-based sources. Many of these problems can be decreased through upstream soil conservation and land-use planning.

Mangroves protect the coast from storms and floods

Reconstruction of Central America

In March 1999, the Inter-American Development Bank (IDB) and the Central American Integration System organized a regional workshop in San Salvador, El Salvador, on the topic of environmental management and natural disaster vulnerability and mitigation. Over 130 government officials and environmental and natural hazard experts from El Salvador, Honduras, Guatemala and Nicaragua along with representatives from other governments, institutions and multilateral organizations participated. The purpose was to share experiences and draw "lessons learned" from the relationship between natural hazards and resource management. In an effort to decrease the risk of similar damages in the future, ideas, policies and action plans were explored that could be integrated into the national and regional reconstruction plans. In May 1999 in Stockholm, Sweden, IDB and the Swedish government organized a workshop focusing on social and ecological vulnerability. The issue of vulnerability mitigation was addressed with a broader and more regional dimension. The particular vulnerability to natural hazards of certain social groups such as children, women and the elderly was discussed. Three important conclusions are:

1. Integrate vulnerability mitigation at the local, national and regional levels. The regional perspective is particularly important in Central America, where natural hazards and the watersheds are transboundary. The combined effect of working together can significantly decrease the region's vulnerability.
2. Undertake local-level participatory hazard vulnerability mitigation and disaster prevention planning. This is to include environmental and natural hazard vulnerability education and information management. Many remote coastal communities are cut off from national emergency efforts during natural disasters; thus, there is a need for adequate and independent local prevention plans based on active community participation.

In the lower and coastal part of the Lempa River Basin in El Salvador is a successful demonstration of community involvement in preparing local emergency response plans, including basic organization, responsibilities and procedures for evacuation and emergency management. In addition, local hazard vulnerability maps and early alert systems based on accurate hydrological and precipitation data were developed. This area received more rainfall than any other area in the country during Hurricane Mitch and, as a result of the area's preparedness, there were no deaths among the 35,000 inhabitants.

3. Strengthen the institutional framework for environmental and hazard management. This can be accomplished by facilitating the use of effective tools such as land-use

planning, environmental impact statements, natural hazard vulnerability assessments and economic incentives to promote sustainable use of the natural resources. For example, during Hurricane Mitch a large warehouse containing highly toxic agro-chemicals was flooded in the coastal city of Choluteca, Honduras. Nearby areas, including the Gulf of Fonseca, were contaminated, potentially affecting human health, and marine and coastal productivity (e.g., shrimp farming industry). Having these types of facilities located in high flood-risk areas indicates both inadequate land-use planning and poor environmental impact assessments. This shows the need to consider both the effects of infrastructure on the natural environment and the impact the environment may have on infrastructure. This further suggests the need to specifically require natural hazard vulnerability assessments as a part of environmental impact assessment legislation and practice.

Mitigation and Prevention

IDB is supporting various programs and initiatives in Central America aimed at decreasing vulnerability to natural hazards. These efforts follow a series of IDB strategies and guidelines including:

- A comprehensive strategy on natural and unexpected disasters which stipulates that all projects must include an analysis containing natural hazard risk assessments
- Specific environmental and social procedures to be approval for all projects
- Implement two newly approved strategies for marine and coastal resources management and integrated water resources management (Websites: http://www.iadb.org/sds/utility.cfm/205/ENGLISH/pub/574); and http://www.iadb.org/sds/utility.cfm/188/ENGLISH/pub/695).

After Hurricane Mitch, IDB supported a series of reconstruction programs incorporating environmental management strategies. For example, a post-hurricane housing program in Honduras will develop guidelines for risk mapping and prepare municipal maps of natural hazard risk to be used for the delineation of uninhabitable areas. Only households resettling outside high-risk areas will be eligible for the housing program benefits. In addition, communities living in areas of high risk will be provided with information about the risks they face and their options to be relocated to alternative locations with support from the program.

Another example is a road rehabilitation program in Nicaragua in which environmental and preventive considerations are addressed in the project's design, supervision and monitoring. Slope stabilization, reforestation, improvement of drainage systems and maintenance procedures are among the measures included.

IDB, The World Bank and the Japanese government are supporting the Center for Coordination of Natural Disaster Prevention in Central America (CEPREDENAC) in an effort to improve hazard mitigation and disaster prevention (http://www.cepredenac.org). This program includes a Disaster Prevention and Mitigation Fund that provides matching grants (maximum of US$150,000) for mitigation and prevention projects at the national and local levels. Eligible projects include development or implementation of natural hazard mitigation plans, vulnerability and risk studies, modification or development of building codes, education, among others.

Other post-Mitch IDB-supported programs include:

- Developing a national program for the sustainable management of priority watersheds in Guatemala
- Developing a tri-national watershed management program focusing on environmental management and resource development in Guatemala, Honduras and El Salvador
- Developing an environmental program for sustainable management of coastal and marine ecosystems and land-use planning in the Bay Islands, Honduras.

Landslide in Honduras

Governments and international funders must be aware that the planning and early reconstruction stages are where steps should be taken for prevention and mitigation in order to reduce vulnerability. One lesson to be learned by Hurricane Mitch is that prevention and mitigation efforts must be strongly voiced to ensure their inclusion at the planning stage. Otherwise, the reconstruction stage will be a mere 'restoration' of the scene for the next disaster.

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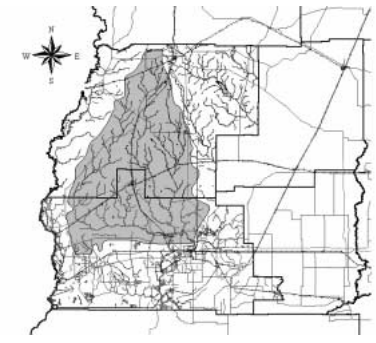
PREDICTION

Real-Time Flood Modeling

By Hassan S. Mashriqui and John C. Pine

A new tool in understanding the nature and extent of flooding is now available to local-level emergency managers and other personnel. This tool links hydrologic and hydraulic modeling programs, geographic information systems (GIS) and real-time weather data. The tool has the capability to predict or determine areas that may be impacted by rising floodwaters. Local officials can use this information for business emergency planning and land-use planning and for selection of evacuation routes and buildings to be used as shelters. In addition, the technology provides information for mitigating flood damage such as examination of alternate strategies for identifying drainage areas, adding pumping stations and levees, and land use options.

West Fork Calcasieu River



West Fork Calcasieu River Watershed

The West Fork Calcasieu River Basin, Louisiana, USA, (see map) is an area that experiences serious flooding. As a trial for this tool, a fully operational model was developed to simulate flooding from severe rainfall. Flood inundation maps using the model showed the nature and extent of flooded areas including critical building, public service structures and transportation routes inside the flood zones.

Flood Modeling and Data

Hydrologic and hydraulic modeling was performed using the Watershed Modeling System in association with Federal Emergency Management Agency (FEMA)-approved hydraulic models. These models predict real-time water surface profiles.

The model used three primary data sources:

1. GIS data (water and road features, land use, soils types and surveyed cross sections)
2. US Geologic Survey (USGS) 1:24,000 Digital Elevation Models (DEMs)
3. Triangulated Irregular Networks (TINs)

As a part of this demonstration, local officials were provided model-generated flood inundation maps in both paper and digital form. Map layers were provided to enable a comparison between alternative flooding buffer zones and selected features of the geographic area. Map layers such as hospitals, schools, nursing homes, bridges, residents, businesses, roads and many others could be viewed in comparison with the various flood-zone scenarios. Population census data at the county, tract, block group and block level was also included. Population counts using census data are made to describe the characteristics of the population in a specific flood zone. Features falling within a specific buffer zone can be selected, saved and grouped by weather scenario. USGS quadrangle maps, GIS map layers, and output displays for the functioning hydraulic and floodplain delineation models were also provided to officials. Multiple scenarios were used to identify buffer zones for potential flood events in the river basin.

GIS provides a unique tool to merge and display geographic images. Watersheds may be displayed using three-dimensional technology. A USGS Quarter Quadrangle can be draped over the USGS DEM contour map creating a three-dimensional image of the area. This type of image is useful to local officials and businesses because it can display a three-dimensional image of the flooding impact. The three-dimensional image has the capacity to show the elevation of the water and its impact on buildings, bridges, roads, land and levees.

Conclusions

Hydraulic models for predicting water-surface profiles and flood inundation may be used by local emergency management, public works, planning, flood management and public safety personnel to identify structures and organizations at risk. The models also provide a basis for predicting the area to be impacted, the water level and the flow rate. The most convenient and user-friendly method to display and query this information is through the use of a GIS.

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1998 Tsunami: Papua New Guinea

By Guy Gelfenbaum, Bruce Jaffe, Christina Neal and Hugh Davies

Tsunamis (also known as tidal waves) are often caused by underwater earthquakes or landslides that trigger a series of traveling ocean waves. Tsunami waves can travel hundreds of miles, but may only have a wave height of a few feet or less and cannot be felt aboard ships nor seen from the air in the open ocean. However, once they reach shore, tsunami waves can be as much as 100-feet high and are a major threat to coastal communities; even waves much smaller can be very destructive.

On the evening of July 17, 1998, an earthquake of magnitude 7.0 was followed by a series of catastrophic tsunami waves that devastated several villages on the north coast of Papua New Guinea (PNG). Early eyewitness accounts, later confirmed by field studies, reported waves 7- to 10-meters high at the coast. The confirmed death toll was over 2,000, and the coastal villages of Warapu and Arop, located on barrier spits around the Sissano Lagoon, were completely destroyed. In the aftermath, thousands of coastal residents were forced to leave their villages and set up temporary camps inland. Many of the villagers were fearful of further disastrous waves and were uncertain about returning to their coastal villages.

The tsunami consisted of three large waves, the first making landfall approximately 20 minutes after coastal residents felt the earthquake. The second and third waves came within five minutes of the preceding wave. The force of the waves was great enough to rip large trees from the ground by the roots and to move both traditional and modern structures landward some tens to hundreds of meters. Preliminary analysis of seismographs and other field evidence put the center of the earthquake at a mere 20-km offshore of the Sissano Lagoon.

Rapid Response to Tsunami

In order to assess the nature of the tsunami, members of the international tsunami community conducted a field survey of the area. A similar international response has been undertaken in Japan, Indonesia, Nicaragua, Philippines, Russia and Peru within the past six years. Within weeks of the devastating PNG tsunami, the International Tsunami Survey Team (ITST), a multi-national team of scientists and engineers from Japan, United States, Australia and New Zealand visited the region to install seismographs, measure water levels and interview eyewitnesses.

A second ITST returned to PNG in late September 1998 to retrieve data, assess damage to buildings and structures, and examine the sediments left by the tsunami. In addition to collecting scientific information, ITST members meet with government officials, relief organizations and local representatives to discuss and help guide reconstruction decisions in the event of another tsunami or natural hazards.

Assessing Tsunami Hazards Using the Geologic Record

When sediment is deposited by a tsunami and preserved, a geologic record of that tsunami is created. By looking at sediments in an area, geologists may be able to identify such deposits and infer the occurrence of past tsunamis. The recognition of past tsunamis allows geologists to extend the record of tsunamis in an area. For nearly every tsunami-prone region, the historic record of tsunamis is relatively short or non-existent and does not reflect the true natural hazard. Because scientists cannot yet predict when a tsunami will occur, obtaining a geologic record of past tsunamis is one way to assess the likelihood of future events.

In addition to documenting the occurrence of past tsunamis, tsunami deposits can help in the analysis of characteristics such as wave height, power and extent of inundation. Interpreting deposits is a relatively new science. Developing this ability would be valuable for understanding the July 17 PNG event and for identifying tsunami occurrences worldwide, both ancient and modern.

Two of ITST's goals were to determine whether or not the PNG tsunami produced a recognizable sediment deposit and to determine whether the geologic record in the area contains information about past tsunamis. The United State Geological Survey and PNG scientists with the ITST made measurements of land elevation, tsunami flow depth, flow direction, and tsunami deposit thickness and character along several transects in the affected area. One transect was at the Arop Community School, several hundred meters from the village. Small pits were dug along this transect to examine the tsunami deposits. The deposits were common and were identified as gray-colored sand typically overlying a brown, rooted soil. The deposits were measured and described in the field and samples were taken for laboratory analyses. The tsunami deposited a thin sand layer (up to 12-cm thick) inland across more than 600 m of coastal plain. In some places, a zone about

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Tsunami

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75-m wide near the ocean had been eroded as evidenced by exposed tree roots. Some sand deposited further inland came from the eroded beach, but at least some of the sand deposited by the tsunami is believed to have come from offshore, as numerous sand dollars (Dendraster excentricus) were found near the surface of the deposit.

Member of foreign assistance team speaking with viligers

The Arop School transect was also chosen as a site to look into the sedimentary record for past tsunamis. Sediment analyses found a layer possibly deposited by a past tsunami. This material was collected for radiometric dating to determine its approximate age. These dates will be added to the record of past tsunamis.

Tsunami Hazard Mitigation

In addition to providing humanitarian relief to survivors of the tsunami, the United States' Agency for International Development's (USAID), Office of Foreign Disaster Assistance, pledged support for a mitigation program in PNG. One objective was to strengthen the capacity of PNG's emergency management and disaster response organizations and to improve public awareness of coastal and other geologic hazards.

USAID's strategy included upgrading the geophysical monitoring and warning systems within PNG. Due to the vast stretches of remote, isolated coastline; limitations of communication infrastructure; and other constraints, a tsunami warning system based on seismic stations and tide gauge sensors is not feasible in PNG. Instead, USAID is supporting an ongoing collaboration of the U.S. Geological Survey's Volcano Disaster Assistance Program (VDAP), the Rabaul Volcano Observatory (RVO) in PNG, and the Australian Geological Survey (AGSO). RVO is responsible for seismic monitoring of active volcanoes in PNG and warning of potential and actual eruptions. A number of PNG's active volcanoes are situated on islands or near the coastline; thus there are overlapping efforts to reduce risk from volcanic eruptions as well as tsunamis. With technical assistance from AGSO and VDAP, RVO will be upgrading and expanding earthquake and volcano monitoring systems and contributing to public education campaigns about both hazards.

In addition to these steps to reduce risk from tsunamis throughout PNG, the ITST made several preliminary recommendations for the safe relocation of villages in the effected area. Those recommendations include the following:

- There should be no relocation of villages near the coast in areas fronted by the ocean and backed by rivers or lagoons.
- Critical facilities such as schools, hospitals and churches should not be located closer than 800 m from the ocean in areas of known tsunami risk
- Evacuation drills should be conducted annually, and people should be taught to run inland as far as possible whenever they feel an earthquake
- Casuarina forests should be planted in front of coastal villages, and trees should have steps or ladders to facilitate vertical evacuation when necessary

There is still much to be learned about the recent and past tsunamis in PNG. For example, analysis of the sedimentary deposits in the area and along other stretches of potentially vulnerable coast could help officials in PNG assess future tsunami risk by identifying the recurrence interval of past events.

Finally, such work in PNG will also aid in understanding and mitigating tsunami hazards elsewhere in the world. Analysis of known tsunami deposits in PNG will assist in the development of sediment transport models that will relate characteristics of a tsunami to any deposits left by the wave. These models can then be used to help interpret the number and size of tsunamis that have impacted the coast in areas of the world where there is little or no written record of tsunamis.

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Recognizing the Need for Coastal Disaster Planning in Micronesia

By Douglas Ramsay

The island of Kosrae is the easternmost island in the Federated States of Micronesia. Kosrae is a 112 km^2 volcanic island surrounded by well-developed coastal mangroves and a narrow fringing reef with no outer islands. The population is approximately 8,000; most depend on fishing and farming for their livelihood.

On Kosrae, major typhoon events are rare; the main tracks are located to the north and west of the island. The last major typhoon to affect the island was in 1905. This absence of a significant natural destructive event within the memory of much of the population has had a major impact on the economic development of the island. Specifically, virtually the entire population and most of the island's infrastructure are now located within the immediate coastal hinterland, on land generally less than 2 m above spring high tide. In addition, coastal erosion has intensified over the last 50 years leading to a landward retreat (between 5 to 30 m) of the shoreline around much of the island and a loss of shoreline mangroves. This retreat is of concern because approximately half of Kosrae's coastal fringe is developed. The remainder is in a natural and undisturbed state, and some areas are being developed into community-managed marine parks.

Though Kosrae's coastal zone is still relatively healthy, it is subject to the same forces that have depleted coastal resources in other parts of the Pacific, namely:

- Rapid population growth with greater than 50 percent of the population under 16 years of age
- Rapid infrastructure development occurring in the immediate coastal hinterland over the last 30 years (e.g., paved roadways, dock and airport facilities). This has lead to the need for coastal defenses for protection and for land reclamation.
- Non-traditional use of coastal resources by landowners (e.g., switch from traditional thatched housing to concrete buildings)
- Over-exploitation ofd natural resources
- Constitutional right of a shoreline landowner to reclaim abutting land on the foreshore or mangrove areas
- Dependence on foreign aid, notably US Compact funding that is decreasing and due to stop in 2001
- Increased public and private ventures geared to short-term profits
- Shift from small family/land settlements to municipal urban villages

In 1998 the Kosrae government recognized that an increasing coastal population and changing socioeconomic pressures were causing the majority of the population and infrastructure to be located in the high-risk zone. In response, the government started developing a shoreline management plan. The goal is to provide a framework for future development and resource management within the context of coastal erosion and coastal hazard management.

A key factor in this strategy is the integration of state and municipal governments and local communities. Although the plan is being coordinated at the state level, the driving force comes from the communities within each municipality. Community workshops are being used to develop an agreement on:

- The current nature, extent and cause of coastal degradation
- The degree to which these increase coastal erosion
- The risks and potential impacts faced by each community from coastal hazards

The communities of each of the four municipalities have established a group to address the issues identified by the community workshop. The group includes the mayor, representatives from the council, fishers, church groups, senior citizens, women's groups, shoreline landowners and other interested parties. A fifth group consists of decisionmakers from various governmental departments, nongovernmental organizations and the municipal mayors. A community liaison officer has been appointed to help facilitate communication between the groups, community and government.

Erosion undermining mangroves along the Malem coastline

The goal is to make the public and the government aware of their coastal resource, the coastal degradation and hazard management opportunities. Education activities in 1999 include:

- An awareness program on various coastal issues using posters and radio broadcasts
- Monthly environmental video

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Community Action

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shows in each municipality (There is no television in Kosrae.)

- Church sermons and classes
- Community workshops on coastal erosion, hazard mitigation and resource depletion
- Development of teaching tools on coastal issues for use in schools
- Training and capacity-building programs on impact assessment and decisionmaking procedures for government and community members

Sand mining, a major cause of coastal erosion

The plan aims to provide a foundation for an integrated, participatory and informed process on development and management of the coastal zone. An additional aim is to have the entire community aware of the full range of natural and man-made hazards and the risks that these pose to the island and its people.

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OUTREACH

Communities Addressing Erosion

By Pierre Gosal

Coastal erosion and flooding cause significant damage in coastal communities in North Sulawesi, Indonesia. Some communities are concerned, but are unaware of what can be done to prevent unnecessary damage. It is impossible for the Indonesian government to address all coastal erosion issues; thus, it is at the community level that action must be taken.

Erosion in Talise

Proyek Pesisir (the Indonesian Coastal Resources Management Project) is developing programs in two villages in North Sulawesi–Bentenan and Talise–to strengthen the villages' capacity to handle these problems. As part of a broader village-level coastal management initiative, Proyek Pesisir is emphasizing community-based monitoring and beach profiling in areas that are prone to erosion and flooding. It is hoped this initiative can be applied in other coastal communities.

Talise

Erosion is a problem for Talise Island and even more severe on the island of Kinabuhutan, east of Talise Island. Dense mangrove forests once surrounded Kinabuhutan Island and protected its coast. These mangroves have been cut and, as a result, most of the inhabitable area is flooded at a full moon high tide. Flooding in other areas is stripping the land of topsoil and erosion endangers the only elementary school on the island.

Bentenan

The village of Bentenan, is located on the eastern coast of the Minahasa peninsula. The coastal erosion rate has been estimated to be one to two meters per year, with occasional periods of deposition. Erosion has undermined the only road connecting Bentenan and Rumbia. Some houses built in the intertidal zone are periodically flooded. The area's growing population is rapidly decreasing the availability of good quality buildable land thus, houses are being built on less favorable land subject to frequent flooding.

The Bentenan Beach Resort built a jetty to maintain a permanent connection between an artificial lagoon and the sea. As a result, there has been deposition to the north of the jetty and erosion to the south.

Other factors contributing to the erosion are uncontrolled cutting of mangroves and thatch palms in the marshy lagoon and sand and coral mining for building material and lime. Dynamite fishing continues to damage the reef structure, also reducing the reef's ability to withstand wave action.

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Beach Erosion Caused by the 1998 El Niño

By Christian M. Appendini and Román Lizárraga-Arciniega

Worldwide there is increasing concern about coastal hazards and, in a broader sense, all natural disasters. It is not that the events are more frequent or stronger, it is the increasing human development and population density that now makes people more vulnerable. Natural events become natural disasters when peoples' lives, properties and the way-of-life are threatened.

Since natural events have and will always exist, society needs to learn to plan accordingly. Coastal events are no exception. With the coastal population density increasing so quickly, it is not surprising coastal areas are commonly affected. Coastal erosion is a problem for every coastal community, particularly where development has occurred with no consideration of existing natural processes. This problem exists more frequently in developing countries where coastal planning is not available or only in its infancy.

Coastal development in Mexico has accelerated with little consideration of coastal processes. Now, what was once a coastal event is a coastal hazard, thus a problem. Nevertheless, no policies exist that require development to incorporate actions to reduce the affects of coastal hazards.

The economy of Rosarito Beach, Baja California, Mexico, strongly depends on tourism, as do many other coastal areas in Mexico. It is not surprising that coastal erosion is now considered a coastal hazard. This led the Universidad Autónoma de Baja California to develop a beach erosion management plan.

Before proposing a management strategy, certain activities were carried out:

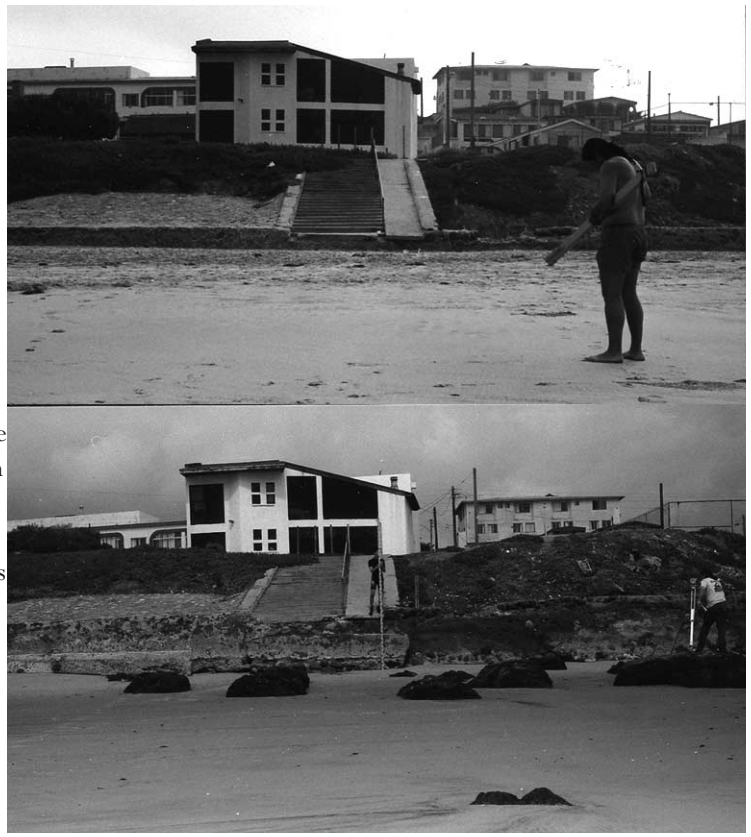
- Analysis of the coastal processes and beach erosion
- Analysis of coastal vulnerability to erosion
- Development of a sediment budget
- Classification of coastal morphology
- Consideration of coastal structures and land use

This article aims to show the importance of these studies and stress that they be undertaken for every coastal area to assess vulnerability to coastal hazards and ultimately develop a management plan.

The study started in 1996, two years before the 1998 El Niño event that severely eroded Rosarito Beach. Erosion was so severe the area was declared a national disaster area. Although a management plan had not yet been completed, the 1998 El Niño and the resulting erosion, though devastating to the region, was a great opportunity for scientists to compare predicted results to the actual condition of Rosarito Beach after the El Niño.

In order to identify areas most vulnerable to erosion, an erosion vulnerability analysis was used to assess beach-loss potential and the resulting potential damage. Beach-loss potential was defined as the susceptibility of the sand deposits (beach) to be removed. For this, the existing morphologies were defined: igneous cliffs, sedimentary cliffs and a low-lying beach. The beach width was definied: a 'wide beach' as greater than 70 m, and a 'narrow beach' as less than 70 m. (Seventy meters was observed to be the largest shoreline recession after extreme wave events.) Using beach-loss potential and morphology, the coast was classified into low, medium or high potential beach loss.

The potential damage other than beach loss was estimated using land use, population density and type of existing coastal protection. The categories of coastal protection considered were engineered, non-engineered and no protection at all. Using these, the coastal damage was classified into low, medium or high potential of damage. Beach-loss potential and damage potential, other than beach loss, were then combined to obtain an erosion vulnerability map.



Before El Nino. Area predicted as highly venerable to erosion

After El Nino. As predicted,significant erosion occured

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Community Action

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Efforts to Address Erosion

Proyek Pesisir has been working in North Sulawesi since 1997 and continues to strengthen the community's interest and knowledge of preserving their environment. Both communities are being trained in beach monitoring and physical coastal processes. In Talise, Proyek Pesisir assisted with the construction of dikes behind the mangrove forest to prevent flooding. With the help of an elementary school teacher, Proyek Pesisir also sponsored a mangrove-replanting project.

Public education efforts in Talise and Bentenan stress the devastating impacts of mangrove cutting, coral and sand mining, and dynamite fishing. In Bentenan, over a dozen individuals have been trained and are participating in monthly beach profiling and monitoring. In Talise, coastal monitoring has also been successfully conducted.

Through workshops, counseling and training events, Proyek Pesisir is assisting the villagers in developing regulations and ordinances. Their intent is to mitigate coastal erosion and flooding problems, with an emphasis on preventing loss of private and public infrastructure. Regulations would include prohibiting sand and coral mining, and tree cutting in rural areas, especially mangroves.

Village leaders in Talise have proposed an ongoing program for replanting mangroves. Proyek Pesisir supports this proposal, and through its extension officer will provide the education on methods and conditions for proper mangrove replanting.

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El Niño

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The February 1998 El Niño event caused severe damage. The actual damage was compared to the predicted damage using the analyses. Devastating damage occurred in the area predicted as highly vulnerabile to erosion by the analysis (see photo previous page). As shown in this photo, the sand level was about the same as the house before the event. The event lowered the sand level in this area by about 3 m. The damage may have been prevented had a policy based on an erosion-vulnerability analysis been implemented in this area.

Though devastating to the region, the 1998 El Niño and the resulting erosion were a great opportunity for research scientists to compare the predicted condition of Rosarito Beach to the actual condition after the El Niño. The results demonstrated that although many coastal areas are making changes to minimize damage, these changes are usually not scientifically based. Scientifically based analyses should be completed in all areas to identify critical areas and develop management plans to minimize or prevent further damage. Mitigation strategies have already been developed and used successfully for many areas and circumstances. If coastal conditions in areas of high erosion were assessed using the techniques mentioned here, existing strategies could be adapted for use elsewhere.

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Sand collected behind a jetty

ELECTRONIC RESOURCES

SPECIAL SECTION

The following information includes websites and E-mail discussion groups available to those interested in natural disasters; emergency planning; management and response; hazard mitigation and numerous other hazard-pertinent topics. The information represents only a few of the 100s to 1000s of websites on these topics. Two sites of particular interest are Emergency Management Gold©1999 (EMGold) at: http://www.disasters.org/emgold/index.htm and Natural Hazards Center at the University of Colorado, Boulder, USA, at: http://www.colorado.edu/hazards/

Selected E-mail Information Sources

Below is a listing, brief description and subscription information of some of the E-mail discussion groups that cover all aspects of disasters. These are a valuable tool particularly for those who do not have internet, worldwide web access.

The Asian Disaster Preparedness Center (ADPC), Bangkok, offers an on-line subscription by sending an E-mail message to listproc@lists.colorado.edu with the single command in the body of the message: "subscribe hazards [your name]."

Networks in Emergency Management (Nets) (focuses on computer networks and networking in emergency management) - subscribe by sending an E-mail message to majordomo@sfu.ca with the single command in the body of the message: "subscribe nets-em [your E-mail address]."

Natural-Hazards-Disasters - subscribe by sending an E-mail message to mailbase@mailbase.ac.uk with the command in the body of the message: "join natural-hazards-disasters [your first name, your last name]."

Disaster Grads - subscribe by sending E-mail to listproc@lists.colorado.edu, and in the body of the message write "subscribe disaster_grads [your first name] [your last name]."

HAZMIT - (a mailing list for the global hazard mitigation community, covering both natural and anthropogenic disasters) - subscribe by sending and E-mail message to hazmit-request@mitigation.com with the command "subscribe" in either the subject or body of the message.

EMERGENCY-MANAGEMENT -subscribe by sending an E-mail message to listserv@zipcode1.office.aol.com with the single command in the body of the message: "subscribe emergency-management [your real name]."

RISKANAL (Society for Risk Analysis list) - subscribe by sending an E-mail message to listserv@listserv.pnl.gov with the single command in the body of the message: "subscribe riskanal [your name]."

CCEP News E-Zine (the Canadian Centre for Emergency Preparedness free weekly E-mail magazine) - subscribe by completing the registration from at

http://www.ccep.ca.

PRIMAtalk (an unmoderated E-mail discussion list to promote discussion of risk management in the public sector - from the Public Risk Management Association) - subscribe by sending an E-mail message to majordomo@atlantech.net with the single command in the body of the message: "subscribe prima-talk.".

EMERG-L (emergency services list) - subscribe by sending an E-mail message to listserv@bitnic.educom.edu with the single command in the body of the message:

"subscribe EMERG-L [your name]."

QUAKE-L (all things seismic, especially current, ongoing disasters) - subscribe by sending an E-mail message to listserv@listserv.nodak.edu with the single command in the body of the message: "sub QUAKE-L [firstname, lastname]."

GIS_GROUP (a list for hazards GIS researchers and users) - subscribe by sending an E-mail message to majordomo@violet.berkeley.edu with the single command in the body of the message: "subscribe gis_group."

DisasterInfo (disaster information relevant to the Americas from the Pan American Health Organization) - subscribe by sending an E-mail message to DisasterInfo@paho.org containing your postal and E-mail addresses.

DESASTRES-CA (a list, primarily in Spanish, for disaster managers and others concerned about hazards in Central America) - subscribe by sending an E-mail message to majordomo@ops.org.ni with the single command in the body of the message: "subscribe desastres-ca [your E-mail address]."

CEPREDENAC - the Center for Prevention and Coordination of Disaster in Central America publishes a weekly, Spanish-language E-mail bulletin. To subscribe, send an E-mail message to cepreden@sinfo.net. (continued page 32)

Technological Challenge in a Fragile Coastal Ecosystem

By Sarah Gammage, Melany Machado and Manuel Benítez

Poverty, population expansion and civil conflict in El Salvador have promoted migration both internally and internationally. Many households fled conflictive zones to relocate along the coast, switching activities to become artisanal fishers, loggers and salt producers. One coastal resource highly impacted is the mangroves. Fuelwood and timber demands on the already shrinking mangrove forests are increasing. Deforestation of the mangrove environment not only decreases the availability of fuelwood but makes coastal communities significantly more vulnerable to coastal storms, leading to erosion and flooding.

In El Tamarindo, El Salvador, rapid deforestation and the unregulated expansion of aquaculture coupled with a consistent and sustained demand for fuelwood have led to the deterioration of the mangrove ecosystems. This concern prompted the design and use of an alternate technology to reduce fuelwood consumption, thus reducing mangrove use.

Community women building a Finlandia stove

The development and use of appropriate technology is not merely the delivery of an acceptable inexpensive substitute, it is a process that results in the successful application of a workable alternative. Attempts to channel technology directly to women to change household resource use, minimize additional household burdens, and increase the fuel efficiency of domestic stoves may prove to be extremely worthwhile. Attempts to introduce solar cookers, solar driers and food storage technologies have often failed, largely because women did not participate in the problem-identification or solution-generation phase. Without a commitment to participatory methods of design, application and evaluation, the technology may be less than suitable, erratically adopted, poorly used and rapidly abandoned.

Improved fuelwood stoves and other non-combustible devices have often been used in attempts to reduce fuelwood consumption. These have met with varying success. If the introduction of alternative technology imposes even a small constraint upon the household, it is not likely to be adopted. For example, solar cookers require constant sun, needing to be moved continually throughout the day. This interrupts other domestic actives or increases the time spent cooking, thus making the use of the solar cooker a burden.

Acceptance of Alternative Fuelwood Stove

In order to evaluate the introduction and acceptance of an alternative fuelwood stove, two groups of 60 households were compared: those using the new technology and those using traditional open stoves. The households were chosen randomly to ensure all economic activities and income levels were represented.

The community chose the "Finlandia" stove. While the principles on which these improved fuelwood stoves operate are similar, different varieties allow for greater on-site modification. The community members chose a stove that could be adapted to the size and location of each site and to each household's pots and pans. The community also elected to tile the stove providing what was to become the only clean working surface on which to prepare food.

Community members and the 60 households receiving the stove were involved in all stages of the project design, implementation and evaluation. With the help of the beneficiaries, a household survey was designed to measure whether the project had reduced fuelwood use and fuelwood costs. Of additional importance to the household was whether the new stove took more time to tend, thus decreasing the time for other tasks.

Data were collected on fuelwood use during the wet and dry seasons. Families were asked how much fuelwood they had bought or gathered and how much they had consumed each week. A reduction of almost six pounds per household member per week (6 lbs per household member per week) was observed. For a family of five, this translates into almost 30 lbs of fuelwood saved a week, a large decrease in gathered and/or purchased fuelwood.

A more rigorous test was done weighing the fuelwood consumed each day over a period of two weeks during both the dry and wet seasons. The results were that the

Finlandia stoves required significantly less fuelwood per capita than the open stoves. The Finlandia stoves were also easier to light and retained heat for longer. Unfortunately, the Finlandia stoves took longer to boil a given amount of water. This was a concern; however, the total length of time the Finlandia stoves remained lit (using less fuelwood) was only slightly longer than the traditional stoves. In fact, those who used the Finlandia stove were able to combine several dishes and cook them simultaneously instead of sequentially (the traditional method), saving time and increasing time for other tasks.

Conclusions and Recommendations

The findings demonstrate that fuelwood consumption and expenditures per capita have decreased with the use of the Finlandia improved fuelwood stoves. The health data from the project also recorded significant reductions in the incidence of burns, respiratory, sight and kidney ailments. Although the data regarding time saved were less conclusive, it appears that being able to cook different dishes simultaneously was an improvement. At the very least, the Finlandia stoves did not increase the time spent on cooking.

Few studies have attempted to measure fuelwood consumption comparing the use of improved and traditional fuelwood stoves over both wet and dry seasons. This study collected information over a period of 18 months and combined socioeconomic data on income, expenditures and time-allocation with quantitative and qualitative data on fuelwood consumption and the use and operation of the stoves. Though time-consuming at the outset, applying a participatory and gender-sensitive methodology that focuses on the roles and responsibilities of women in the community was critical to ensure improved fuelwood stoves were adopted and appropriately used. The findings clearly relate fuelwood consumption to poverty, income and cash constraints and the collapse of the rural economy in El Salvador. It was encouraging to see that even in the face of economic hardship and in the wake of Hurricane Mitch, changes can be made in the way fuelwood is used and consumed.

It is clear that the Finlandia variety of improved fuelwood stove can reduce fuelwood consumption and may contribute to reducing environmental dependency in fragile ecosystems. Fuelwood is a plentiful renewable energy source and when managed sustainably can provide an excellent source of domestic energy. Strategies that focus on substituting other non-renewable energy sources may be both short sighted and difficult to implement given the tastes and preferences of the rural communities. Obviously a long-term goal would be to reduce fuelwood consumption to sustainable levels, substituting other forms of renewable energy wherever possible.

The community of El Tamarindo has been interested for some time in mangrove management. The availability of stoves that reduce fuelwood consumption may prove useful in any strategy to reduce total fuelwood consumption in this and surrounding communities. However, alone these behavioral changes do not address the fundamental cause of environmental dependency. Change must be part of an integrated strategy that addresses education, provides affordable health care, and develops policies that enable a shift from unsustainable for-profit and subsistence activities to sustainable ones that preserve livelihoods and habitats. This change must be community initiated and sanctioned to be effective and to contribute to an integrated development strategy.

Cooking on a finished Finlandia stove

Copies of the full report are available from the International Center for Research on Women, 1717 Massachusetts Avenue, NW, Washington, DC 20036 USA. The authors are members of the Centro de Estudios Ambientales y Sociales para el Desarrollo Sostenible in El Salvador. Contact: Sarah Gammage, E-mail: sgammage@bellatlantic.net

POLICY

Guiding Principles for a European Integrated Coastal Management Strategy

By Anne Burrill, Peter Burbridge and Sarah Humphrey

Coastal regions of the European Union (EU) are being looked to for new opportunities to diversify local and national economies, from aquaculture and windfarms to tourism and leisure. Concurrently, coastal populations are growing significantly.

Human activities have not been without impact to the coastal environment; it is estimated that as much as 70 percent of Europe's coastline is highly threatened due to direct and indirect human impacts. Principle areas of concern are loss of natural habitats, loss in biodiversity and cultural diversity, decline in water quality, and competition for space, among others. Demographic changes in coastal areas as a result of changing economic opportunities are also presenting new social challenges, from urban expansion to decline of rural communities.

The European Demonstration Programme in Integrated Coastal Management has responded to this concern by undertaking projects that have generated a wealth of knowledge. A reflection paper, Towards a European Integrated Coastal Zone Management (ICM) Strategy: General Principles and Policy Options, based on the following six thematic studies was released in April 1999.

The Six Thematic Studies

1. Legal and Regulatory Bodies: Appropriateness to ICM
2. Participation in ICM Process: Mechanisms and Procedures Needed
3. Role and Use of Technology in ICM
4. Planning and Management Processes: Sectoral and Territorial Cooperation
5. Influence of EU Policies on Coastal Zones
6. Information needs for ICM

The findings appear to confirm the hypothesis that most of the problems and conflicts observed in Europe's coastal zones can be traced to procedural, planning, policy and institutional weaknesses. This results from a lack of awareness about the strategic economic and social importance of sustainable coastal zone management.

Historical Perspective

Problems have stemmed from decades of uncoordinated management that has occurred because:

- Legislation and policy have been sectorally-based and uncoordinated, and decisions have often worked against the long-term interests of sustainable development
- Rigid bureaucratic systems have limited local creativity and adaptability
- Local initiatives in sustainable management have lacked adequate resources and support from higher administrative levels
- Management of the coast has lacked vision and is based on a limited understanding of coastal processes
- Scientific research and data collection have been isolated from end-users

Many approaches have been used, and a large geographic region has been covered by the 35 demonstration projects–from Cork to Athens and the Gulf of Finland to the Algarve. Results indicate that while there is no one correct approach to ICM, there are a number of general principles that should be followed to strengthen efforts.

General Principles

Coastal zones are subject to geographically far-ranging environmental and socioeconomic influences, many of which transcend the boundaries of local, regional and even national administrations. The scope of these linkages are only just being understood, e.g., the importance of North Sea sediment dynamics to the Wadden Sea and the repercussions of changing employment patterns for sustaining communities in peripheral areas. A systems approach, including both the land and sea components, will help to identify the key driving forces in a given coastal area, and appropriate partners are also identified. There are seven principles that should guide coastal management in Europe:

Principle 1: Take a Wide-Ranging Perspective. Europe's 89,000 km of coast is extremely diverse–not just in environment, but in social, cultural, institutional and economic characteristics. Good local information is critical to assess the problems and needs.

Principle 2: Build on an Understanding of the Area's Specific Conditions and Needs. The correct approach to ICM in a specific area should be determined on the needs and conditions particular to that area. This emphasizes the importance of critical information gathering and strongly suggests that it is not appropriate for the EU to prescribe a generic ICM approach or solution.

Numerous economic activities are located in risk-prone coastal plains, estuaries and nearshore marine environments. The dynamic nature of coastal systems is largely

ignored during the planning stages of development in urban and rural areas. For example, solid, structural coastal defences (e.g., groins and breakwater) lend a misguided sense of security to developers who continue to invest in hazardous areas, thus increasing the potential losses from flooding or erosion. Such defences are increasingly costly to maintain-particularly with sea-level rise-and are now known to adversely affect other parts of the coast. Planners need to anticipate and, where possible, avoid being locked into costly efforts to maintain status quo.

Principle 3: Work with Natural Processes-Not Against Them. Working against natural processes is both costly and ineffective.

Principle 4: Ensure that Today's Decisions Do Not Eliminate Tomorrow's Choices. Coastal dynamics illustrate where future options are being compromised. These dynamics extend beyond the physical forces to socioeconomic changes associated with broader political, sectoral and developmental trends. The precautionary principle is applicable to all uses of coastal space and resources. Although the future cannot be predicted, the key is to maintain flexibility in the face of uncertainty.

Principle 5: Participatory Planning is a Key to Developing Consensus. Participatory planning has been a strong feature and message of many of the demonstration programmes-often reaching beyond the standard procedures associated with planning. Participation provides a means to harness local knowledge, energy and commitment, and to arrive at a genuine understanding of the issues and the stakeholders' perspectives. Ownership of the process provides a solid foundation for policy adoption and implementation.

Responsibility for coastal management activities is often divided among government agencies, services and administrations operating sectorally or territorially. In many countries, for example, management of offshore areas is often a function of the central government, while land-based planning is a function of the local government. Coastal management must integrate the concerns of all relevant sectoral agencies–from conservation to heavy industry and tourism. In addition, all community levels must be involved in policy and decisionmaking–from local, regional and national to continental. In Europe, the assignment of management responsibilities between different levels of government should be determined by how the resource is subsidized. It is critical that policies and actions be consistent at all levels.

Principle 6: Ensure Support and Involvement of All Relevant Administrative Bodies. Without involvement of all relevant administrative bodies, support will never be gained, thus consensus will never be reached.

Principle 7: Use a Combination of Instruments to Achieve Objectives. A range of instruments are available to implement ICM–from command and control to economic incentives and voluntary agreements–each having its strengths and drawbacks. Ideally, a wide range of instruments should be used at all stages, from developing awareness and promoting dialogue through strategy development and implementation.

Moving On

So what should be the role of the EU? Certainly there is justification for action at the European level. The justification lies in the following factors:

- European sectoral policy has and will continue to influence the way member states and regions use coastal areas and resources
- Europe's coastal zones offer an important asset to European policy objectives, from social and economic cohesion to environmental health
- Many coastal issues, both socioeconomic and environmental, extend beyond national boundaries

Finally, it is worth adding that since many issues are common to several coastal member states, there is great potential for sharing experiences between different parts of the EU. The demonstration programme has been an important first step in this direction, and the challenge now is to determine: Where do we go from here?

(Details of the individual demonstration projects, the strategy, background documents and thematic studies can be found at website: http://europa.eu.int/comm/dg11/iczm/)

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Project Impact: Building Disaster Resistant Communities

By Jennifer East

The United States' Federal Emergency Management Agency (FEMA) has taken a proactive approach to weathering hurricanes in the 1998 and 1999 seasons. While one can not control natural disasters, one can take measures to reduce their impacts. Project Impact: Building Disaster Resistant Communities is a national initiative designed to undertake actions that protect families, businesses and communities by reducing the effects of natural disasters. At the core of these efforts is the belief that we can come together to create active public-private partnerships that will build disaster-resistant communities. Since its creation in 1997, 120 communities have joined on as Project Impact communities. Since hurricane season began in June 1999, some hurricane-prone Project Impact communities have made significant strides toward making themselves disaster resistant.

Deerfield Beach, Florida

The coastal communities of Florida are particularly susceptible to hurricanes, tropical storms and flooding. For example, the city of Deerfield Beach has been hit by at least seven major hurricanes in the last 75 years. Deerfield Beach has been quite active as a Project Impact community. Deerfield Beach joined with the State Farm Insurance Company to build a disaster-resistant model home for public viewing. Dearfield Beach has also retrofitted the Chamber of Commerce building to be disaster resistant; this building serves as a critical location for businesses and as the operation center during a disaster. Deerfield Beach is also a partner with Broward County in the development of a Broward County Community Emergency Response Team (CERT) to train individuals on emergency preparedness. So far, 75 residents have graduated from the CERT training program. The goal is to arm the community with the tools necessary to make all residents safer and smarter when the next storm hits.

Escambia County, Florida

Escambia County is at risk from a number of hazards. The area has been included in four presidential disaster declarations in the past five years, three of them have been hurricanes. In light of the region's vulnerability, the city and county have implemented strong coastal construction regulations and are currently collaborating on a local mitigation strategy. The county is also involved in a program to provide hurricane shutters and wind retrofitting for a number of critical facilities.

Wilmington, North Carolina

Wilmington is no stranger to hurricanes. In July 1996, Hurricane Bertha caused an estimated US$17 million in damage to homes, businesses and utilities in New Hanover County. Eight weeks later Hurricane Fran caused US$240 million in damage.

Wilmington has joined Project Impact. The school board is overseeing a large-scale project funded by a Project Impact grant and a US$1.8 million bond issue to improve the disaster resistance of local schools. A risk assessment was conducted for nine school buildings, which are also emergency shelters, and recommendations were made for mitigation measures. In addition, mitigation measures will be included in school building codes.

The county's emergency management team supports training exercises and drills, participates in county disaster-awareness programs and staffs the emergency operations center. At the school board's expense, a two-way radio communications network was installed to be used during the frequent breakdown of communications across jurisdictional and agency boundaries during disasters.

In addition, a newly renovated water supply plant has been located outside the floodplain and designed for 120-mile-per-hour winds. There are two 1,250-kw diesel generators to supply 100 percent power in the event of an emergency.

Charleston, South Carolina

Charleston has suffered from numerous hurricanes; notably Hurricane Hugo in 1989. As a direct result of Hurricane Hugo, damage-reduction tools such as building and zoning codes and floodplain management rules are in place. Moreover, there are now state regulations for coastal construction on barrier islands.

The Charleston community has also joined Clemson University and the South Carolina Sea Grant Consortium to develop a disaster-resistant demonstration house in Charleston's historic district. This demonstration house will serve as an educational center for homeowners and contractors interested in retrofitting historic buildings.

Freeport (Long Island), NY

Long Island, New York, is particularly vulnerable to weather hazards, and many communities have suffered significant, repetitive losses caused by flooding. Freeport as a Project Impact community has adopted building codes requiring hurricane straps on houses.

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Rhode Island: First Showcase State for Disaster Resistance

By Michele Steinberg

Though the smallest state in the United States, Rhode Island is one of the most densely populated. With 420 miles of coastline, Rhode Island is vulnerable to hurricanes and winter coastal storms that can cause extensive loss of life and property and severely disrupt essential human services. In the past century, two major hurricanes (1938 and 1954) killed 281 people and inflicted over US$1 billion in damage (in 1999 dollars). Today, residential and commercial coastal property in Rhode Island, valued at more than US$83 billion, is at risk of hurricane damage.

In consideration of these and other factors, Rhode Island's governor declared the state a "Showcase State" for disaster resistance and resilience. This directs state agencies to work towards reducing Rhode Island's future vulnerability to natural hazards. The initial partners in this effort were the Institute for Business & Home Safety (IBHS), Rhode Island Sea Grant at the University of Rhode Island Coastal Resources Center (CRC), the Rhode Island Emergency Management Agency (RIEMA) and the Federal Emergency Management Agency (FEMA). Much of the Showcase State effort builds on work accomplished by Sea Grant/CRC and RIEMA since 1991 (see "The Rhode Island Hazard Mitigation Program," InterCoast, Fall 1998).

The goals of the Showcase State efforts are:

- To help a state and its citizens help themselves by reducing vulnerability to natural disasters
- To generate a "me too" attitude among other states by showcasing the successful efforts of particular states
- To learn what works and what does not work to reduce the emotional and financial devastation caused by natural disasters

Rhode Island, though vulnerable to a number of hazards, has not experienced a major disaster in several decades. The Showcase State initiative is intended to make loss reduction actions part of everyday decisionmaking. In the past eight months, the Showcase State effort has made a great deal of progress in changing the way Rhode Island deals with natural hazards.

Milestones

A Showcase State Steering Committee has been formed from the state agencies and private-sector entities responsible and accountable for implementing various actions that will help the state become more disaster resistant and resilient. A subcommittee on hazard identification and risk assessment will meet in fall 1999 to set parameters and a starting point for a statewide risk assessment.

The Showcase State partners recognize that if businesses do not recover after a natural disaster, communities do not recover. A statewide Disaster Recovery Business Alliance has been started as a private-public link intended to improve coordination on disaster preparedness, mitigation, response and recovery. The majority of businesses in Rhode Island are small (97 percent have 500 or fewer employees), so working with existing organizations, such as the Chambers of Commerce, has been necessary to reach businesses with the important message of disaster resistance. Workshops and informational materials have been tailored to small business sectors.

Two of the most important aspects of creating disaster-resistant communities are improving the way structures are built to withstand natural hazards, and ensuring that development decisions take natural hazards into account. Rhode Island has a state building code with high standards for wind, water and seismic hazards. The Rhode Island Building Commission is working to improve education on hazards for builders and enforcement officials, and to change the code to promote simple, inexpensive upgrades for wind hazards when buildings are renovated. Rhode Island has a State Guide Plan for development, and mandates comprehensive plans at the local level. The State Guide Plan includes consideration of the flood hazard in its land use element. In the next several months, Rhode Island communities will pilot test an IBHS self-rating form designed to gauge how well their local plans incorporate natural hazards concerns.

Coordinated, effective emergency response is vital in the immediate aftermath of a disaster. State, local and federal government officials are working cooperatively to improve emergency response capability, standards and training, and shelter capacity. IBHS is working with the state to develop an early access system for insurance adjusters, to speed the post-disaster insurance claims process and thus improve quick recovery for residents and businesses.

The Showcase State effort supports and in turn is supported by FEMA's Project Impact initiative (See article page 18 this issue). In Rhode Island, the cities of Warwick and Pawtucket received seed funds from FEMA to reduce their

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Project Impact

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Elevation projects are also underway to elevate streets in hard-hit areas, and a US$890,000 Flood Mitigation Assistance Grant is being used to help 30 homeowners affordably elevate their homes three feet above the base flood elevation.

Key to the success of Project Impact is a strong partnership with the business community and strong public support. In Freeport, the business community sponsors activities such as hurricane awareness seminars, lectures for public schools and other citizens, and hands-on demonstrations of hurricane proofing. Frequent mailings of emergency information ensure the citizens are kept informed.

Warwick, Rhode Island, USA

The city of Warwick is a coastal community exposed to numerous hazards. The Hurricane of 1938 and Hurricane Carol in 1954 caused extensive damage along the entire shoreline. Inland flooding along the Pawtuxet River has also been a frequent problem. The city's vulnerability is compounded by the close proximity of coastal and riverine environments to residential and commercial areas. Having both commercial and residential areas at risk makes Warwick an ideal Project Impact community because strong public/private partnerships, the key to Project Impact's success, are required for mitigation efforts to be successful (see page 19, this issue).

Warwick has a significant commercial center with several large shopping malls, a series of industrial and business parks, and the largest airport in the state. Warwick has a strong Chamber of Commerce representing major companies and small businesses alike. One example of a strong public/private partnership is the city's alliance with a building-supplies store (Home Depot) to teach techniques for retrofitting and flood-proofing houses and improve community training and education. The city has also established a planning council to focus on disaster-prevention. The council is working in cooperation with the Coastal Resources Center, University of Rhode Island, USA, and the Rhode Island Emergency Management Agency, USA, to develop a local all-hazards mitigation plan.

Tragedy caused by natural hazards is most acute at the local level-in the community and in neighborhoods. The effects can be devastating; however, there are many ways to reduce or prevent these effects. Although one must stay prepared to respond to the inevitable occurrence of disasters, it is critical that everything possible is done to reduce the potential for disaster and create a safer future for our children: FEMA's Project Impact is a large step towards achieving this.

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Rhode Island

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vulnerability to natural hazards. Showcase partners are working with the two communities to pilot various initiatives, including the retrofit of nonprofit childcare centers. An IBHS program, "Protecting Our Kids from Disasters," helped raise public awareness about natural hazards by gathering insurance company volunteers and others to make the Boys & Girls Club of Warwick and the Pawtucket Day Nursery safer places for children. Volunteers secured bookshelves and picture frames to walls, placed protective sleeves over fluorescent bulbs, and installed safety latches in cabinets and drawers. Safety film was installed on windows that will keep glass shattered by wind or debris from flying indoors.

Rhode Island has proved to be an excellent pilot for the Showcase State idea. In less than a year, the goal of generating a "me too" attitude among other states has been met. IBHS will work with two more states in 2000 and is considering requests for design-ation from three additional states. The value of protecting public and private assets from natural hazards becomes more evident as work proceeds in Rhode Island.

(This article was also published in CUSEC Journal, Volume 6, Fall 1999. It is a publication of the Central U.S. Earthquake Consortium.)

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Managed Retreat as a Hazard Mitigation Technique

By John Pethick and Jeremy Lowe

There are over 150 estuaries along Britain's coastline. These have played a major role in determining the location of ports, cities, roads, industries, and agricultural activities. This land use has, in turn, resulted in significant modification of the estuarine environment. These modifications, among other influences, have resulted in increased flood potential. The most significant and widespread change occurred between the 17th and 19th centuries as land was reclaimed for agricultural use. Large areas of the estuaries' intertidal zone were removed leaving the estuaries unable to effectively dissipate tidal or wave energy. In addition, these estuaries were unable to respond to future changes imposed by human interference or natural environmental change.

The removal of intertidal areas within estuaries has led to larger tidal ranges, higher water surges, and increased wave energy at the shore. As a result, the self-sustainability of these critical coastal areas has been reduced–in some cases eliminated–with former wide estuaries left as no more than parallel-sided canals.

The scale of the problem was not realized until the 1980s when English Nature, the government conservation agency, did a survey of estuarine salt marsh habitat in Britain. The survey revealed that up to 40 percent of the marshes bounding the estuaries had been lost to erosion over the previous decade. English Nature termed this loss "coastal squeeze" and suggested it was due to the landward migration of intertidal habitats brought about by sea-level rise. This migration was interrupted as the marshes were squeezed against the reclamation embankments causing erosion of their seaward edge, erosion that was not balanced by deposition on their landward margins, increased wave attack on flood defences, as well as reducing animal habitat.

In response to these findings, a policy of landward 'set back' of the embankments was proposed to allow the landward transgression of intertidal habitats. The proposal met with fierce opposition from farmers and landowners who regarded the proposal as an economic "set back"' To reduce public outcry, the policy was hurriedly renamed 'managed retreat' and then 'managed realignment.' Though conservationists recognized the need for landward realignment, opposition continued. Not until 1991 was a small-scale trial undertaken at Northey Island in the Blackwater Estuary, Essex. This was followed by two larger-scale trials in the Blackwater: no further progress has since been made.

This lack of progress has been partly due to European legislation, the Habitats Directive, that designated areas of internationally-important habitat Special Conservation Areas. These areas were to be protected from change resulting from human activity.

In Britain, these protected areas included large expanses of freshwater grazing meadow that had been created by reclamation of former salt marshes. These were the very areas needed for intertidal retreat. This legislation meant the loss of intertidal areas seaward of the embankments could not be regained by landward retreat despite the fact that these seaward areas were also protected under the Habitats Directive. This impasse has yet to be resolved.

Also contributing to the standstill of the managed realignment program is scientific uncertainty. Initially it seemed obvious that if the embankments prevented landward migration of the intertidal zone, then the answer was removal of the embankments, or at least their relocation further landwards. There was doubt such a simple solution would be beneficial to the natural estuarine environment. The controversy's thrust was that much of the land reclamation occurred centuries ago, giving the estuaries time to adjust to the new tidal regime. Re-establishing the original regime would, it was argued, cause major re-adjustments that may be harmful or undesired. For example, the re-creation of 100 hectares of salt marsh in an estuary could result in an additional million cubic metres of water entering the estuary from the sea on each flood tide. This increase would generate increased current velocities and cause erosion of existing intertidal areas-in order to restore others. The net outcome could not be predicted given the paucity of estuarine behaviour models.

Managed retreat in progress in the Blackwater Estuary, Essex, UK. Tidal water is entering a grazing marsh for the first time since its reclamation in 1750

As a result of the initial doubts, and in order to ensure a positive outcome of a managed realignment

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ASSESSMENT

Economic Impact of Hurricanes

By Richard M. Vogel

Since 1990 hurricanes have caused more than US$30 billion in damages in the state of Florida, USA. Hurricane Andrew, a Category 4 hurricane that struck Miami, Florida, in 1992, alone accounts for at least US$26 billion worth of damages; while in 1995 in northwest Florida, Hurricane Erin (Category 2) and Hurricane Opal (Category 3) caused over US$3.7 billion in combined damages. In monetary terms, injury, loss of life and physical damage represent only a part of the economic impact that results from a hurricane. In addition to these, hurricanes can cause a rise in unemployment, changes in income and an altered pattern of regional economic growth.

The impact of a disaster is a function of the event's severity and intensity; the zone of impact; and the level of damage, disruption and dislocation. While similar to each other, hurricanes, tropical storms and other weather related events striking different parts of the state are not directly comparable–differing as a result of variation in the degree of physical and sectoral impact and differences in regional economic and demographic characteristics.

Shifted beach sand in Florida

In this century, Florida's Panhandle has been struck by over 24 hurricanes. With a population growth of almost 2 percent annually, the risk to life, property and the economy from hurricanes continues to grow. This article presents a summary of the economic impact of natural disasters, and more specifically an overview of the economic impact of several recent hurricanes on northwest Florida.

Economic Impact of a Natural Disaster

A natural disaster situation is primarily a local or regional event that gives rise to three levels of economic impact: direct, indirect and induced. Direct impacts are the result or immediate consequence of the disaster such as physical damage, loss of life and injury. Indirect impacts are losses resulting from changes in the level of activity arising from damage to the physical economic infrastructure. Increases in unemployment or lost income resulting from plant shut downs or business interruption fall into this category. Induced impacts arise as a result of changes or alter-ations to regional demand and supply relationships.

There are three principal short-run economic effects of a natural disaster: changes in employment levels, changes in income, and inflationary pressures. Employment changes occur as a result of damage or destruction to residential, commercial and industrial facilities temporarily disrupting normal economic activity. Short-term business closures can result in increased unemployment and reductions in income from wages. Some sectors, such as construction and other closely related reconstruction activities, generally experience a rise in employment and income. While income is directly affected by changes in sectoral employment, factors such as temporary population displacement and altered traffic patterns may cause additional and indirect changes to income. Transfer payments into the community may increase, and disaster aid may additionally affect income.

Inflationary pressures are the result of shortages that arise in the disaster's aftermath. Housing prices may rise due to damage and loss to the housing stock. The degree of upward price pressure, however, depends upon the level of damage, the local availability of resources, and the mobility of resources into the affected community. Likewise, sellers may not wish to antagonize existing customers by raising prices, thus face charges of price gouging and losing customer good will–especially if the emergency situation is relatively short-lived.

While there is considerable debate about employment and income effects, disasters tend to cause a short-run decrease in wealth. Because of deductibles and exclusions, insurance coverage is typically incomplete. Even with additional government disaster relief and assistance, households may have to dip into savings and other holdings to completely rebuild damaged homes or replace lost property.

In the long run, the natural disaster may lead to permanent changes in employment and income, the acceleration of pre-existing economic trends, and an alteration in regional economic growth. Long-run changes in employment and income, outside of any pre-existing trends, are attributable to factors such as incomplete sectoral or economic recovery and disruption to regional sectoral linkages. The disaster may

act as a catalyst for sectoral expansion or decline, especially through price and valuation changes, accelerating pre-existing trends. Following the disaster, for example, price and land valuation changes may lead the owners and operators of land intensive activities, such as farming and mining, to reevaluate their operations. Changes in growth and development can arise from sectoral shifts in economic activity and changes that may arise in the institutional, social and political relationships within the community.

The North Florida Gulf Coast

Since 1995, five hurricanes have made landfall in northwest Florida causing almost US$4 billion in property damages and disrupting social and economic activity. Hurricanes Erin and Opal, the most serious of these storms, struck Pensacola in summer and fall of 1995. Hurricane Danny struck the area around Mobile Bay in the summer of 1997. In 1998 Hurricane George made landfall at Biloxi, Mississippi, causing considerable damage from Perdido Key to Fort Walton Beach, Florida. In August 1998, soon afterwards, Hurricane Earl struck near Panama City; this area was still experiencing storm surges and flooding from Hurricane George.

Following Hurricane Erin, 260,000 households and businesses lost electric power a minimum of a full day; power was not completely restored for six days. Hurricane Opal caused power outages for up to four days for some 61,000 households. These storms additionally resulted in the closure of the bridge from Gulf Breeze to Pensacola for several weeks and the beach road between Pensacola Beach and Fort Walton Beach for over a year. While less damaging and destructive, Hurricanes Danny in 1997, and Earl and George in 1998 caused power outages for up to two days for some households and businesses. Hurricanes Erin and Opal caused extensive damage to Pensacola Beach, leading to a steep drop in tourism in 1995, but returning to normal levels in 1996 and 1997.

Hurricane Opal struck at the beginning of October 1995, as Pensacola, Navarre and Fort Walton Beach were still recovering from Hurricane Erin in early August. Regional economic indices published by the Haas Center for Business Research and Economic Development showed a drop in business activity in the months immediately following Erin and Opal. Nonetheless, the existing overall upward trend in regional business activity continued for 1995, surpassing its pre-disaster growth rate in 1996. Employment was relatively undisturbed by the two hurricanes, although sectoral variation might have resulted from a disaster-induced reduction in tourism-related employment (destruction of hotels and restaurants, for example) counterbalanced by an increase in employment from post-disaster recovery and reconstruction activities.

The economic impact resulting from Hurricanes Danny, Earl and George was even more limited–confined primarily to property damages. For the entire Gulf Coast, property damage estimates for Danny range between US$60 and US$100 million; Earl caused approximately US$79 million in damages. Hurricane George, with total property damages in the United States of US$5.9 billion (mostly in Puerto Rico and the Virgin Islands), caused US$340 million in damages to Florida, mainly in the Florida Keys. Preliminary economic data show only a minor economic downturn with recovery in the four months following each of these events.

Conclusion

Advances in meteorology have reduced loss of life attributable to hurricanes by providing more reliable hurricane warnings, thus allowing communities along the Gulf Coast time for preparation and evacuation. Despite greater foreknowledge, coastal communities still face the risk of dramatic economic losses in the form of property damage, disruption of economic activity, and losses of income and employment. Nevertheless, development in the hardest hit and most vulnerable areas, such as Pensacola Beach, Navarre Beach and Fort Walton Beach, has continued unabated.

Over the last decade, hurricanes in northwest Florida have created five serious life-threatening emergencies. While future hurricanes in the area are sure to cause substantial damage, it is difficult to predict their outcomes. However, past experience suggests that hurricanes affecting primarily residential property and activity will have only a limited impact on employment, income and other economic measures (aside from the monetary costs of damage). While more severe and long-term economic impacts will be felt by hurricanes causing extensive and direct damage to an area's economic infrastructure. Still, past experience does not preclude other outcomes.

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Coastal Management in Belize

By Janet Gibson

Recognizing the importance of coastal resources to a country's biodiversity, environment and economy, the government of Belize passed the Coastal Zone Management Act (CZM), No. 5, in April 1998. This act establishes a CZM Authority and its technical arm, the CZM Institute. It formally consolidates the work the CZM Project carried out over the past 10 years–ensuring long-term management of Belize's globally significant marine and coastal resources.

The CZM Authority

The CZM Authority is an autonomous public statutory body established under the Ministry of Agriculture, Fisheries and Cooperatives. It is charged with implementing and monitoring policies that govern the use and development of the coastal zone in Belize. The minister appoints a board of directors, and the directors appoint a chief executive officer. The board of directors, which includes representatives from government, nongovernmental organizations (NGOs), the private sector and academia, held its inaugural meeting on December 10, 1998, and has been meeting on a monthly basis.

Provisions of the Act

The CZM Institute carries out coastal management in coordination with the various agencies involved. Its main functions are to:

- Conduct marine research
- Maintain a data center
- Provide information as required by the Authority
- Organize training courses
- Support other agencies involved in CZM
- Maintain coastal monitoring programs
- Assist with the preparation of a national CZM plan

Presently, the CZM Institute is involved in data collection and analysis; research on manatees; coastal water-quality monitoring; and coastal planning, focusing on marine protected areas and island development.

The CZM Institute will be affiliated with the University College of Belize, working in collaboration with the university's Marine Research Centre. Both parties have already signed a general framework memorandum of understanding, and details will be discussed in the near future. The act requires that the institute supports the University College of Belize initiative in providing courses and educational programs related to the coastal zone.

The act also establishes an advisory council appointed by the Authority. The council replaces the former CZM technical committee. The council includes representation from the government, private sector, the NGO community and academia. Its function is to advise the Institute on technical matters concerning coastal issues and to facilitate coordination among agencies. The council has the same membership as the original technical committee and the same function; but it is now formally established by law.

The act requires a coastal zone management plan within three years of an appointed date. This plan will include aspects such as land use, marine protected areas, cultural and scenic areas, recreation and tourism, activities such as aquaculture and other industries, and guidelines for environmental monitoring.

The act also introduces fiscal measures to support the CZM Authority and Institute's work. Measures range from user fees charged, to donations and funds from donor agencies. The CZM Authority is also responsible for establishing a Barrier Reef Foundation to promote the conservation and management of Belize's coastal resources.

Comments and Reactions

Although this act is viewed as progress towards integrated CZM in Belize, the act needs strengthening. Presently, both the advisory council and the board of directors are reviewing the act and submitting recommendations for amendments that will clarify and strengthen its provisions.

First, the definition of "coastal zone" as the "area bounded by the shoreline up to the mean highwater mark, on its landward side and by the outer limit of the territorial sea on its seaward side, including all coastal waters" is too limiting. It does not address the important link between coastal management and land-based activities. In reality, the CZM program has been working on watershed issues; however, when the act was drafted this limiting definition was the only one that received consensus.

Second, as written, there is possible overlap of user fees established by other agencies. This entire system needs to be re-examined and amended in order to be effective.

Third, currently the act defines the CZM Authority as a "coordinator." For the CZM Authority to have the power to be effective, the legislation needs to be strengthened. This could be accomplished if the legislation was changed to clearly state that the CZM Authority's mandate transcends individual sectors and ministries. To achieve this, it has been suggested that the CZM

Authority be appointed legally as a member of the National Environmental Appraisal Committee. This committee is responsible for reviewing all environmental impact assessments; thus the CZM Authority would be in a stronger position to address the concerns of coastal developments and their impacts.

Conclusions

The CZM Act should be viewed as a significant "first step" in the process of sound coastal management in Belize. By passing the act, the government of Belize affirmed the importance of the coastal and marine resources and acknowledged the need for multi-sectoral coordination and integration for successful management. Integrated coastal management is now a permanent and formalized element of governance in Belize.

The act will hopefully evolve into a strong legislative framework that reaches beyond just coordination, progressing towards implementation and management and, ultimately, active mitigation, thus reflecting true "authority" as embodied in its name.

Small islands off the coast of Belize surrounded by fringing reef

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Managed Retreat

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program, the British government has initiated a major estuarine morphology research program. To date the work has concentrated on the prediction of long-term development of estuaries using tidal regime models. Prediction of estuarine morphology, particularly channel width, assuming various sea-level rise scenarios has demonstrated that estuaries will respond to increased sea-level rise by rolling landward. The seaward intertidal areas erode, releasing sediment that is carried landward to be re-deposited as transgressive intertidal areas. Using field data from the Blackwater and Humber estuaries, these models indicate that sediment transfer from the seaward erosional areas neatly balances the deposition landward. Model predictions suggest the rate of such a transgression is around 2 m to 10 m for every millimetre of sea-level rise. The results mean that a managed realignment program must concentrate on the head of an estuary to allow intertidal transgression while seaward areas must be regarded as sacrificial sites for sediment production. This is a difficult message for conservationists and landowners alike; especially those located in the seaward reaches of an estuary. However, taking these actions could lead to a sustainable estuarine resource with widespread social and economic benefits, which, therefore, transcends local interests.

The importance of the location of inter tidal restoration sites in an estuary is emphasised by another aspect of the work, which has indicated that restoration of even small salt marsh areas. Additional studies indicated that the size and location of intertidal restoration sites can lower mean water levels in the estuary as a whole. For example, a 300-hectare restoration site located at the head of an estuary can lower water levels by over 1 m, while a similar area located at the seaward edge would lower the water level only a few millimetres.

These studies indicate that restoration could be used to offset the local impacts of sea-level rise due to global warming. In addition, restoration of intertidal areas can reduce the risk of flooding, both by decreasing wave-energy dissipation and water levels. Despite the apparent beneficial results of a restoration program, there are still areas of concern. The restoration of an intertidal area can alter the tidal flow enough to turn an accreting (growing) system into a net erosional system. This leads to increased flood risk and disinterest by conservationists. The critical issue appears to be the elevation of the restored area; areas with high surface elevations relative to modern sea level, such as recently reclaimed marshes, can cause ebb irregularities and net erosion. Conversely, lower restored surfaces, characteristic of older 17th century reclamation areas, result in increased deposition throughout the estuary.

The work outlined here suggest that the program of managed realignment in Britain can be expected to produce major benefits to estuarine conservation interests by increasing intertidal habitats,

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Managed Retreat

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and to other estuary users by reducing flood risks. However, the results so far emphasize if such benefits are to be realised, the estuary must be managed as a single functional unit within which the exact location and elevation of restored sites are critical.

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Seaweed Farming in Tanzania

By Flower Msuya

Seaweed farming in Tanzania began in the 1930s when wild seaweed was harvested from the Zanzibar Islands and exported to Europe. Seaweeds contain polysaccharides such as carrageenan, agar, and alginate that have become important ingredients in the food, pharmaceutical, and cosmetic industries. The demand for seaweed by these industries grew quickly. In the early 1950s, about 400 tons (dry weight) of the red seaweed Eucheuma were exported to European markets. Between 1973 and 1975, the Zanzibar seaweed trade collapsed mainly because wild seaweeds harvests could not satisfy demand, and the wild crop could not compete with the cleaner, farmed seaweed from the Philippines.

Seaweed farming, however, ensured a continuous supply to the industries, thus making farming profitable. In the mid-1980s, the first experiments with seaweed farming in Tanzania were conducted. However, due to lack of funding, commercial production did not start until 1989 when private entrepreneurs started experimental farms in Paje and Jambiani on Unguja Island, Zanzibar. By 1992 seaweed was also farmed on Pemba and Mafia Islands. On Mainland Tanzania commercial seaweed farming started in 1995.

When seaweed farming started on in 1989, both men and women participated. Slowly, in most areas men went back to fishing and activities that were triggered by tourism such as road and house construction, making lime and working in guesthouses. Today on Unguja Island, seaweed is farmed mostly by women; however, on Pemba Island, Zanzibar, seaweed is farmed mainly by men. The difference is the topography, which determines the farming technique, of the two islands. Unguja has shallow bays and intertidal areas that allow farming at low tides. The technique used is fixed wooden pegs in the sediment with nylon ropes holding seaweed tied to the pegs. On Pemba, seaweed is farmed in deeper waters and the long line (floating method) is used. Here farmers use boats or canoes to reach their farms. Women, who continue to attend to agriculture, fishing, caretaking, etc., do not participate. On Mainland Tanzania, although the use of pegs dominates, both sexes are involved equally in the farming. Limited alternative economic activities (lack of a large tourism industry) causes men to participate in seaweed farming.

To a great extent, seaweed farming replaced the use of destructive fishing methods, especially dynamite fishing which has destroyed much of the marine environments. Of the two income producing activities, most fishers changed from destructive fishing methods to seaweed farming.

Benefits of Seaweed Farming

Seaweed farming is more profitable than traditional activities such as handicraft, collecting octopus, fishing, petty trade and agriculture. In Tanzania, for example, a seaweed farmer with a plot of 50 ropes can make 13,000 Tshillings (US$22.7) per harvest. Most farmers have more than one plot and can harvest every two to three weeks (the minimum wage in Tanzania is US$600 per year, gross). As a comparison, a cap/hat (handicraft) that takes three or more months to make sells at about US$2. An ordinary fisher makes about US$565 per year, gross income, whereas a seaweed farmer makes about US$1,000 per year. In addition, seaweed farms attract some fish species allowing farmers to provide for their family while farming.

Negative Impacts of Seaweed Farming

Seaweed farming also has some negative direct and indirect impacts on the intertidal organisms such as changes in organism abundance and biodiversity. Intertidal areas become barren and in some areas algae has overgrown. Farmers, being scared of a sea urchin's poisonous spines, kill those found in their farms. When seaweed is grown on top of seagrass, the seagrass dies. Also, opportunistic organisms, such as tubeworms, use the dead seagrasses as shelters;

farmers' movements cause disturbance of the substrate, exposing and resuspending the clay in the substrate; and clay is carried away leaving behind coarse sand. When under stress, the farmed seaweed Eucheuma produces toxic chemicals were likely to affect other intertidal organisms.

Seaweed farming has also affected social structure. Traditionally Zanzibari women had no means of earning cash income. The seaweed farming income gave them money power, placing them in a different social role. Family conflicts have arisen resulting from the wives' changed role in the family. Some women give part of their earnings to their husbands to be allowed to continue farming.

Another obstacle was taking care of young children when farming. As a result of the accidental death of a child, Unguja farmers contributed part of their earnings to build a day care center to care for children while mothers farmed. Other concerns include children leaving school early to earn farming income, sun-related illness, and dangerous marine organisms.

Impacts of Seaweed Farming

The Institute of Marine Sciences (IMS), University of Dar es Salaam, conducted the first environmental impact study of seaweed farming between 1992 and 1995. This and other studies showed that seaweed farming has improved the standard of living for farming families. Farmers are able to purchase items such as radios, kitchenware, cloths, and furniture; many old homes have been improved and new houses built; and the number of children suffering from malnutrition has decreased. Studies by the IMS contributed to the establishment of commercial seaweed farming on the coast of Mainland Tanzania. By mid-1996, 21 villages were participating in seaweed farming, now more than 30 villages are involved.

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Economic Valuation of a Mangrove Ecosystem: Practical Implications for Management

By Marion Glaser and Monica Grasso

Environmental functions relate to the capacity of natural systems and processes to provide goods and services which, directly or indirectly, satisfy human needs. Mangroves provide many important environmental functions. Typically, the extractable harvests of the mangrove ecosystems are important in poorer tropical coastal areas, not only for commercial uses but also for subsistence. By definition, such subsistence use does not pass through formal markets. Particularly in regions with important subsistence sectors, classic market-based production evaluations of mangrove ecosystems are likely understate the true social cost of possible alternative uses or conversions of the mangrove ecosystem. Moreover, most ecological functions also lack market prices and, as a result, their economic value is often ignored or underestimated. However, the use of monetary valuation, be it in the context of cost-benefit or cost-effectiveness analysis, constitutes a clear and effective way of calibrating information for a range of diverse cultural, ecological, economic, social and other concerns. It is essential to provide such information as an input into ongoing, resource-use decision-making, and alternatives to comprehensive monetary valuation of ecosystems for this purpose are not available. For these reasons, economic valuation techniques were used for mangrove management research in northern Brazil. This was done despite some clear problems associated with the use of monetary valuation techniques in the natural resources sector.

This article is based on field research carried out between 1996-1998 by the socioeconomic group of the Mangrove Dynamics and Management Project (MADAM) in a coastal area (Caeté Bay, Bragança municipality) of Pará State, northern Brazil.

The study's main objectives are:

- To present a socioeconomic approach for the valuation of mangrove ecosystems in a developing country
- To introduce some first results from the application of this approach in a coastal mangrove area of northern Brazil
- To discuss the implications of utilizing the results for mangrove and associated coastal management planning

Socioeconomic surveys were the main basis for the economic

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Mangroves

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valuation of the mangrove ecosystem. Such surveys are versatile tools since they reveal the value to humans for some physical functions. They also generate knowledge of the relationship between society, the economy and ecosystems.

Methodology

The research area is the mangrove ecosystem on both sides of Caeté Bay. The area of primary human interaction (i.e., production/extraction activities) with those mangroves determined the geographic limits.

In this area a Community-Based Statistical Survey (CBS) was done to determine the actual geographic area and population size of interaction with the mangroves and mangrove-related resources. Interviews and field visits were conducted with town and village leadership and local government officials. Over 50 villages, plus the town of Bragança, were identified. Information on mangrove and fish products use was gathered on individual households in 21 rural communities. An Urban Survey, a replication of the household-level survey complemented by questions on household structure and income was undertaken in two areas of the town of Bragança in June 1997.

Mangrove productivity and household production studies were done to obtain information, including but not limited to, information about family structure and dependency, income, economic activity of household members, products collected from the mangrove, among others. Some 250 households were visited once at two-week intervals to capture seasonal or moon-phase-related production variations.

A tourism survey evaluated the relationship between rate of tourist visitation and the mangroves' function of providing fishery products. The influence of the ecosystem's natural beauty on visitation rates was also assessed. In addition to questions related to the visit (reason, expenses and length of stay), tourists also answered questions on the cost of travel.

The existence value of the mangroves for visitors was determined using the Contingent Valuation Survey. Potential alternative uses were the conversion of the mangrove area to clear cutting for charcoal, use as pasture or for real-estate enterprises. The specific objective of the contingent valuation survey was to estimate the economic net benefits to society from preserving the mangroves. We hypothesize that individuals would be worse off if this specific mangrove area was lost to another use. This economic loss would take the form of a reduction in personal welfare to visitors who were assumed to be willing to pay an amount to prevent the area from being converted to another use.

The socioeconomic approach revealed relationship between the mangrove ecosystem and the local economic system. Although some ecological functions of the ecosystem were not evaluated directly, it was possible to infer a value for the ecosystem to society by identifying how the ecosystem helps to alleviate poverty areas where most household depend on the mangrove and have few other income or employment options.

Results

The CBS

The CBS delivered a first set of results:

- Eighteen Caeté Bay mangrove products were identified as used for subsistence and commercial purposes.
- The 18 major mangrove products were prioritized in order of highest use among households
- The economy-ecosystem linkages at the household level for the rural and urban areas were determined
- A database of household types, in terms of mangrove uses, was established for the rural area

The Urban Survey

The survey showed that relatively high numbers of urban residents produce mangrove products for sale. However, despite the methodological bias towards surveying urban areas with more intensive mangrove product use, direct mangrove use was found to be much less diverse and intensive in the urban than rural area. Moreover, subsistence use of mangrove products is much rarer in the urban than rural area, and is restricted to the very poorest households.

The Production Study

Fishers' net monthly revenue from the mangrove ecosystem was found to be between US$50-1,000. However, the aggregated value for the mangrove will be underestimated if based solely on the fishers' income, approximately US$228/ha/year (not a final value, research still in progress), due to the poverty of local mangrove fishers in the area.

Tourism

During February 1997, 185 tourists visiting the area were interviewed. Seventy-five percent of respondents were male, with an average age of 33 years. The main recreational activities were fishing, boating and consumption of local fishery products.

Existence Value-Contingent Valuation

About 185 respondents participated in the survey. The questions used were close-ended, with two possibilities of bid values (the values presented to the people interviewed). Answers

presented the expected behavior, i.e., declining percentages as the prices go up.

Practical Application and Outlook

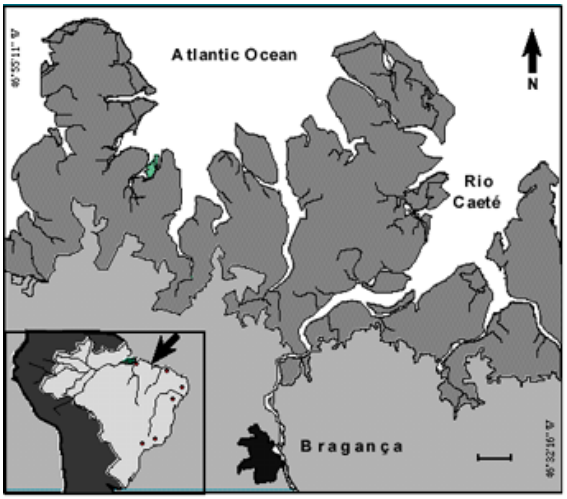
Throughout the three MADAM phases, the integration of research results into policy relevant frameworks (decision-support systems) is ongoing. However, since the policy process does not wait for the conclusion of research projects, the research results are already in demand to guide official decisionmaking. Thus, in response to a demand from decisionmakers, the results of the socioeconomic and natural science working groups have provided data for the development of resource management legislation. The mangrove resource with the highest ecosystem and local socioeconomic importance was the mangrove crab (over half the rural population financially depended on mangrove crab collection). Management measures initially designed to address ecological dangers have been modified to incorporated the social and economic importance of the resource as revealed by the research data. In practice, this has meant that draft legislation for a de facto year-round prohibition on crab collection was modified to a prohibition during the main reproductive period with a view to introducing an additional prohibition for a three to four month period with compensation to collectors for income loss. To maximize the applicability of research results, the second phase of the MADAM socioeconomic research focuses on those mangrove products which have the highest social and economic importance, and compares the effects of alternative, ecologically desirable management approaches.

The economic valuation approach assigned no value to mangrove services such as pollution absorption, coastal protection and carbon dioxide absorption. At present, a small population and lack of polluting industries suggests a low value. Moreover, the absence of hurricanes in coastal northern Brazil renders the coastal protection function of the mangroves insignificant.

Equity is a major concern in socioeconomically-based economic valuations. In the Caeté Bay villages, mangrove subsistence production among poor households is high. By definition, subsistence production does not pass through market channels; alternative modes of value attribution can be selected by the evaluator. Where subsistence production is high and occurs among the poorest households, the market prices assigned assume a purchasing power these products rarely have. The same applies for assigning the price of a substitute-marketed product. The assumption that a product used purely for subsistence will be substituted by an alternative product can be extremely inequitable when the function of the subsistence product is only to support the household over periods of extreme economic need. In the research example, the use of the price of alternative products available for sale is greatly at odds with the actual real-life alternative (hunger or worse) for the resource users.

The inclusion of equity criteria would allow an element of social justice to be incorporated into the valuation exercise. It may therefore be appropriate to employ higher weighting of the costs and benefits of poorer ecosystem stakeholders via an inequality coefficient. However, the weighting in the final analysis always includes a political decision about the degree of desired equity, or conversely the degree of acceptable inequality.

It must be concluded that the use of conventional valuation techniques needs to include distribution aspects, particularly for environments where poverty and destitution are common. If not critically examined and appropriately corrected, market-based decision aids such as the conventional economic valuation can fail to reflect more comprehensive perceptions of value and may result in management policies seriously at odds with social sustainability objectives.



Study area

For further information contact Dr Marion Glaser, Centre for Marine Tropical Ecology (ZMT), Fahrenheitstr 1, 28359 Bremen Germany. FAX: 0049 421 2208 330 E-mail: mglaser@zmt.bremen.de; or Monica Grasso, International Society for Ecological Economics, P.O. Box 36, Solomons, MD 20688 USA. 🌐:

Economic Instruments used in Coastal Zone Management in the Mediterranean

By Ivica Trumbic and Aleksandar Bjelica

In 1994, the Priority Actions Programme Regional Activity Centre (PAP/RAC) in Split, Croatia, conducted an analysis of economic instruments used in the Mediterranean. The approach was based on the experience of the Organization for Economic Cooperation and Development member countries. A questionnaire was used to collect information on the existing conditions in mid-1994. The countries of: Albania, Cyprus, Croatia, Egypt, France, Israel, Italy, Libya, Morocco, Syria and Tunisia were assessed.

Economic instruments are being implemented to provide a certain level of environmental protection and avoid additional economic costs. These instruments are usually preferred to existing command regulatory policies, since they allow polluters greater flexibility in achieving the required pollution level, and they stimulate rapid technology change in pollution abatement. Another argument, still unexplored and controversial in the use of economic instruments, is the so called 'double-dividend effect.' Here, some studies suggest that economic instruments could be applied in a way that would not just reduce the pollution level, but also reduce taxes and increase employment. The main environmental problems in coastal areas are urbanization of agricultural land, increasing population and associated increased sewage and solid waste, and discharge of waste water into the sea and other surface waters.

Important economic activities in Mediterranean coastal areas include tourism, agriculture and transportation. Conflicts occur most frequently between agriculture and fishing; industry and tourism; and cities (urban waste) and the natural environment.

The Mediterranean countries have developed natural resource management programs for their individual environmental problems. Generally, environmental management is centralized and the administrative machinery acts on the regional and local level. Ministries and government institutions are directly involved in environmental management, while nongovernmental organizations participate to a lesser extent.

An analysis of the application of economic instruments in the Mediterranean countries has shown that economic instruments are being used and are widely applied in the fields of water protection, land management, and industrial and solid waste–the areas with the most apparent environmental problems. The analysis identified charges and resource pricing, and subsidies as the most effective economic instruments currently in use.

Difficulties most frequently encountered in applying economic instruments are poor organization, nonconformity of economic instruments with practice, inadequate environmental monitoring, inappropriate use of economic instruments, uncertainty whether tax proceeds are being used for maintaining and improving the natural resources, and small, inconsequential fines.

It appears that overall, economic instruments are efficient and their application does result in the reduction of environmental pollution and improvement of environmental quality. Economic instruments with incentives for compliance have proven to be more effective than those without an incentive.

Some of the assessed countries have experience in the implementation of economic instruments (France, Israel, Italy and Tunisia), and some have very little experience (Croatia, Albania, Morocco and Syria). In some, economic instruments are yet to be applied (Cyprus, Egypt and Libya).

It is hoped that those countries not yet applying economic instruments will learn from the successes and failures of those countries currently using these methods.

For further information contact: Ivica Trumbic, Priority Actions Programme Regional Activity Centre, Kraj sv. Ivana 11, HR-21000 Split, Croatia. Tel: +385 21 34 34 99. Fax: +385 21 36 16 77. E-mail: pap@[illegible]dst.hr.

Marine and Coastal Geographical Information Systems

Edited by Dawn J. Wright and Darius J. Bartlett
Taylor and Francis, 1999

This book addresses basic and applied scientific problems in deep-sea and coastal science using Geographical Information Systems (GIS) and remote sensing technologies.

Part 1 covers the conceptual and technical issues associated with the use of GIS. Issues include data models for marine and coastal GIS; an algorithmic approach to marine GIS; representation of variability in marine environmental data; and coastal geomorphology 3-D GIS.

Part II covers the applications of GIS including real-time GIS for marine applications; applications to fisheries management and electronic chart display and information systems;and more.

In addition, institutional issues such as managing coastal data sources, applications to maritime boundary delimitation, and information quality consideration are discussed. Mapping capability and other topics are also discussed.

"Monographs in GIS" series (# 0-7484-0862-2 Hbk). Addition information and ordereds online at Website: http://wwws.thomson.com/pub/routeldge/order_blank.html, 348 pp.

Disaster by Design: A Reassessment of Natural Hazards in the United States

Dennis S. Mileti
Joseph Henry Press, 1999

Over time, events have shown that natural disasters and the technological hazards that may accompany them are not problems that can be solved in isolation. Losses from hazards-and the fact that the United States cannot reduce them-result from a shortsightedness of the human relationship to the environment. More simply, accepted methods of coping with hazards have been based on the idea that people and technology can control nature. This has not worked. Instead, the nation must shift to a policy of "sustainable hazard mitigation." This concept links wise management of natural resources with local economic and social resiliency. Recent natural disasters have emphasized that it is increasing important to understand the social science aspect (economic, social and political ramifications) of natural disasters.

This summary, and the report it is based on, outlines a comprehensive approach to enhancing society's ability to reduce the costs of disaster. Topics include fostering local sustainability; using mitigation tools such as land use planning and advanced warning systems and improving engineering and insurance coverage. Also of paramount importance is to establish government policies and conduct hazard and risk assessments, as well as exchanging information and experiences by developing a comprehensive, internationally-supported and shared database on hazards that occur worldwide.

For information and/or copies contact: National Academy Press, 2101 Constitution Avenue, NW, Lockbox 285, Washington, DC USA 20055. Tel: 202-334-3313. Fax: 202-334-2451. Website:

ELECTRONIC RESOURCES

SPECIAL SECTION

(continued from page 13)

The Emergency Information Infrastructure Partnership (EIIP) hosts several E-mail discussion lists through its Emergency Management Forum (EMForum) including:

academia@emforum.org - research, reference sources, higher education
business@emforum.org - contingency planning and business continuity
eiip@emforum.org - notification of EIIP events and activities
firefighting@speccomm.com - Firefighting.Com & Associates News
government@emforum.org - opinions, comments about government roles
highered@emforum.org - in support of the FEMA's higher education program
mitigation@emforum.org - implementing "Disaster Resistant Communities"
postings@emforum.org - the EIIP monthly newsletter
preparedness@emforum.org - planning, training, exercises, evaluation
professional@emforum.org - jobs, conferences, announcements, educational opportunities
recovery@emforum.org - issues in public and individual assistance programs
response@emforum.org - serving the public during the first critical hours
technology@emforum.org - issues in emergency information technology
volunteers@emforum.org - vital contributions of volunteers, NGOs
actnow@emforum.org - FEMA's Act Now Preparedness Updates
firelist@speccomm.com - National Fire & Rescue News

To subscribe contact EIIP at E-mail: eiip@emforum.org or see the EMForum website - http://www.emforum.org

SELECTED WORLDWIDE WEB/INTERNET INFORMATION SOURCES

http://www.disasters.org/emgold/index.htm

Emergency Management Gold©1999 (EMGold) is a multilingual site to assist those who use English as a second language. Languages are French (Francias), German (Deutch), Italian (Italiano), Portugese (Portugeze), Spanish (Espanol). EMGold's listing of the GLOBAL EMERGENCY MANAGEMENT SYSTEM (GEMS) (c)1999

http://www.disasters.org/emgold/library

EM Gold gives one of the most comprehensive country by country indexes of disaster-related websites. For example: (underlined items are website links)

American Samoa (Unincorporated Territory-Pacific) Claimed in 1900. Area is 75 square miles consisting of five volcanic islands. Capital is Pago Pago. Climate is tropical. Population is 50,923 and is ethnically Polynesian. Official language is English. Unit of currency is the U.S. Dollar.

Antigua & Barbuda: (country information) Emergency Guidance, Mitigation Plan for Schools Against Natural Disasters
Belgum: (country information) Protection Civile Belgium, Institute for Occupational Safety and Health, Red Cross
Bosnia: (country information) Dinar. Bosnia Information
Turkey:(country information) Telsiz ve Radyo Amatrleri Cemiyeti (TRAC) (ARES)
Venezuala: etc. VietNam: etc. Yugoslavia : etc. Zimbabwe: etc.

EMGold's Virtual Library is an integration of information relating to Academia (Education), Business and Industry, Government (Federal, State and Local) and Volunteers (NGOs) in Emergency Management. Topics include: Academia, Associations, Computers, Conferences, Earth Science, Maps, Media and Medical. EMGold's ALERTS directory

http://www.disasters.org/emgold/Alerts.htm

This site gives information on current disasters worldwide

http://www.colorado.edu/hazards/

Natural Hazards Center at the University of Colorado, Boulder, USA, is a national and international clearinghouse for information on natural hazards and human adjustments to hazards and disasters. The following is a selected list of websites obtained from the Natural Hazards Center and other sites. By visiting these websites and their links, one can compile a network of websites and communications on all aspects of natural hazards and disasters.

http://www.fema.gov

The Federal Emergency Management Agency (FEMA) Website now contains thousands of pages of hazards/disaster information.

http://www.redcross.org

The American Red Cross provides extensive information on disaster mitigation, management, and recovery.

More Websites

http://www.cdc.gov/nceh/programs/emergenc/prevent/prev_em.htm
The Centers for Disease Control and Prevention (CDC), National Center for Environmental Health (NCEH) has issued several on-line Prevention Guides to Promote Your Personal Health and Safety Before, During and After Emergencies and Disasters in both English and Spanish.

http://hoshi.cic.sfu.ca/~anderson/
The Emergency Preparedness Information Exchange (EPIX) is one of the most comprehensive. EPIX contains extensive information about both current situations and disaster management generally. Simon Fraser University, British Columbia, Canada.

http://web20.mindlink.net/sarinfo/sarinfo.htm
The SARINFO Home Page provides information on search and rescue. The site includes an extensive file library.

http://www.iaem.com
The International Association of Emergency Managers (IAEM - formerly the National Coordinating Council on Emergency Management) website includes information on emergency management and on its Certified Emergency Manager program.

http://www.disastercenter.com/home.htm
The Disaster Center is a ganglion of Web links, bulletin boards, forums, and pages of all kinds dealing with disasters. The site assembles and arranges disaster information from hundreds of others sites and adds information of its own to produce an extensive reference resource.

http://www.yahoo.com/Environment_and_Nature/Disasters
Yahoo includes a section devoted to disasters that interested persons can consult to determine the latest Net resources.

http://www.worldbank.org/html/fpd/urban/dis_man/dis_man.htm
The World Bank established a new Disaster Management Facility (DMF) to ensure that disaster prevention and mitigation are integral parts of development programs.

http://www.unige.ch/idndr
The Directory for Disaster Reduction Institutions was created by the United Nations and the University of Geneva. It contains information on collaboration, research support and training at the local and regional levels.

http://www.disaster.info.desastres.net/crid/eng/index.htm
The Regional Disaster Information Center (Centro Regional de Informacion Sobre Desastres - CRID) website for Latin America and the Caribbean facilitate access to technical and scientific information on disaster prevention.

http://www.epc-pcc.gc.ca
Emergency Preparedness Canada (EPC) offers emergency management and preparedness information in English or en francais.

http://www.ema.gov.au
The redesigned Emergency Management Australia (EMA) website includes sections on personal safety, school resources, general and current emergency management issues and others.

http://www.adpc.ait.ac.th/Default.html
The Asian Disaster Preparedness Center (ADPC), Bangkok, website focuses on Asia and the Pacific.

http://incede.iis.u-tokyo.ac.jp/intro/glodisnet_subject.html
International Center for Disaster-Mitigation Engineering (INCEDE) at the Institute of Industrial Science, University of Tokyo contains websites and documents on all disasters focusing in the Asian region. It is a good source of alternative WWW on disasters.

These represents only the tip-of-the-iceburg for informative websites. Most any of the above sites will link to numerous other excellent sites.

InterCoast Network
International Newsletter of Coastal Management

Available on the Worldwide Web
http://crc.uri.edu/comm/htmlpubs/ic/index.html

The Hidden Costs of Coastal Hazards: Implications for Risk Assessment and Mitigation

H. John Heinz III Center for Science, Economics and the Environment
Published by Island Press. Price: Paper: $30.00. 210 pp. ISBN: Paper: 1-55963-756-0

Society has limited dollars to invest in hazard mitigation.
The question is: Which actions will be most cost effective, considering all impacts and costs?

In 1997, the H. John Heinz III Center for Science, Economics and the Environment began a two-year study to develop new strategies to identify and reduce the costs of weather-related hazards associated with rapidly increasing coastal development. The Hidden Costs of Coastal Hazards offers the first in-depth study that considers the costs of hazards to: natural resources, social institutions, business and the environment.

Hurricane Hugo, which struck South Carolina, USA, in 1989, provides information on the full range of economic costs caused by a major coastal hazard event. Using Hurricane Hugo, the authors looked at pre- and post-hazard information and recommend ways to improve assessments and to form a comprehensive framework for developing and implementing mitigation strategies. To do this, the book:

- Describes and examines unreported, undocumented and hidden costs such as losses due to business interruption, reduction in property values, interruption of social services, psychological trauma, damage to natural systems and others
- Examines the concepts of risk and vulnerability and discusses conventional approaches to risk assessment and the emerging area of vulnerability assessment
- Documents the impact of Hurricane Hugo and provides insight from some of the survivors

The Hidden Costs of Coastal Hazards takes a structured approach to the problem, suggesting a new framework for community-based hazard mitigation, and offering specific recommendations. Decisionmakers–both policymakers and planners–who are interested in learning about the categories of costs and risk associated with coastal hazards will find the book a unique source of new information and insight, as will private-sector decisionmakers, including lenders, investors, developers and insurers of coastal property.

The H. John Heinz III Center for Science, Economics and the Environment is a nonprofit institution dedicated to improving the scientific and economic foundation for environmental policy by fostering collaboration among industry, environmental organizations, government, and academia. Available from: Island Press, Box 7, Dept 2NET, Covelo, CA 95428 USA. Tel: 800-828-

The Global Trade in Coral

Green and Shirley, 1999
Published by World Conservation Press, Cambridge, UK, 70 pp, ISBN: 1-899628-13-4

In the last decade there has been a large increase in the global trade of live coral for aquaria. The World Conservation Monitoring Centre looked at trade in live coral from the ecological and economic perspectives. The study identified the taxonomic composition of the trade and the quantities of coral passing between nations. This illustrates the links between major exporters and importers. Data is presented on the practicalities of monitoring international trade in coral at the global scale. Export and retail prices are used to estimate the revenue to exporting nations. Size and growth-rate data used to assess the sustainability of the trade in live coral is also presented.

Available from: World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge, CB3 0DL, United Kingdom. Tel: 44 1223 277314. Fax: 44 1223 277136. E-mail: info@wcmc.org.uk. Website: http://www.wcmc.org.uk/

Complacency or Action?

(continued from page 1)

Hurricane predicting, as explained by Ginis (page 2), has improved significantly over the last decade and will continue to improve with the use of new technologies. Mashriqui and Pine (page 6) discuss the use of real-time, three-dimensional flood models to provide input to decisions regarding evacuation routes, shelters, and the impacts to public utilities. Appendini and Lizárraga-Arciniega (page 11) used pre-and post-El Niño data in Mexico to advocate pre-hazard modeling and planning to minimize shoreline erosion. Gelfenbaum, Jaffe, Neal and Davies (page 7) discuss how the analysis of a single hazard event can be used to plan for future events, as well as decipher past events worldwide.

As population grows and demand for new development increases, so does the risk of developing in marginal lands, such as beaches and wetland areas, that are vulnerable to hazards,. Pethick and Lowe (page 21) illustrate the ill effects of long-term land use choices which led to altered estuarine systems and increased vulnerability to flooding and sea-level rise. Here, mitigation and "recovery" efforts will not be a one-time intervention, but will require long-term restoration and political will to affect such change. Burrill, Burbridge and Humphrey (page 16) furthered this point noting that again human activities, not Mother Nature, have seriously altered the European coast leaving inhabitants battling evolving hazards and significantly increasing their vulnerability to individual hazards. Gibson (page 24) outlines Belize's new coastal management program that was enacted last year. Integrated programs such as this provide excellent opportunities for partnerships in planning and implementation and to proactively explore hazard mitigation as a key tool in regulatory and non-regulatory program elements.

In El Salvador, poverty, population expansion and civil conflict have driven many households to the coast, resulting in increased pressure on the natural resources and coastal areas. Gammage, Machado and Benitez (page 14) report on the challenges faced when introducing appropriate technology to decrease utilization of limited resources (fuelwood from mangroves) that protect coastal communities from flooding and erosion. Similarly, in Brazil the mangrove environment is being placed under great pressure by communities. Glaser and Grasso (page 27) discuss the economic value of the mangrove ecosystem in terms of what is and is not tallied in an economic evaluation. This is important because before management decisions are made, it is necessary to look at the value (not in monetary terms) of the resource to a community.

Complacency can be blamed for increased risk in many regions of the world. Ramsey's observations in Micronesia target the absence of a significant destructive event in recent memory. He notes that since the last major disaster in 1905, virtually the entire population base and most of its infrastructure has been built on the coast, leaving the people or residence extremely vulnerable.

Triggered by the partial collapse of the insurance industry in Florida after Hurricane Bob, the United States has enhanced its efforts in hazard mitigation research and implementation. The two articles–East (page 18) and Steinberg (page 19)–agree that it is not possible to control the occurrence of natural disasters; however, it is possible to take measures to reduce their impacts by building partnerships among a broad group of constituencies for both pre-disaster and recovery phases. Both programs recognize how crucial the business community is for the recovery of services and supplies, thus making public/private partnerships key for both mitigation and disaster management.

Despite the great technological advances in forecasting and modeling, natural hazards still take a huge toll in human life and, often as devastating, loss of property and economic collapse. The enormous economic losses are sobering and should provide great incentive to change the status quo. Vogel (page 22) explains the short- and long-term economic effects of a natural disaster (e.g., employment shifts, housing sales, etc.). Using recent hurricanes affecting the Florida coast, he looks at the type of property damaged as a factor in determining economic impacts. Though not news to anyone, he notes that the human population, though well aware of the inevitable occurrence of a disaster, continues to rebuild in those areas hardest hit.

While disaster brings much despair and loss, it does offer an opportunity to rebuild with more consciousness and thought. In 1998, Hurricane Mitch's merciless destruction of Central America received worldwide attention. The impacts were even more devastating due to poverty and social and environmental factors. Franklin (page 4) discusses the role the Inter-American Development Bank took through mitigation during reconstruction; this prompts one to imagine the impact of donor agencies in promoting mitigation as a key development tool.

(continued page 36)

Complacency or Action

(continued from page 35)

Outreach is essential when developing strategies for hazard mitigation. In Indonesia, the Coastal Resources Management Project is developing a program to strengthen local capacity to address natural resource management, including erosion and flooding. Gosal (page 10) discusses the introduction of community monitoring of coastal processes as a first step to developing and implementing a local management plan.

An area not addressed in this issue, yet still important, is pre-hazard safety preparation (shelters, evacuation routes, helicopter or boat rescue, etc.). People management, particularly in distress situations, is not easy and often not well organized. Progress in this area has improved significantly; however, as coastal populations grow the problem only grows. The United States and some other developed countries are addressing evacuation strategies for many types of hazards; however, the challenges are greater in developing countries where poverty, social structure and physical ability often negate any action.

The concept of hazard mitigation is age old. Fishers worldwide have been building their huts on stilts and finding safe havens for their boats during a storm. What is new is the apparent increased rate at which natural events are occurring and/or the attention that they raise, perhaps due to enhanced worldwide communication or increased economic value of losses and recovery. What is needed now is to take the opportunity to plan for the inevitable in every way to save lives and reduce severe economic distress. We need to learn from experience, be proactive through prediction and modeling, undertake proactive planning initiatives, ensure proper policy development and implementation, provide education and outreach, and cultivate partnerships and incentives. Having done this, when "that" event occurs, we need to ensure that our efforts in prediction, outreach and disaster planning have resulted in increased success for safety and evacuation. As important, when rebuilding is initiated, we must balance the needs of getting the community back to working order and rebuilding in a wise fashion. The goal is to minimize the loss next time, because it will happen again, if not in our lifetime in our children's.

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