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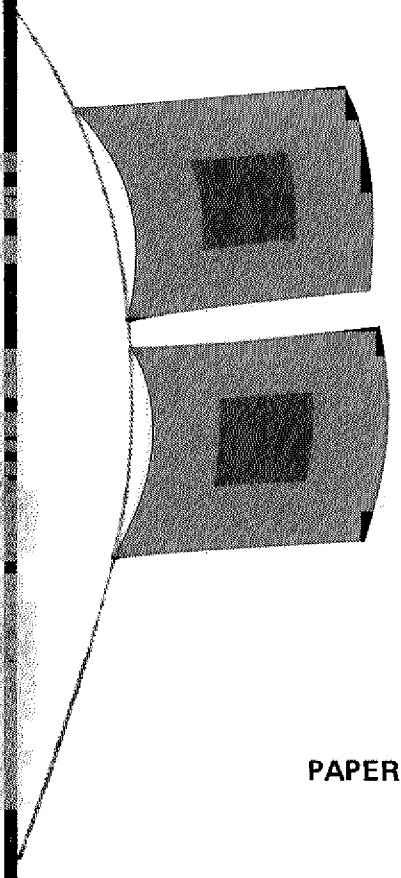

HURRICANES
AND COASTAL STORMS

PAPERS PRESENTED AT A NATIONAL CONFERENCE

Cooperatively sponsored by

Federal Emergency Management Agency
Florida Sea Grant College
Florida Bureau of Disaster Preparedness
Florida Bureau of Beaches and Shores
Florida Office of Coastal Management
Florida State University
National Oceanic and Atmospheric Administration

Earl J. Baker, Editor

Report Number 33

April 1980

HURRICANES AND COASTAL STORMS

Awareness, Evacuation, and Mitigation

Papers presented at a national conference
held in Orlando, Florida on May 29-31, 1979

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FOREWORD

A fact about which those of us involved in putting together the National Conference on Hurricanes and Coastal Storms are proud is the cooperative manner in which the meeting evolved and was conducted. Several state and federal agencies participated and contributed in a variety of ways.

My own initial involvement in the conference came about as a part of a research project on hurricane evacuation alternatives being funded by the Florida Sea Grant Program. Part of the grant was to support a small two-day symposium of experts held in Tallahasse during February, 1979. It was agreed that unused funds earmarked for the February meeting would go to assist an otherwise self-supporting national conference on hurricane evacuation alternatives and issues, which would serve both as an input device for the study and a dissemination mechanism. Sea Grant personnel, particularly Marion Clarke and Bob Carrodous, also assisted in publicizing the meeting.

While final arrangements were being made on funding of the Sea Grant project, the Florida Division of Disaster Preparedness (now the Bureau of Disaster Preparedness) was planning a hurricane conference for late spring and early summer. We both felt it made sense to try to combine the two meetings into one, a notion which Sea Grant endorsed enthusiastically, noting that it (Sea Grant) would like to see the conference's scope broadened beyond the evacuation issue. As well as helping plan the meeting from its initial stages, Judy Peckinpaugh organized two sessions at the conference--exemplary local response plans, and the National Flood Insurance Program--the latter being a particularly difficult subject on which to find people who have not just opinions but data as well. The most substantial contribution from the Division, however, was its provision of Bob Wilkerson's time. He not only organized a paper session for the conference but assumed primary responsibility for a myriad of tasks (many of which are pure nuisances) whose time demands can only be appreciated by those who have had responsibility for arranging the details of a major conference themselves. In addition, the Division provided travel funds for site visits to Orlando and secretarial services and other support relating to publicizing the conference. In setting a date for the conference, it was learned that the Federal Disaster Assistance Administration (now part of the Federal Emergency Management

Agency) was at least contemplating a hurricane conference of its own which would address some of the same topics as ours, with additional emphasis on hurricane awareness programs and meetings. FDAA offered to help support our meeting financially and with manpower if we could accommodate certain goals which they sought in such a conference. The accommodations were natural and strengthened the program, and both Sea Grant and the Florida Division of Disaster Preparedness welcomed FDAA's co-sponsorship of the conference.

FDAA's support and involvement were substantial and major assets to the meeting. They provided travel support for speakers and funds for printing and mailing pre-conference publicity materials and conference folders, etc. FDAA provided one and one-half man-months of public information officer manpower in developing promotional materials, letterheads, etc., and in preparing materials to support and follow up the conference session dealing with organization and hosting of hurricane awareness meetings. (FDAA also assisted groups with holding awareness meetings later in the summer.) Further direct support of the conference provided for registration, certain aspects of publicity, local arrangements, cash flow, etc. It is also worth noting that FDAA supported the travel of approximately 15 regional and Washington FDAA personnel. Other FDAA staff devoted time to publicity, pre-meeting arrangements, etc. Special thanks are in order to Roy Newsome, Ugo Morelli, Bob Blair, Heather Schoen, Phil Mullin and, of course, Bill Wilcox, who not only made a major presentation himself, but was instrumental in arranging for Governor O'Neil's presentation.

Because of its involvement in coastal matters, including hazards, the Florida Burea of Coastal Zone Management was invited early in the planning stages to co-sponsor the meeting. Ted LaRoe agreed, and he organized a paper session on land use and growth controls. His agency supported travel expenses of a number of speakers and was very helpful in publicizing the conference among groups and agencies involved in Florida's coastal program.

Having shown early interest in a "Coastal Zone—'78" type meeting, the Florida Bureau of Beaches and Shores agreed to co-sponsor and assist with the hurricane and coastal storms conference. Jim Balsillie organized a paper session on coastal construction (in which he presented a paper) and helped publicize and plan the conference.

Florida State University, in addition to providing part of my time for coordinating the conference, provided typing, telephone and mailing assistance. Funds from an award from the Policy Sciences Program at FSU helped in two ways:

they helped support the February meeting on evacuation alternatives (thereby freeing more Sea Grant funds for the May conference), and they paid for services in conference support.

Though not originally a formal sponsor of the meeting, the National Oceanic and Atmospheric Administration, through Dick Foster, offered assistance in several ways. What proved to be the most essential was in producing this proceedings volume. NOAA paid for the printing of most of the copies so that they could be distributed widely and, hopefully, prove useful. We also appreciate Administrator Frank's keynote address, which opens this volume.

Earl J. Baker
Editor and Conference Director

Keynote Address

LIVING WITH COASTAL STORMS: SEEKING AN ACCOMMODATION

Richard A. Frank
Administrator, National Oceanic and
Atmospheric Administration

Ladies and Gentlemen:

I am pleased to be with you at this National Conference on Hurricanes and Coastal Storms, and proud that NOAA is one of its sponsors.

During the next several days, you will participate in discussions with a wide range of public officials, scientists, business executives and concerned members of the public about ways for planning for and coping with the hazards of these severe natural events. Many of our country's foremost experts on the subject are here. I compliment Florida State University for bringing them together to address these issues.

Until the twentieth century, most development along the U.S. Coasts resulted from the economic advantages of access to transportation and fishery resources. In the last several decades, however, increasing numbers of Americans have been locating their homes, hotels, and other facilities on the nation's beaches and barrier islands for other reasons. They find the meeting place of the land and water attractive for recreation and relaxation. Life at the edge of the ocean can be fascinating and beautiful—the endless ways in which the sun, sand, and sea combine somehow refresh both mind and spirit.

But those who choose to live at the coast voluntarily place themselves close to a large, and sometimes very unstable, body of water. Storm-driven waves, built up over thousands of miles, can reach heights of 50 feet or more in the open sea. Hurricane wind speeds can exceed 200 miles per hour.

We must seek an accommodation between our desires to enjoy and benefit from coastal areas, and the dangers inherent in such uses. I will discuss today the hurricane, the greatest of those dangers, the strategies available to accommodate human activities to it, and programs NOAA is undertaking to help implement those strategies.

The Hurricane Problem

A hurricane will kill hundreds, if not thousands of Americans, and cause billions of dollars of property damage sometime soon. I do not know precisely when or where; but it will happen.

Since 1900, 129 hurricanes have crossed our Atlantic and Gulf coasts. Fifty-three of these have been classified by NOAA's National Weather Service as "major" hurricanes--

that is, hurricanes with peak winds in excess of 110 miles per hour and storm surges greater than eight feet.

The impacts of these storms can be staggering. The two deadliest U.S. hurricanes in this century killed over 6,000 people at Galveston, Texas in 1900, and 1,800 people at Lake Okeechobee, Florida in 1928. The two costliest landfalls were by Hurricane Agnes, a relatively weak storm which caused $2.1 billion in damages in the northeast in 1972, and Hurricane Camille, which caused $1.4 billion in damages in 1969 in Mississippi and Louisiana.

And we have been lucky, when compared to other areas of the world. Hurricane Tracy virtually wiped out the city of Darwin, Australia on Christmas Day, 1974. About 300,000 people died when a hurricane struck Bangladesh in 1970--probably the largest fatality figure even attributed to a single natural event.

In the 79 years since the Galveston disaster, the United States has put men on the moon, orbited satellites to forecast the weather, and invented that miracle of modern civilization, the pop-top can. One might assume that our technological ingenuity has reduced or eliminated the risk of losing substantial numbers of lives in a hurricane. That is, however, not true.

In fact, the hurricane peril has significantly increased. More Americans are at risk today from a major hurricane than at the turn of the century.

- First, more people are potentially in the path of hurricanes. Our coastal populations are increasing at a rate more than three times the rate of national population growth. This is not primarily due to the high fertility of U.S. beach lovers--rather, newcomers are moving into coastal areas in record numbers. By 1970, 48 million people lived within 50 miles of the Atlantic coast alone.
- Second, a large percentage of these coastal dwellers have no significant experience with hurricanes. In the last twenty years, only one hurricane with a substantial death toll has hit the east coast of the United States, and only two have hit the Gulf coast. Much of the uninitiated population has little appreciation of the potential destructive power of these storms.
- Finally, the long periods of time between major hurricanes has lulled society into a false sense of complacency. Awards of water and sewer permits by governmental authorities have allowed concentrated development in areas where people are in jeopardy during coastal storms. Building codes are lax--and sometimes poorly enforced. Evacuation plans are often out of date, if they exist at all. In the Florida Keys, the population exceeds 60,000. It could not be evacuated in the likely time available to cope with a major hurricane.

What Can Be Done

Three basic and complementary strategies are available to reduce the costs of killer hurricanes. We can try to mitigate the intensity or impact of the hurricane. We can better warn populations in areas threatened by an approaching hurricane and have appropriate responses to those warnings. And we can strive for prudent development in areas significantly threatened by hurricanes. I would like to speak briefly about each of these.

The storm itself. Can mankind alter and thereby diminish the destructive force or impact of hurricanes? NOAA, through its Project Stormfury, has been researching the feasibility of reducing the intensity of hurricanes by seeding them. The idea is to expand the eyewall and inner rainband clouds, thereby slowing the speed of the maximum winds. So far, three mature Atlantic hurricanes have been seeded with silver iodide. Two seedings of Hurricane Debbie in 1969 had encouraging results--peak winds were reduced by 30 percent in one test and by 15 percent in the other. We will reach definitive scientific conclusions, whether positive or negative, only after much more research.

For the sake of all countries affected by hurricanes, we dare not abandon these research efforts. But we cannot expect them to be of short-term help. The results, even if positive, will not be operationally useful for many years. Good hurricanes for research, like other good things, are hard to find. They occur infrequently. NOAA has been prepared for the last two years to engage in test seedings in the western Atlantic between Bermuda and Puerto Rico, but the right hurricane has not developed. We are currently discussing with the Government of Australia the establishment of a cooperative program of test seedings for hurricanes in the South Pacific and Indian Ocean.

Even if we knew how to mitigate hurricanes, the social and legal problems of using such a technology are formidable. Who decides whether or not to seed an approaching hurricane? Should liability be assessed when a seeded storm later causes damage, even if that damage is, as our present research indicates it will be, totally unrelated to the seeding? Our preliminary science shows we cannot change the direction of a storm or its rainfall, but some countries are skeptical of that conclusion and may insist on liability regimes.

Perhaps hurricane impacts can be moderated in more conventional ways. Massive engineering works such as the Galveston sea wall can absorb some of the battering force of ocean waves and reduce the damage to nearby structures.

Yet we know that physical structures are not entirely effective and may cause other harmful effects. The destructive forces of Camille in 1969 and Eloise in 1975 were not deterred by sea walls built to protect individual structures. The feasibility of such

structures should be examined for highly developed sites, giving due consideration to environmental impacts as well as protection capabilities.

Effective warning and appropriate response. A second strategey to reduce loss from hurricanes is to achieve early and accurate warnings of their approach, and to design and initiate appropriate responses to those warnings.

NOAA performs three activities toward those ends. First, it forecasts and warns of the approach of the hurricane. Second, for evacuation purposes, NOAA prepares maps that detail which routes will not be inundated at various levels of storm surge. Third, through its Coastal Zone Management program, NOAA provides financial support to states to develop appropriate responses to a hurricane warning.

Since 1950, we have significantly improved our ability to forecast and warn about approaching hurricanes. The use of computers, satellites, and other scientific tools have been primarily responsible for those changes in our forecasting abilities. I am particularly proud of the excellent performance of NOAA's National Hurricane Center and its distinguished director, Dr. Neil Frank.

But over the past fives years we have reached a plateau in our warning capabilities. Based on our present estimate of probable future technological advances, we do not foresee substantially better hurricane forecasting in the near future.

In any event, we cannot rely solely on warning to mitigate damage. I doubt that we will ever be able to predict far in advance exactly where a hurricane will make landfall. Our current lead time for a warning is approximately 12 daylight hours, and it is debatable how much this may be increased in the future.

The appropriate response to a hurricane warning may be evacuation of a large geographic area; it may be ordering people to remain in their homes; or it may be telling them to seek shelter at higher elevations. The responsibility for initiating the appropriate response remains with local and state officials. NOAA's Coastal Zone Management program is assisting local and state governments to design and implement effective and appropriate responses to a hurricane warning.

On islands where most of the structures are one or two-story residences, evacuation is the only feasible means of escaping a significant storm surge. Evacuation maps being prepared by NOAA reveal that many barrier islands along our coastline could be entirely inundated in a major hurricane. We estimate that at least three-quarters of the 250 to 300 barrier islands between Massachusetts and Texas would be subject to significant flooding even from a Class I hurricane.

Hurricane Camille led to an apparently successful evacuation of 175,000 people from the Gulf Coast. Approximately 6,000 homes were completely destroyed by the

hurricane, and 30,000 more were severely damaged. Camille caused about 150 fatalities; the number would probably have been in the thousands had this massive evacuation not taken place.

Nevertheless, the current state of the art in the evacuation field is not good. Most locales have no information at all about flooding under storm conditions. Most information about evacuation routes is out of date or otherwise insufficient. Old evacuation plans which do not reflect the boom in coastal populations may be more dangerous than no evacuation plan at all. If evacuation routes become overcrowded, we might lose more lives by exposing people to the risk of drowning in their automobiles, than if they had stayed home.

Prudent coastal development. A third means of reducing the impact of future hurricanes is to ensure that only prudent development takes place in coastal areas subject to danger. Prudent development includes planning, sensitive not only to natural carrying capabilities of the area in terms of water supply and sewage assimilation, and sensitive not only to the desire to protect or exploit particular natural amenities or resources, but sensitive also to the latest advances in our scientific knowledge about natural hazards.

Prudent development might mean a presumption that low-lying, exposed coastal areas and barrier islands should not be intensely developed or developed with permanent structures, but rather should be used as recreation areas, with construction limited to temporary facilities necessary to support recreational uses.

The balance is difficult—how best to maximize the very substantial benefits from use of the coast without unacceptable risks of loss of life and property.

At least three levels of policies may be employed to promote prudent development. The first is to require disclosure of the hurricane risks. At a minimum, potential investors and residents should be informed, for example, of the extent of flooding that would occur at various levels of storm surge. And notice should be provided whether or not society collectively makes a judgment on the wisdom of the development.

Eliminating inducements to construction in particular areas is a second-order step to promote prudent development. Federal insurance or eligibility for federal disaster relief could be denied; loss of structures in hazardous areas, especially construction not attuned to the hazards, perhaps should not qualify for tax deductions. Even if society did not reach a conclusion about the desirability of using particular areas, it could conclude the risk should fall entirely on the user, that is, it should not be shared with society through subsidies. Any such federal decision should be taken only after due consideration to state and local policies as reflected through coastal zone managment plans.

A third and more drastic level of action includes prohibitions on the extent or nature of development. For example, the population of barrier islands could be limited to

numbers that can be evacuated safely within the warning times likely to be available. Systematic programs to acquire hazard-prone coastal areas to be used thereafter solely for public recreation purposes could be implemented. I believe that such prohibitions, except with regard to federal land, should be state or local decisions.

Plans developed pursuant to the Coastal Zone Management Act are ideal vehicles for incorporating difficult social judgments of the above types into land use decisions. The South Carolina coastal management program, for hazards, public use, and aesthetic reasons, has adopted a policy which prohibits the use of public funds for construction of roadway access to previously undeveloped barrier islands, except where "an overwhelming public interest can be demonstrated . . ." The State of Georgia is considering a policy which prohibits the use of public funds for road construction to undeveloped barrier islands, and has decided that licenses will not be issued to encroach on state-owned water bottoms to construct roads to undeveloped barrier islands.

Tomorrow's session of the Conference will be devoted to the subjects of land use, growth management and hazard mitigation. The challenge before you is to bring available tools to bear more creatively on the unique problems created by coastal storms.

NOAA Activities

I have alluded to ways in which NOAA has been involved in dealing with our national hurricane problem. I would like to be more specific about what we are doing.

NOAA's Office of Coastal Zone Management, National Weather Service, National Ocean Survey, and Environmental Research Laboratories have been developing such a program to focus our resources on the hurricane threat. Many of you have been consulted on projects that we have considered.

Program elements that we have adopted or are considering include:

- We are accelerating NOAA"s modeling activities to improve our ability to predict the nature of hurricane storm surges and the damage they are likely to cause. In the past, models were useful primarily for relatively straight sections of the coast. Such coastal areas are mathematicians' versions of what we all know is a different reality. Our new models will incorporate coastal irregularities and local topographic and bathymetric features. We are discussing a five-year program to focus on the 20 most densely populated areas.
- We will provide support and assistance to state and local officials so that they may develop comprehensive evacuation plans. Our first efforts will be to focus on the six-county area around Fort Myers, Florida and the three-county area around Galveston, Texas. Eventually, assuming you and we are convinced

of the utility and priority of these plans, we hope to include representative areas in the Mid-Atlantic and New England areas as well.

- Our Office of Coastal Zone Management promulgated new regulations, which became effective this year, requiring states to spend at least 20 percent of their second-year federal coastal administration grants on specified national issues. One of these issues is coastal hazard mitigation activities. This should provide a badly needed source of funding for state planning activities.
- We are considering broadening NOAA's post-disaster survey activities. If feasible, we will document the extent of flooding through precise aerial photography, and by supplying water level measuring devices in areas where no natural benchmarks exist. Better information about the nature and extent of the flooding and the associated damage will not only help us verify storm surge models, but will be a valuable set of information for evacuation planners in assessing the adequacy of their preparations. Our survey teams would include these planners.
- We are preparing a series of books that will describe the barrier islands off each state from New York to Texas. These books, created under the direction of Dr. Orrin Pilkey of Duke University, will provide information helpful in determining the prudent uses of these islands.
- Finally, although not focused directly on the hurricane peril, we are considering pilot projects for a series of coastal erosion atlases. NOAA's National Ocean Survey and other government agencies are repositories of information about the shape of our coasts dating back to the 19th century. At Cape Henlopen, Delaware we have a series of five coastal surveys from as early as 1837. When combined on the same map, they demonstrate dramatically the progressive erosion of the coastal area.

My remarks today have touched only part of the total coastal hazards problem. I have not extensively discussed coastal erosion, flash floods that often accompany hurricanes as they travel inland, and other more localized matters such as subsidence and coastal mudslides. Since none of these has the same potential for massive losses as major hurricanes, our most urgent attention should be devoted to the national hurricane problem.

In sum, NOAA joins you in an effort to use scientific knowledge to achieve the most beneficial accommodation for man between the inherent benefits and dangers from the coast.

WARNING AND EVACUATION

COPING WITH HURRICANE EVACUATION DIFFICULTIES[1]

Earl J. Baker

Twenty-four hours before expected landfall of a hurricane, approximately 300 miles of coastline will be placed under a warning (the average 24-hour forecast error being 100 miles). Except in very rare storms, the eventual major damage will be confined to an area little more than 50 miles in width. Thus, the imprecision of forecasting technology presents a response problem for the public and for local officials alike. If all low-lying places throughout the 24-hour warning area are evacuated, up to 80% of the evacuation will eventually prove to have been "unnecessary." That is, only 20% of the 24-hour warning area will finally receive the storm conditions which would probably claim human life. The public, therefore, is reluctant to leave that early, and local officials are reluctant to urge evacuation forcefully that early.

The problem is that population densities are so great in some coastal areas and are served by such inadequate transportation routes that it might not be physically possible to evacuate everyone who would need to leave unless the evacuation began in earnest as much as 20-odd hours before landfall. There is a tendency to "wait-and-see" until perhaps 12 hours before expected landfall, but some coastal areas might not be able to afford that luxury. In ascertaining how long it will take to evacuate an area (or conversely, in calculating the maximum number of poeple who can reasonably be evacuated, given a typical warning), several assumptions must be made.

Assessing Evacuation Difficulties

How early will people leave? Overall, it appears reasonable to assume that in the highest risk areas (near the eye's landfall and near the beach) about 80% to 90% of the residents will at least attempt to leave. In slightly more moderate risk areas--those near inlets and "protected" bays--the response may be only 45% to 50%. There is some question, however, whether they will leave early enough.

Two case studies are instructive: In Camille a watch was issued from St. Marks, Florida to Biloxi, Mississippi on Saturday, August 16, 1969; later that day a warning was issued for the Florida panhandle, then extended westward to Grand Isle, Louisiana. Very early Sunday morning (when Camille was 250 miles away) evacuation was advised from low-lying areas of Mississippi, Alabama, and part of Louisiana. Landfall occurred at 11:00 P.M. Sunday at Pass Christian, Mississippi. Of the people interviewed after the storm who

said they evacuated, only 4% left Saturday. Nineteen percent left on Sunday morning, presumably after the evacuation advisory was issued. The great majority evacuated after 1:00 P.M. on Sunday--48% between 1:00 and 6:00; 24% between 6:00 and 8:00; and 5% after 8:00 (3 hours before landfall).

In Eloise warnings were issued for the area between Grand Isle, Louisiana and Apalachicola, Florida early on Monday, September 22, 1975. At 9:45 P.M. a National Weather Service statement advised relocation from low-lying areas in the Fort Walton Beach-Panama City area of the Florida panhandle, and shortly after midnight the warning area was extended eastward and officials in Bay County decided to evacuate certain areas. Landfall occurred at 7:00 A.M. on the 23rd, halfway between Fort Walton Beach and Panama City Beach (60 miles east of the center of the warning area delineated on the morning of the 22nd). Interviews conducted in Panama City and its beach areas indicate that evacuation did not begin in earnest until 2:00 A.M. on the 23rd—only about 1/5 of the evacuees having left before that time. Almost three-fourths of those evacuated left between 2:00 and 5:00 (2 to 7 hours before landfall). About a fourth of the evacuees said they encountered difficulties in reaching their destination, with traffic congestion being cited most frequently as the reason.

Will advice or orders compel evacuation? The surveys undertaken after hurricanes generally do a poor job of differentiating between official "orders" to evacuate and "advice" to evacuate. It isn't clear what the two terms mean to respondents. Many public officials are recently encouraged by the fact that state legislators have given them clear-cut authority to force people to evacuate. In fact, however, the public has probably always assumed that officials had such power, and in many cases officials have actually acted as if they possessed the authority. Physically removing reluctant residents is hardly practicable, and it would be a very inefficient use of manpower in any event. The most likely result of the newly bestowed authority is more forceful wording of messages broadcast over the media.

Taking the existing data at face value, however, it appears that even if evacuation is ordered, a hard-core element of holdouts will remain--perhaps a third or more of the people who believe they reside in low-risk areas. In Eloise 80% of the stayers and 47% of the leavers said that "messages from public officials" had no influence on their decision whether to evacuate. In neighborhoods where respondents said that public officials had come through their neighborhood advising evacuation, 66% of the residents evaucated. This compared to 55% in areas where officials apparently did not go through advising evacuation, but the difference was not statistically significant at $p = .05$. Even if there was a difference, it might not be attributable to the action of the officials' decision to

advise leaving and the residents' decisions to leave. When asked if they would have evacuated if public officials had gone through their neighborhood (where they had not), 33% of the respondents said no. Responses were about the same for people who heard that they "should evacuate" from other sources.

In Carla, whether people said the "source of warning" was the media or some other source made no difference in their decision to evacuate. In areas where people were advised or ordered to leave, 89% did so, compared to 52% in other areas. Finally, an Environmental Protection Agency review of a variety of evacuations led to a conclusion that anywhere from 6% to 50% of the public might not respond to an official order to evacuate an area.

Will public awareness campaigns lead to greater evacuation? Intuitively it seems that if people know more about hurricanes, they will be more likely to evacuate if they are threatened. Thus, efforts are often undertaken to increase public knowledge about hurricanes. It is inadvisable, however, to count on such programs to significantly increase evacuation rates.

A recent effort in Texas suggests that people who have been sent hurricane awareness brochures in the mail answer questions about hurricanes (through the mail) more accurately than people who did not receive the brochure (79% vs. 69% knew that over 50 miles of coastline can suffer damage, for example). Also, 76% vs. 59% said they have a pre-planned evacuation route. Television and radio, however, had even more marginal (if any) effects.

There is some question whether knowledge has much effect on the decision to evacuate in any case. Surveys undertaken after Camille and Eloise failed to detect any differences between leavers and stayers with respect to such items as how many hurricane terms they knew and how many of the "hurricane safety rules" they knew.

Whether awareness programs are needed specifically to inform newcomers, veteran coastal residents who have become complacent with hurricane inactivity, or people who think they have experienced hurricanes more severe than they actually have is also open to question. Survey data casts doubt on the significance of all three factors, with the possible exception of the third.

Knowledge of one's homesite elevation, however, does appear to affect the evacuation decision. If public information campaigns are to be effective, they should inform people of personal risk information rather than take a blanket approach, although the latter is clearly easier and cheaper. Once evacuation times are calculated for an area, the figures should be disseminated among the residents of the pertinent areas.

What assumptions should be made about evacuation route capacities? Efforts to anticipate whether existing transportation routes could handle the number of people and

vehicles evacuating have been undertaken by at least three groups: the city of Sanibel, Florida, the Southwest Florida Regional Planning Council (SWFRPC), and the Texas Transportation Institute. All the studies use very similar methods and assumptions. One premise was that at least one traffic lane must be left open into the evacuating area for emergency vehicles. Another was that low-lying routes would be flooded several hours before landfall. The Highway Capacity Manual serves as the basis for each group's computations, although a number of adjustments are made for factors such as inclement weather conditions.

For Lee County, Florida the SWFRPC study calculated the capacity of most routes to be between 500 and 600 vehicles per lane per hour (and most routes to be one-lane). The Sanibel study used figures ranging from 560-800. Less specifically, but including adjustments for weather and roadway conditions, the Texas study used average figures of a) 1150 for freeways and multi-lane rural highways, b) 800 for two-lane rural highways, and c) 500 for urban streets.

Is Vertical Evacuation Advisable?

In recognition of unlikely if not impossible evacuation problems, some areas are giving increased attention to "vertical evacuation." The notion is to "store" people temporarily in multi-story buildings above the level of inundation. The buildings would not be shelters in the same sense as other public shelters--there would be no provision of food and supplies, for example, and the shelter would be very short-term, with refugees leaving as the storm tide receded.

The two places having done the most work on the idea are probably Miami and New Orleans. Miami (Dade County) has identified approximately 40 buildings on the Miami "mainland" (rather than the beach areas) which are believed to be suitable for vertical evacuation. Plans are for the buildings to be used primarily by would-be evacuees who wait too long to evacuate by conventional means. New Orleans commissioned a feasibility study but apparently has not chosen to make the plan operational. There are many questions and reservations about vertical evacuation.

The utmost care must go into the selection of vertical shelters. Crowding people into a high-rise building only to have it topple into the ocean would be catastrophic. Eloise gave structural engineers an opportunity to inspect beneath a number of major beachfront buildings in Panama City Beach, and some of the revelations were apalling. One 14-story condominium nearing completion was found to be missing 1/3 of its structural support, as many of its steel-reinforced concrete pilings were missing concrete. Blueprints tell only part of the story. There is no guarantee that buildings are constructed according to plans. Again, the questions of 1) code adequacy and 2) code enforcement

come into play. Even if a building remains standing, there are possibilities of partial wall or roof failure and window breakage which may lead to interior damage.

There are other reservations about vertical evacuation as well. If vertical evacuation is less desirable than conventional evacuation, then it would be preferred that as many people as possible evacuate by conventional means. But if the public is aware of the availability of vertical refuge, will people who would have otherwise evacuated inland decide instead to use the multi-story structure? Will such numbers overcrowd the temporary shelters? If the vertical option is not publicized well in advance (in an effort to preclude its acting as a deterrent to conventional evacuation), will it be possible to make the plan known to people at the last minute? Especially on barrier islands, and particularly if connecting causeways or other roads are incapacitated by the hurricane, vertical refugees may be in a highly vulnerable situation after the storm. Medical and sanitary services may be inadequate or too slow in coming. The larger the stranded population, the greater the problem could become.

Preventing the Growth of Impossible Evacuation Situations

Despite its drawbacks, vertical evacuation is probably the only feasible solution to present impossible evacuation situations in some areas. There are steps which governments can take to prevent the necessity of relying on vertical evacuation, however, or at least to ensure that vertical structures are safe.

The most stringent approach is via a growth cap. The first place to recognize the futility of trying to evacuate ever increasing numbers of people and to head off the problem is Sanibel, Florida. Motivated both by wanting to preserve environmental quality and wanting to mitigate hurricane risks, the city determined the maximum number of people they would be able to evacuate from the island given a "typical" hurricane, and decided not to permit the population to exceed that number. That was translated to 3800 new dwelling units, a 90% increase over the number existing at the time of the plan. Building heights are restricted to 45 feet, and a recent referendum dictated that the new construction be phased in at a rate of no more than 180 units per year. The plan has not been challenged in court, but no one has yet been denied the right to build solely on the basis of the hurricane evacuation capability. Other communities have also imposed population caps of one sort or another for non-hurricane-related motivations.

A family of devices such as large-lot zoning, down-zoning, open-space zoning, and density zoning are similar in their effect to population caps. Usually prompted by ecological and health concerns, such measures tend to minimize the over-concentration of development in sensitive areas while redistributing it to areas which can tolerate it more safely. Interim development controls, or moratoria, represent a temporary approach

whereby the above sorts of controls might be implemented until a more definitive growth management strategy can be adopted following the necessary evacuation capability studies.

A more flexible solution would not prescribe exactly what policy had to be enacted, but would require that it must demonstrate that residents (and transients?) could be safely "accommodated" in a hurricane threat. The first step in the performance demonstration would be the calculation of the maximum number of people who could be evacuated. The policy may seek to 1) increase the evacuation capability (by building another causeway, elevating, or widening existing roads, for example), 2) decrease the numbers who would need to leave the area (by constructing necessary shelter facilities), or 3) limit the population.

Note

[1]The research reported herein summarizes findings of a project funded by the Florida Sea Grant Program.

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RESPONSE TO HURRICANE WARNINGS AS A PROCESS: DETERMINANTS OF HOUSEHOLD BEHAVIORS

John P. Clark and T. Michael Carter

Introduction

Considerable research has been conducted in the past 20 years by social scientists on individual and group response to numerous aspects of natural hazards. While much of this research has been descriptive in character, sufficient evidence has been accumulated to begin the development of formal explanations for observed behavioral patterns. In this paper, we will present in broad outline an emerging model of individual response to natural hazard warnings. Throughout, we will emphasize a number of important implications of the model for individual response to hurricane warnings in general and evacuation behavior in particular.

The General Model

In a generic sense, there appears to be little difference in the manner in which individuals respond to natural hazard warnings in comparison to other types of information. That is, individual response to natural hazard warnings does not appear to be a unique phenomenon, but is consistent with individual response to a wide variety of informational inputs. What we have, then, is a general model of individual decision-making.

The basis of all formal models of individual decision-making is the maximum utility model developed by economists. This model asserts that under conditions of uncertainty individuals will choose actions which maximize their long-term payoff. This model is quite elegant in its formal statement; this elegance, however, is achieved by the imposition of a number of stringent assumptions. First, it is assumed that the individual has complete and accurate information on which to base the decision. This information includes knowledge about: (1) the alternative states of nature which could exist, (2) the probabilities of occurrence of each of these states of nature, (3) the alternative actions available to the individual, (4) the consequences of a particular action if a particular state of nature occurs, and (5) the utility (cost or benefit) of each possible consequence. Second, it is assumed that the individual will behave in a rational manner. That is, it is assumed that the individual will evaluate the overall utility of each alternative action, in light of its utilities and the probability of the states of nature, and choose the most beneficial.

If either of these assumptions is incorrect, then the action actually chosen will probably be that predicted by the model. In fact, this is the situation researchers have found in a wide variety of tests of the maximum utility model. When faced with a situation in which the predictions from a formal model are not confirmed by empirical data, the scientist typically attempts to relax one or more of the model's assumptions. An excellent review of such attempts in the economic and psychological literature is given, within the context of natural hazards, by Slovic, Kunreuther, and White (1974).

A Proposed Model of Response to Warning

The model of individual response to warnings that we present here is in many respects similar to models proposed by other researchers in a variety of contexts and falls into the general category of "bounded rationality" decision models. In contrast to the maximum utility model, we begin by assuming that the individual has complete information regarding the five inputs into the decision-making process outlined above. By incomplete information, we mean the individual either has little or no information on these inputs or has inaccurate information on these inputs.

Upon receiving a warning message, the individual is assumed to: (1) evaluate the information contained in the message, (2) integrate this new information into the body of information currently available, and (3) evaluate the overall utility of each alternative action on the basis of the existing body of information. It should be noted that we have retained a key portion of the assumption of rational behavior in our model. What is yet to be dealt with, however, is how the individual chooses an action based on these overall utilities.

In the maximum utility model, since full information was assumed to be available, it was reasonable to expect the individual to act in accordance with the overall utilities. The reasonableness of this expectation is based on the fact that the individual would arrive at the same overall utilities if the decision-making process were repeated a number of times. In the model proposed here, however, such an expectation is not reasonable. Given incomplete or inaccurate information as inputs, it is likely that significant changes in the overall utilities would result from the addition of relatively small amounts of new information. That is, it is likely that the overall utilities of alternative actions resulting from a series of sequential passes through the decision-making process would display considerable instability, pointing first to one action and then another as most beneficial.

Assuming such inconclusive results, the individual has three additional courses of action not specified in the maximum utility model: (1) delay reaching a decision and passively await additional information, (2) delay reaching a decision and actively seek additional information, or (3) tentatively begin a course of action that appears to be

preferable while actively seeking additional information to confirm this decision. Should the results prove to be conclusive, the individual, of course, would be expected to take the preferred action. Our model is sequential, or iterative, because as new information is obtained, the individual is assumed to repeat the decision-making process and obtain a new set of results.

Our model, then, allows for four general outcomes, two of which end the process and two of which continue the process. We can now ask what internal or external factors of the process determine which action will be taken. One of the factors clearly involved is the amount of information available to the individual from both the warning message and other sources. The greater the amount of accurate information, the more stable the results of the decision-making process will be. Another important factor is the saliency of the situation. If the overall costs associated with ignoring the new information (the warning message) appear to be quite low, then the model would predict the individual would delay a decision and passively await new information. If these costs were high, however, it is likely that the individual would choose one of the other three actions. Finally, our model allows individuals to vary along a dimension which we will call "decision thresholds." This dimension addresses the problem of at what point individuals will be satisfied with the stability of the utilities and, thus, decide to take a particular action rather than delaying a decision. It is in determining these individual threshold levels that such factors as previous experience, family responsibilities, and personality characteristics enter into the decision-making process.

Implications of the Model for Hurricane Warnings

Our interest here is not to predict the response to a hurricane warning of any particular individual, but rather to predict the distribution of responses in a population. Thus, we will attempt to employ the model to predict: (1) the range of responses that will be displayed by a population, and (2) the proportions of the population which display each predicted response. Along with these predictions, we will present evidence from a variety of studies to assess the general validity and parameters of the model.

As stated earlier, our model predicts that a population will distribute themselves across four general responses to an initial hurricane warning. There are two primary factors which lead us to predict, in a general way, what proportions of the population should display each type of response. These factors are the saliency of a hurricane warning and the information contained in the hurricane warning. Since hurricane warnings indicate the existence and very real potential of a destructive natural hazard, we would expect hurricane warnings to have high salience to the population. This high salience would, in turn, lead us to predict that the response distribution would be skewed toward

making a definite decision to take action in response to the warning. On the other hand, incomplete information contained in the warning message would serve to mitigate against significant proportions of the population actually taking immediate action. The typical hurricane warning includes approximately 100 to 150 miles of the coastline, whereas the typical hurricane only necessitates the evacuation of an area of about 40-50 miles. Given the uncertainty as to the exact location of landfall, we would predict that few residents will actually leave an area in response to an initial hurricane warning.

Data relevant to these predictions can be obtained from a survey we conducted during the spring of 1978 of approximately 200 households in six Atlantic and Gulf coastal communities (see Carter, Clark, and Leik [1979] for details). Based on response to a series of questions on the anticipated reaction to a hurricane warning, we can deduce the following distribution of responses: (1) less than 10 percent would take no action, (2) approximately 25 percent would delay a decision and actively seek additional information, (3) another 25 percent would tentatively begin preparations for a hurricane while actively seeking confirmatory information, and (4) approximately 40 percent would reach an immediate decision to evacuate. In addition, responses to a question concerning anticipated reaction to a later recommedation to evacuate were distributed as follows: (1) 12 percent would leave after the warning, but before evacuation was recommended by local officials (2) 54 percent would evacuate only when recommended to do so by local officials, (3) 27 percent would not evacuate until they were sure the hurricane would seriously affect their local area, and (4) 7 percent claim they would not evacuate.

The clear implication from these distributions is that significant delays will occur between hurricane warnings and recommendations to evacuate and peak evacuation periods. Such delays are accounted for by the model in terms both of the time involved in trying to confirm that evacuation is necessary and of the fact that officials generally recommend evacuation prior to the time environmental conditions make it clear that evacuation is necessary. In the previous paper in this volume, Baker has reviewed evidence from studies of response to Hurricanes Camille and Eloise that such delays do occur.

An additional implication from the model deals with the sources from which additional information is sought. The model predicts two factors would determine which sources were utilized: (1) the ease with which the information could be obtained, and (2) the perceived reliability or credibility of the source. Perhaps more importantly, the model predicts that significant proportions of a population will utilize multiple sources of information. Researchers at Mississippi State University conducted interviews with 378 coastal residents in the area of Florida affected by Hurricane Eloise (see Windham, Posey,

Ross, and Spencer [1977] for further details). Respondents were asked what factors were influential in their decision to evacuate or not to evacuate. The evidence from this study is very clear that multiple sources of information were utilized.

Since our model is one of sequential passes through the decision-making process and since we have shown that multiple sources are utilized, it is likely that sequential pieces of information may come from different sources. The possibility, then, exists that inconsistent information may be received and the implication of this must be considered. As stated above, since the individual is assumed to have incomplete information, small increments to the available information may change the overall utilities of alternative actions. Such instability in the utilities would be greatly magnified if sequential pieces of information were inconsistent. According to our model, such a pattern of unstable utilities would lead to decision delays. Since local officials cannot exercise control over all sources of information, certain portions of the delay in reaction to hurricane warnings may be beyond their influence.

Finally, we turn to the role of previous hurricane experience in the model. Both our data and the Mississippi State data indicate that a very small proportion of the coastal population has had any life-threatening experience with major hurricanes. The vast majority of coastal residents have had either no experience or relatively minor experiences. As stated above, we believe that these experiences influence the threshold levels—the degree of the stability in the utilities which would prompt individuals to evacuate. Of primary importance in this respect are two pieces of information previously identified as inputs to the model: (1) the consequences of combinations of states of nature and actions, and (2) the probability of a hurricane hit.

The model predicts that if an individual's prior experience indicated that the consequences would be minor (i.e., low negative utility) of staying in an area hit by a hurricane and/or the probability of a serious hurricane hit was low even though a warning was issued, then the threshold level would be high (i.e., relatively stable and significant benefits for evacuation would be required to motiveate a decision to evacuate). This is precisely the type of experience held by those with only minor hurricane experience.

If this explanation is correct, then we can predict increasing problems with response to hurricane warnings in the future. As time progresses, the relative proportion of coastal residents with no hurricane experience can be expected to diminish. Because of the fact that hurricane warnings are issued for such large areas and any given hurricane will actually affect a much smaller area, most of the inexperienced coastal residents will gain only minor experience. This minor experience, in turn, will raise their threshold levels which will make it more difficult to motivate them to evacuate in the future.

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WILL COASTAL RESIDENTS REACH SAFE SHELTER IN TIME?

R. H. Simpson

In a major hurricane, the question raised by the title is poignant. Any answer but an unequivocal YES is, in fact, a vitiation of nearly all other links in the chain of hurricane preparedness and warning measures. Yet each year the patterns of population growth and of coastal construction pose new problems that tend to compromise or place qualifications on the YES answer. And, because the resolution of these problems almost always depends or impinges upon political and legal issues, most public officials or the agencies they represent find it difficult to attack the problems in a straightforward manner. Here we shall sidestep the political and legal implications and confine our remarks to a description of the problem.

The key element in the title question is that of TIME: The time available for evacuation after warnings are received, the reaction time of the resident in deciding to relocate, and the travel time in reaching safe shelter.

From the National Hurricane Center, you will learn in another session here that the outlook for extending the expected warning time is not promising, despite the progress of research and technology. While specific warnings may sometimes exceed 15-18 hours, it would be risky to assume that an explicit time of more than 10-12 hours will be available to implement and complete the relocation of threatened coastal residents--this year or ten years from now.

If the maximum time available for evacuation is, say, 12 hours, a discreet amount of this will be lost due to the vacillation of coastal residents in deciding whether to leave and, if so, where to go. The amount of this loss will, of course, depend upon earlier hurricane experiences of coastal residents and the effectiveness of local or regional hurricane-awareness programs. While state-sponsored awareness programs have steadily improved, they can hardly be expected to fully offset the loss of reaction effectiveness due to the massive migration of populations to the seashore. Some coastal areas presently have less than one out of three residents with any firsthand experience with hurricanes.

The third time factor—that required to reach a safe shelter—is the one that is probably the most deceptive, dangerous, and difficult to come to grips with. If the only alternative in seeking safe shelter is to use automotive transport on public highways to reach inland shelters many miles from home, these uncertainties represent a frail link in preparedness planning.

Some limited stretches of coastline are well equipped with multi-lane, high-speed highways connecting the threatened areas with locations inland where places of safety are abundant. However, many are afflicted with road systems that mainly parallel the coast; have inadequate capacity for moving large volumes of traffic; and may be readily severed or incapacitated by rising water, by an accident on a narrow bridge, or some combination of these. It is particularly important to recognize that, in some hurricane cases, preliminary rises in sea level—such as the 5- to 6-foot rise in the Tampa Bay area when hurricane Agnes of 1972 was moving northward hundreds of miles at sea--may cut many high-speed traffic arteries in at least one place and create a traffic nightmare that could absorb 4 to 6 of the critical hours of available evacuation time. The purpose of restating these facts—well known to most emergency-planning groups--is to direct attention to the urgent need to initiate some planning for developing viable measures for the in situ relocation of the threatened population. This is sometimes referred to as "vertical" evacuation. Such a proposal was first generated and carefully examined in a study by the Miami Federal Executive Board through its Committee on Hurricane Shelters in May, 1973. However, few serious attempts have been mounted to pursue this alternative. This is unfortunate because some such alternative may prove to be the only means of avoiding the catastrophe that would result when residents of some coastal sectors, trapped in traffic jams that would occur during horizontal evacuations, are overtaken by rising tides and hurricane winds with no safe shelter within reach.

The Miami proposal for vertical evacuation called for:

1. The use of suitably constructed high-rise buildings located on the flood plain or near the shore as temporary shelters, evacuees occupying the common-use areas and hallways above the second or third floors for the few hours in which the danger from wind and flooding is greatest. This requires a certification of the structural worthiness of the building to withstand hurricane conditions.
2. A public policy of building low-rise public structures—schools, libraries, and other official buildings—on earthen mounds 20 feet or more above mean sea level so they could serve as emergency shelters.
3. The use of other low-rise sturdy structures not directly exposed to the fury at the open coast.
4. A program to encourage or require a developer of coastal residential complexes to intersperse garden-type apartments or homes with elevated or high-rise apartments that could be certified for use as emergency shelters during a hurricane.

The ADVANTAGES of the so-called "vertical-evacuation" procedures are that the time to reach shelter in many exposed areas is minimized, highway traffic problems are reduced, and dependence on automative transport is reduced or eliminated for many people located near the shoreline.

The PROBLEMS in implementing such a plan are, however, not trivial. First is the question of certification of the structural worthiness of prospective shelters. Not all high-rise structures are good risks in hurricanes and, in some cases, could be death traps. It is not always a simple matter to make a determination of worthiness years after the construction is completed. Second, is a hierarchy of legal problems involving security and liability and the right of a property owner to refuse shelter to an evacuee caught in the storm. These are all knotty problems requiring at least some enabling or clarifying legislation.

But are there other alternatives? I think not! Must we wait until a major hurricane catastrophe demonstrates the urgent need to confront and come to grips with the problems of establishing in situ shelters on the flood plain or near the shoreline?

This problem should be confronted now; and one place to begin is to identify the problem and stimulate support and cooperation towards its solution as a part of all hurricane-awareness programs.

LEGAL ASPECTS OF FLOOD WARNING AND EVACUATION

Mitchell Wendell

Preparation for and response to disasters has often been characterized by little serious consideration of legal problems. The premise has been that when crisis is actually in being, the responsibility of all concerned is to respond--to undertake the rescues, to issue the warnings, to maintain public order, to promote safety, and to protect property. Whether or when this should be regarded as a legal duty has generally not been asked. It has been enough that disaster response should be undertaken as a matter of public policy and humanitarian concern. What the responders have thought necessary or feasible in the conduct of a particular disaster operation has frequently been done, and few questions have been asked.

This attitude is a very strange one, especially in situations where great likelihood of damage and injury exist which one would suppose would cause even greater concerns about liability.

Yet, it is a fact that to date there has been remarkably little litigation resulting from disaster operations. In some instances, this may be due to government aid programs which have provided assistance to victims of floods and other disasters or to a willingness of many people to accept stoically the losses which they consider inevitable consequences of storms. Perhaps also the difficulty of success in establishing legal liability where "acts of God" are involved has dissuaded many potential litigants and their lawyers from taking their chances in the courts.

In the past, another deterent to success in pressing claims growing out of disaster operations has been the principle of governmental immunity from suit. Those who give warnings and constitute response forces are predominantly officials and employees of public agencies such as the Weather Service, the National Guard or police and fire units.

Still another contributor to reluctance to examine legal questions has been the justified belief that they could be troublesome. Consciousness of possible liability for warning, rescue, and protective actions may make governments and personnel cautious and so inhibit their participation. Consequently, it has been tempting to let slumbering problems lie. Such an attitude has been compatible with the sentiment that customarily suppresses serious attention to latent danger of catastrophes like floods. It has been often observed that private persons and public officials like to act as though disasters will not strike. They are encouraged in such behavior by the likelihood that in any given location a

hurricane or earthquake has only a statistically small chance of occurring at any given time.

But the ostrich view of legal problems may be changing. There are good reasons why it should.

Over a period now many decades long, Congress and state legislatures have gradually limited or removed the defense of sovereign immunity. Thus, it is no longer a barrier to public liability for negligence, fault or other failure on the part of public employees which causes injury or damage to persons and their property. The Federal Tort Claims Act and state laws having a similar purpose now make it possible for public entities to be sued for many of the injuries their acts and omissions cause. The technique is for the statutes to consent to suits against the unit of government and to prescribe the extent of the consent and the procedures under which it may be invoked. In general, the result is to expose public agency programs to many of the same liabilities with which private activities must contend. However, the law is not entirely the same as it applies to public and private acts and omissions. Because the details of the statutes in the states vary, single statements cannot describe with accuracy the situation as it applies to all fifty of them and to their thousands of local governments. Likewise, the Federal Tort Claims Act is a statute with particular detail, both in its specific content and in the interpretations resulting from court cases. In a brief presentation, it is not feasible to follow these idiosyncrasies. Nevertheless, a basic understanding of the problems of liability can be obtained by discussing the generally applicable concepts and principles.

Flood warning and evacuation present two different sets of operational characteristics. The first type of program is the development and dissemination of information. Evacuation involves movement of people and property consisting of physical activities which can directly include accidents causing injury and damage. Some principles are common to both types of program; others must be considered separately.

The point of departure for any discussion of legal liability is the existence of responsibility to have a program or take an action. A party who is at fault and who may therefore incur liability can be guilty of a culpable act or omission only if the individual or agency involved has a duty and, like a private individual, acquire liability by volunteering services which it need not have undertaken.

For more than fifty years the federal government has built reservoirs and other physical works with the specific purpose of protecting against floods. However, Congress has expressly barred federal liability on account of flood damage in connection with the construction or operation of these works. State and local governments also have built protective structures. What their liabilities are, if any, depends on the provisions of the applicable state laws.

Flood warning is not a time-honored activity of any governmental entity. In earlier times, the ability to observe and predict conditions that would cause flooding was either nonexistent or too incomplete to make a meaningful program possible. Thus, it cannot be said that a governmental duty to warn of this kind of danger is inherent in the responsibilities of either national or state governments. In more recent times, however, the National Weather Service has established a Hurricane Center and generally undertaken to include in its forecasts and reports information specifically calculated to apprise local populations concerning the presence and severity of flood threat or occurrence.

An increasing number of warning programs for local areas supplement the information from the National Weather Service with observations of their own because flash floods and precipitation or runoff in small watersheds is frequently not covered by an NWS station. Consequently, the question of what, if anything, a particular flood warning program is responsible for reporting and who bears the responsibility may be a complex one.

The threshold question is whether an information program of a public agency can give rise to any liability. In order for it to do so, it is not only necessary to establish that the agency has a duty to provide the information but that the conduct of the damaged parties was rightfully in reliance on the information given or omitted.

The federally authorized program does not require that NWS cover all water bodies and coasts in the United States.

Fault in a warning program, if any were found to exist in the legal liability sense, would probably consist of either making an incorrect analysis of data and consequently wrongfully giving or withholding a warning. Conceivably, there could also be negligence or culpable mechanical failure in transmitting a warning. If persons in the affected area took erroneous precautions or failed to take any and suffered harm thereby, the circumstances which characteristically result in claims for damages would be present.

Liability in connection with evacuations is certainly a possibility. There has been a substantial amount of concern over whether officials can order people to leave their homes or places of business. Generally speaking, the effort has been to avoid a definitive answer to this question. Customarily, occupants of a threatened area have been advised to leave but the decision has been left up to them. This reduces the possibility of claims that public authorities were at fault in either requiring evacuation or not insisting on it. However, absence of clear cut and universally applied patterns of behavior complicates operations. Some people usually stay behind even when they should not. Subsequent efforts to rescue them under difficult conditions sometimes adds to the risk for response workers as well as for the inhabitants of the flood plain.

Of course, the emergency conditions under which evacuations take place may also increase the risk of accidents and injuries or damage result therefrom.

If warning and evacuation plans become established means of response to flood danger in particular areas, it should be expected that local populations will justifiably come to rely upon them. Under such circumstances, there seems to be little policy reason why the quality of performance under such governmental programs should be less likely to warrant liability for negligence, omission or other faulty performance. However, there are at least two considerations which are not common to most tort situations.

One is the standard of care that should be applied in determining whether liability-producing fault exists. A defendant cannot be held to more than a reasonable degree of care and professional proficiency in performance. Since weather forecasting is not an absolutely reliable science and since judgments concerning the timing or necessity for evacuation can have some elements of subjectivity, determination of what constitutes reasonable care may be difficult in particular cases.

A second uncertainty is the classification properly to be given to torts connected with warning and evacuation activities. The statutes which remove or reduce immunity from suit for governmental agencies frequently make distinctions based on whether the function is a "governmental" or "proprietary" one. The former is a function traditionally or normally performed primarily or exclusively by government; the latter is a function which can be performed by private business. Immunity from suit is fairly well stripped away under statutes for proprietary functions. For governmental functions, it is less so. A distinction is made under interpretation of the Federal Tort Claims Act between a faulty exercise of discretion by a public official and faulty performance of a non-discretionary act. The latter results in liability and the former does not.

Flood warning probably is not yet so well established as to be a traditional activity of government. But neither is it a function that can easily be performed by private business, even though there are some private weather services.

HURRICANE EVACUATION DEMAND AND CAPACITY ESTIMATION

Thomas Urbanik II

The hurricane is a large circular storm of awesome violence. The destruction caused by these giant storms is legend. The death and damage is caused by wind (a sustained 74 mph or greater, and gusts may reach 200 mph), flood produced by rains and storm tides. The worst natural disaster in the United States history came as a result of a hurricane which struck Galveston, Texas in 1900 and killed more than 6,000 people.

But the hurricane is not the unheralded killer it once was since a storm can no longer strike an unsuspecting and unprepared public. Nevertheless, hurricanes still have the undisputed title of "The Greatest Storm on Earth." Warnings are of no value, however, if they go unheeded or if action is not possible.

This paper is concerned with one aspect of the hurricane problem, transportation. The scope of the analysis is limited primarily to a consideration of the demand for evacuation and the capacity of a highway system to accommodate evacuation under threat of a hurricane.

The methodology followed in the remainder of this paper is: first, a procedure will be developed for estimating the demand for hurricane evacuation; second, factors will be developed to adjust highway capacity estimates for hurricane conditions; and finally, the procedures will be applied to Galveston, Texas.

Demand Estimation

The vehicular demand for evacuation during a hurricane can be estimated in a three-step process. First, it is necessary to know how many people reside in the area under evaluation. Second, estimate how many vehicles and what types of vehicles will be used in the evacuation. Third, it is necessary to estimate the percentage of the residents who will leave. These factors are called demographic factors, vehicle factors, and response factors, respectively.

Although a fourth parameter, when will they leave, would be desirable, the lack of data makes an alternative approach necessary. The approach to be used is--given available capacity, when must evacuation begin to be sure that an opportunity exists for everyone to evacuate.

Demographic Factors

Any reliable population estimate may be used for estimating purposes. The 1970 census is one source of the necessary data. Where more current, reliable data are available, they should be used.

Vehicle Factors

The number of vehicles used in an evacuation is determined by the number of people in each vehicle. However, since we do not know average occupancy during an evacuation, an alternative approach is necessary. As a conservative estimate, it is assumed that the maximum number of vehicles available will be used. This is not unreasonable since the number of vehicles available in Texas (7,214,218 in 1977) was less than the number of licensed drivers (8,159,265 in 1977).

An estimate will, therefore, be made of per capital vehicle ownership for the smallest political subdivision of government for which data are available. In developing vehicle availability, only autos and pickup trucks used primarily as personal vehicles should be counted. The per capital rate developed for the county (or other unit, if required by data availability) is simply multiplied by the projected study area population to obtain vehicle availability.

Response Factors

The evacuation percentage for various coastal communities has been shown to vary from 30 percent to 100 percent. Given a firm order to evacuate, at least two-thirds of the population of larger urban areas could reasonably be expected to leave. In smaller coastal communities, it may not be unreasonable to expect nearly 100 percent evacuation.

There may, however, be an obligation to provide an opportunity for everyone to evacuate. For this reason, one estimate of required evacuation time will bebased on all residents evacuating. A second estimate of evacuation time will be based on those most likely to leave.

Generalized Demand

The following procedure is recommended to provide a planning estimate of demand. First, estimate population (either present or future as appropriate to the analysis) using U.S. census data or other reliable projection. Second, determine the most current per capita vehicle rates for study area (or next largest geographical area for which both registered vehicles and population data are available). The per capita rate is simply total registered autos and pick-ups owned as personal vehicles, divided by total population for the same area. Third, determine the maximum number of vehicles to be evacuated by multiplying the population by the per capita rate. The demand is then reduced by the appropriate response factor (0.30 to 1.00).

Capacity Estimation

The ability to accommodate vehicular traffic is a primary consideration in the hurricane evacuation problem. Highway capacity is a measure of the effectiveness of various highways in accommodating traffic. Traffic engineers are familiar with methods of computing capacity under normal conditions. This study will provide additional factors to adjust for environmental conditions experienced prior to the landfall of hurricanes. These factors are necessary because traffic engineers generally ignore the effects of rain, wind, and accidents on capacity, since they occur relatively infrequently. During a hurricane evacuation, they can be expected with reasonable certainty. Simplified techniques for determining capacity will be presented as a planning tool for those not familiar with techniques for determining capacity.

Factors Affecting Capacity

It is seldom that all roadway and traffic conditions that affect capacity are ideal. Therefore, adjustment factors must be applied to determine capacity for most highways. Factors affecting capacity can be classified in three categories--roadway factors, traffic factors, and ambient factors, although in some cases they are interrelated. Procedures for adjusting for roadway and traffic factors are widely known; however, an adjustment is necessary for ambient conditions associated with hurricanes.

Generalized Capacity

By assuming roadway and traffic conditions, it is possible to develop generalized capacity figures. By assuming generally poor roadway and traffic conditions, a conservative estimate of capacity under hurricane conditions can be made for planning purposes, especially for those not familiar with capacity analysis. A more detailed analysis of a particular location could always be done by someone familiar with capacity analysis and using factors developed for ambient hurricane conditions. Table 1 is the generalized capacities developed for four classes of roadway facilities.

Table 1: Generalized Capacities

Type of Facilities	Vehicles per Lane per Hour
Freeways and expressways	1150
Urban streets	500
Two-lane rural highways	850
Multi-lane rural highways	1150

Note: Capacities include ambient condition adjustment for hurricanes, and an adjustment for poor roadway conditions.

Galveston Case Study

Galveston, Texas, is a barrier island located along the Texas Gulf coast 50 miles south of Houston. There are three means of vehicular access to Galveston. Two access routes are primarily along the coast and do not provide viable escape routes. The third access route is via the Interstate 45 causeway bridge.

Population

The 1970 Census placed the Galveston population at 62,897. The estimated population increase for the Galveston SMSA through July 1, 1976 is 9.7 percent. Using this percentage yields a population estimate of 68,998 which will be used to project the number of vehicles available for evacuation.

Vehicles Available

The 1970 U.S. Census indicated somewhat more than 21,910 autos (the census has a single category for households with 3 or more autos, making exact projections impossible) in Galveston. This number of vehicles represents a 0.348 per capita auto ownership. The census data for Galveston county indicate a per capita auto rate of 0.404 based on a 1970 census population of 169,812 and more than 68,653 autos.

The Census Bureau estimates the 1976 Galveston County population at 186,300. Galveston County registered autos numbered 91,524, or a per capita rate of 0.491. The number of registered trucks in Galveston County in 1976 was 26,960 and yields a per capita rate of pickups used as personal vehicles of 0.042. This is based on previous research that indicates that 30 percent of all trucks in Texas are pick-ups used primarily as personal use vehicles.

For the purpose of this study, the 1976 Galveston County rates based on actual registration were factored by the ratio of the 1970 census autos per capita in Galveston to the per capita rate for Galveston County (0.348 divided by 0.404 yields a factor of 0.861). pick-up used as a personal vehicle of 0.037, or a total vehicle availability of 0.460 for Galveston Island. Total vehicles for evacuation therefore, is estimated as 68,988 times 0.460, or 31,734.

Capacity

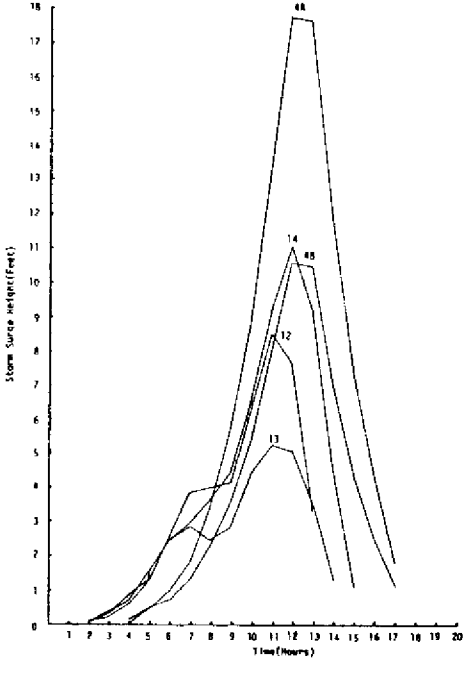
The critical point for evacuation capacity is the intersection of 61st and Broadway that feeds onto the Interstate 45 causeway. Virtually all traffic leaving the island has to use one of these five lanes. Using the previously developed 500 vehicles per lane hour yields an hourly capacity of 2,500 vehicles.

Time Available

The available evacuation time is partially determined by when the evacuation route will become flooded. This can occur either due to rainfall or due to storm tides. As

indicated previously, prediction of rainfall is difficult. No prediction of rainfall closure will be made; however, it is quite possible that roadways will be impassable due to rainfall before they are flooded due to storm surge.

The lowest construction elevation of IH-45 from 59th street to SH-6 is 7.8 feet. However, subsidence may have reduced some elevations to five feet or less. If a minimum elevation of 7.8 feet exists, the necessary evacuation time is possible as shown in the surge profiles in Figure 1. However, if the minimum elevation is 4 feet or less, evacuation may or may not be possible regardless of the number desiring to leave. The reason is that 4-foot tides may occur along the Texas coast 18 to 36 hours prior to a storm. Since the National Hurricane Center's goal is to issue a hurricane WARNING 18 to 24 hours before landfall, evacuation may not be possible.



Source: National Hurricane Center

Figure 1. Potential Storm Surges at Galveston

Qualifications

In addition to the limitations already indicated, two others should be noted. The study did not include considerations of tourists because no data existed to indicate when they might leave, or whether they might come during the threat of a hurricane. It was, therefore, assumed that tourists would leave in advance of the critical evacuation time period. If tourists need to be evacuated, evacuation times would increase.

The study indicated that winds of 50 mph and gusting to 75 can exist 10 to 20 hours prior to landfall of a hurricane. Since winds of that magnitude can overturn trucks, motor homes and vehicles with trailers, consideration should be given to prohibiting these vehicles on highways upon issuance of a hurricane warning. This would undoubtedly require special legislation.

It should also be noted that the study was only concerned with those having private vehicle transportation available. Any final plan must take into consideration those who do not have or cannot use a personal vehicle for transportation.

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THE ROLE OF COORDINATION AMONG EMERGENCY SERVICE AGENCIES IN COMMUNITY PREPAREDNESS

T. Michael Carter

Introduction

This paper will summarize the early findings from a nationwide study of community response to natural hazard warnings (Leik, Clark and Carter, 1977). The hurricane component of this research includes information on the pre-hurricane preparedness of eight counties along the Gulf and Atlantic coasts. Detailed data exist for five of these counties. The focus of our research has been on the identification of factors which determine coordinated community response to natural hazard threats. While the research has examined the full range of community organizations that would become involved in responding to a hurricane threat, special emphasis is placed here on the local weather service office, law enforcement agencies, and civil defense offices.

Our study was designed to build upon earlier findings reported by the Disaster Research Center at Ohio State University. Of particular relevance is an excellent paper by William Anderson (1970) on structural features which constrain the effectiveness of local civil defense offices during emergency situations. Presenting illustrative data, Anderson utilized a number of well documented sociological generalizations on the behavior of organizations under conditions of uncertainty to point out some of the more severe problems facing local civil defense offices. In the decade since publication of Anderson's paper, additional research has been conducted which not only confirms his original thesis, but which can also be used to refine his thesis considerably.

In the remaining portions of this paper, we will present general data on three factors which influence community preparedness. First, data on the variation in how the local civil defense offices are formally organized in each of the eight study sites will be presented. As will be shown, the nature of this organization has important effects on the potential effectiveness of civil defense efforts. Associated with this data, we will next present information on the coordination of civil defense offices and other local emergency service agencies during a hurricane threat as specified by community preparedness plans. Finally, detailed data from five of the eight sites will be presented which address the extent to which differences in the degree of coordination with other community organizations exist between local weather service offices, law enforcement agencies, and civil defense offices.

The Organization of Local Civil Defense Offices

The organization of local civil defense offices can be described by examining three separate structural dimensions: (1) whether or not a combined city-county civil defense office exists, (2) whether or not the civil defense office is independent of other offices in the community, and (3) whether or not the local civil defense director is a full-time position. Table 1 presents the structural location of the civil defense offices in each of the eight sites included in this study along these three dimensions.

TABLE 1

THE ORGANIZATIONAL STRUCTURE OF LOCAL CIVIL DEFENSE OFFICES

	Combined City-County	Separate City-County
Independent Organization		
Full-time	Site#3 Site #8	City of Site #4
Part-time		City of Site #7 County of Site #7 County of Site #1
Attached to Another Organization		
Full-time	Site #6	County of Site #2
Part-time		City of Site #1 County of Site #4 City of Site #2 City of Site #5

Of the eight distinct forms of organization, only the two combined city-county civil defense offices with a part-time director are not represented in our data. In studies of a total of thirty counties, we have yet to encounter a single civil defense office which is so organized. Thus, it appears that our data cover the range of civil defense organizations, if not reproducing the actual distribution.

Taking Anderson's thesis as a starting point, we can begin to point out a number of potential problems these communities can expect to encounter in responding to a hurricane threat. First, those sites with separate city-county civil defense offices will have to pay close attention to coordination problems arising from the autonomous actions of two parallel sets of agencies. That is, carefully planned coordination between the city

and county agencies will be necessary to insure that inconsistent actions are not undertaken. We found no evidence in any of the five sites with separate city-county civil defense offices that such coordination has been adequately planned.

Another problem facing civil defense offices, pointed out by Anderson, was that of uncertainty of authority. This problem is especially crucial for those offices which are attached to other organizations, primarily the police or fire departments. The relative authority of the civil defense office and its parent organization must be carefully specified prior to an emergency situation if authority conflicts are to be avoided. In addition, if the civil defense office is regarded as being under the authority of the parent organization, then one of its primary roles--overall coordination of the community's response--will be difficult to perform. In all six cases where the civil defense office is attached to another agency, the parent agency is seen to have ultimate authority. In only one of these six cases, however, is the parent agency prepared to assume the overall coordination role. Thus, in the five remaining communities we can find no agency which has the predetermined authority to assume overall coordination.

Another set of problems cited by Anderson involves uncertainty over organizational membership and responsibilities. These problems will be most severe when the civil defense director holds a part-time position. In each of the seven cases where such an arrangement exists, the civil defense director is a government employee with other responsibilities. In a number of cases, in fact, the role of civil defense director is only a title with no budgeted resources available.

Based simply on the organizational structure of the local civil defense offices, six of the eight sites studied have important structural constraints which will tend to limit the effectiveness of their response to hurricane threats. The organizational structure of the local civil defense, however, is closely associated with the planned role of the civil defense during emergency situations. We are referring here to whether or not the community preparedness plans call for all relevant agencies to coordinate their activities from a central location--the emergency operations center.

As noted in Table 1, there are twelve separate civil defense offices in the eight counties. In only five of the twelve cases is such integrated coordination called for by the preparedness plans. However, of the three combined city-county offices, only one--Site #8--has plans to integrate the coordination of all agencies during a hurricane threat. Thus, in seven of the eight sites the overall community response to a hurricane threat will be determined at a number of different locations by different agencies. Given the results of a number of studies by ourselves and others, such a situation makes adequate overall coordination unlikely.

In many important respects, then, the manner in which local civil defense offices are formally structured determines the potential effectiveness of their actions in emergency situations. While considerable research has been conducted which documents these effects, this research apparently has not been translated into policy at the city or county level. Our research has shown that the majority of our study sites have civil defense organizational structures which tend to create coordination problems, rather than solve such problems.

Coordination Among Community Organizations

In the preceeding section, we highlighted a number of structural characteristics of the civil defense offices in our study sites which should tend to reduce the coordination among community organizations. In this section, we will present data from five of the sites to determine if a lack of coordination does, in fact, exist. In particular, two types of data will be presented: (1) the extent of routine coordination, and (2) the extent of anticipated coordination under a hurricane threat.

In our study design, we collected two types of information on each organization's contact with other community organizations. First, we asked each organization whether or not it had routine relations with each other organization included in the study. This design enables us to assess the degree to which claimed contacts are reciprocated. That is, if the weather service claims to have contact with the civil defense, does the civil defense also claim to have contact with the weather service? If both agencies claim such contact, then their relation can be viewed as coordinated.

Next, we presented each organization with a four stage scenario of a serious hurricane threat. At each stage, we asked each organization which other organizations they would contact and which other organizations would contact them. Again, we can assess the extent of anticipated coordination during a hurricane threat. That is, if the civil defense claims they will be contacted by the weather service, does the weather service claim they will contact the civil defense? If such is the case, then their anticipated relation can be viewed as coordinated.

In the data which follow, we will examine these two types of coordination among thirty key organizations for the five sites with detailed data. As mentioned earlier, we will focus on three types of organizations: (1) the weather service office, (2) law enforcement agencies--state police, county sheriff, and city police department, and (3) the civil defense offices. In Table 2, we present a summary of our findings. For each type of relation--routine and hurricane scenario--we present two types of information. The first column gives the percentage of the other thirty organizations with which the referent organization claims contact. The second column gives the percentage of these claimed contacts that are reciprocated—or, in our terms, coordinated.

TABLE 2

COORDINATION OF COMMUNITY ORGANIZATIONS

Type of Organization	Routine Relations		Hurricane Scenario	
	% Claimed Contact	% Not Coordinated	% Claimed Contact	% Not Coordinated
Weather Service	50	47	63	50
Law Enforcement	52	45	12	88
Civil Defense	28	76	30	82

A number of interesting differences in the coordination patterns of these three types of organizations are readily apparent. First, it is clear that the civil defense offices have rather poor coordination with other community organizations during routine periods. Two points are relevant here. The average civil defense office only claims to have routine contact with less than a third of the other community organizations which would become involved in the response to a hurricane threat. Further, three-fourths of those organizations with which the civil defense claims to have contact do not claim to have contact with the civil defense. On the average, then, the civil defense is routinely coordinated with about two other community organizations. In contrast, both the weather service and the law enforcement agencies have much higher rates of routine coordination.

The coordination of the average civil defense office is slightly worse in the hurricane scenarios. In this case, the civil defense only claims to have contact with an average of about ten of the thirty organizations: but of these, only about two reciprocate such claims. Again, our data indicate the civil defense will be coordinated with only two of the thirty organizations under conditions of a hurricane threat. The coordination of law enforcement agencies with other community organizations is practically non-existent in the hurricane scenarios. In contrast, the coordination of the average weather service has improved somewhat.

It seems clear, then, that widespread lack of coordination among the civil defense and other relevant community organizations exists in our study sites. For the most part, this lack of coordination can be attributed to the problematic organizational structure of local civil defense offices, rather than to the individuals involved. The data in Table 2 relate to eight of the twelve civil defense offices cited in Table 1. Of these eight, five

have part-time directors who have full-time positions with other local government agencies.

Conclusions

Based on our findings to date, we can point to a number of serious coordination problems at the local city-county level of government. With one possible exception, none of our study sites appears to be adequately prepared to respond to a serious hurricane threat. For the most part, the fault does not lie with the civil defense office itself, but with the local government which determines the organizational structure of the civil defense office.

A final problem cited by Anderson was the uncertainty of support from local officials faced by civil defense offices. In a number of our sites the civil defense organization has undergone radical change in recent years. The general tendency appears to be to improve the civil defense immediately following a major disaster by giving it independent status with a full-time director. Then, if another disaster does not occur within the next five years or so, the civil defense office will be attached to another agency with a part-time director. In such a situation, it cannot be expected to perform adequately during the next hurricane.

It seems clear that quite different structural arrangements for local civil defense offices must be developed at the local level of government if coastal communities are to attain adequate hurricane preparedness.

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PREDISASTER PLANNING TO PROMOTE COMPLIANCE WITH EVACUATION WARNINGS

Ronald W. Perry
Michael K. Lindell

Pre-impact evacuation constitutes an important management tool for minimizing the catastrophic consequences of natural disaster. A properly implemented evacuation program cannot only reduce the loss of life from the initial impact of a hazard agent, but also significantly enhance the operation of emergency services. The greater the number of residents who can be removed from the scene, the more likely that post-impact activities can be shifted away from search and rescue activities--recovering bodies, administering medical aid, and transporting survivors--and concentrated upon the prevention of further destruction and the recovery of partially damaged property. Moreover, evacuations serve to moderate the negative psychological impacts of disaster upon victims (Perry and Lindell, 1978). Hence, successful evacuation programs not only directly save lives but also serve to reduce loss of property and disruption of social networks, and consequently may enable communities to regain equilibrium more quickly and smoothly.

Given the potential utility of pre-impact evacuation planning, it becomes important to consider issues affecting the likelihood of success of such programs. One particularly important consideration is that many people don't evacuate immediately when they are asked to do so (Quarantelli and Dynes, 1972: 67). This reluctance to leave has been documented by a number of studies of individuals' evacuation decision-making processes (Mileti and Beck, 1975; Drabek, 1968). Although only a few investigators have done so, the results of studies of individual response to warnings can be utilized in evacuation planning by considering actions which could be taken by planners to enhance citizens' tendencies to comply with evacution warnings (Dynes et al., 1972; Drabek and Stephenson, 1971). In this way, attention may be directed toward the development of incentives to evacuate.

In this context an "incentive" is any procedure or provision devised by authorities and incorporated into emergency evacuation plans which increases the probability that threatened individuals will comply with a warning to evacuate.

Of course, the discussion of incentives to evacuate implies that such procedures will be instituted on a voluntary rather than enforced basis. Some researchers have pointed out that enforced evacuation--characterized by an order to evacuate and the forcible

removal of those who do not comply with the order—would insure that an endangered area would be emptied of people, making incentives unnecessary. Although many states in the United States have provisions in their legal codes for forcing people to leave an endangered area, there are rather obvious political reasons and sometimes not so obvious practical reasons that enforced evacuations would be undesirable. Perhaps the most important reason that enforced evacuation can be problematic centers upon the relative inefficiency of the technique. Coordinating the exodus from a threatened area and providing some form of reception for evacuees is a sufficiently difficult task without authorities being forced to engage in social control activities related to the forcible removal of those who refuse to comply with the warning. Indeed, if people don't voluntarily comply, the only alternative for enforced evacuation is to arrest and forcibly remove residents. Such mass arrests produce the undesirable convergence of additional personnel and material to a threatened area when the objective is to remove all people.

A careful review of the empirical literature on individuals' responses to disaster warning indicates that five major issue areas merit careful consideration. Adaptive plans, warning confirmation behavior, the role of the family, security and property protection, and sheltering have all been shown to be associated with the degree of success of an evacuation program.

Studies of evacuation indicate that in order to effectively clear an area, residents must either have prior knowledge of some standing evacuation plan or be informed of such a plan at the time of warning. The problem of families not evacuating (or evacuating to an even more dangerous location) when evacuation routes and destinations are not well known has been widely documented. Although it is clearly important that an adaptive plan be communicated to evacuees, there is some controversy over when and how the emergency plans should be communicated. Some investigators have argued that advance dissemination is undesirable because: (1) people will forget, misplace, or misunderstand any detailed plan they are given, and (2) distribution of a plan creates anxiety over the possibility of disaster and this anxiety will be dysfunctional in an emergency. Others have countered this view by suggesting that: (1) salience (not anxiety) is produced and that sensitivity to disaster plans makes compliance more likely, and (2) a properly structured disaster plan need only involve communication of general (easy to recall) elements to the public which can be supplemented with details at the time warnings are issued. On the whole, one can recommend that one feasible incentive to evacuate would center upon the establishment of safe destinations and plausible routes which could be distributed to citizens in advance as part of general community emergency preparation. Such a plan need not be particularly elaborate and could be made available to the public in the form of a labeled map.

An alternative strategy which would yield equivalent results and minimize the material which citizens must maintain involves making detailed evacuation information available at the time of warning. This could be accomplished using either of two strategies. As part of the warning message, citizens could be given a phone number to call for detailed evacuation instructions. Upon calling the number, citizens could report their location and be given appropriate evacuation instructions for their locations.

Alternatively, as is frequently done in small communities, evacuation warnings can be issued on a face-to-face basis; designated emergency officials--often fire fighters or police officers--issue the warning to each house in the threatened area. In such cases, officials could explain the warning and hand residents a single sheet of paper with map and other appropriate instructions.

In all of the preceding strategies, the incentive is the provision of a detailed plan for protective action. Each strategy precludes the difficulty cited by one disaster victim (Hamilton, et al., 1955: 120):

> We couldn't decide where to go or what to do. So we grabbed our children and stuff and were just starting to move outside. Where if it had just been ourselves, we might have taken out. But we didn't want to risk it with the children.

Another incentive to evacuate can be derived from addressing the problem of transporting evacuees to shelter. Most evacuation plans assume that the majority of evacuees will supply their own transportation. Limited official transportation is made available to those who cannot otherwise arrange transportation. An incentive to evacuate can be found in systematizing and publicizing this available transportation. This can be accomplished by specifying departure times and locations for official transportation either as part of a community emergency plan or within the warning message itself.

Virtually all evacuation research reports that people attempt to confirm the warning message. This has been particularly important when the warning called for an evacuation. Warning confirmation may include surveying the environment, observing the behavior of neighbors, talking to friends or relatives, or contacting some official source. While the consequences of this confirmation process sometimes include jammed communication lines as well as information which may conflict with the initial warning, it is important to remember that people who fail to confirm a message tend not to evacuate.

One probable incentive, then, would involve developing warning confirmation centers rather than leaving confirmation as a haphazard process. Citizens could be instructed to contact these centers for warning confirmation and/or more detailed instructions. Such a system could be based on telephone contact and would also serve a rumor-control function. Furthermore, since confirming instructions could be somewhat

standardized, such centers would minimize problems which traditionally arise when citizens receive contradictory or conflicting warning messages and instructions while seeking confirmation.

An alternate strategy which combines both warning and confirmation centers could involve a phone call warning system whereby key residents in geographic zones would be warned by telephone and they would assume the responsibility of warning other citizens in their area (cf. Holgate, 1978). All residents would then have available the phone number of a center so that after the initial warning they could call for detailed information.

Telephone convergence on a disaster area is a significant problem. In fact, many disaster planning handbooks emphasize that one should never advise citizens to use their telephone (Leonard, 1973; Healy, 1969). It is also well known that such rules are systematically violated; people call into an area to check on relatives, and residents call out to issue reassurance to friends and relatives as well as to call for official confirmation of warnings. Quarantelli and Taylor (1977) have suggested that technical advances in the telephone industry, coupled with the widespread violations of requests not to use phones are compelling grounds for serious consideration of the feasibility of evacuation incentives (warning systems and confirmation centers) based upon telephone contacts.

It has long been known that families tend to evacuate as units (cf. Drabek and Boggs, 1968) and that the separation of family members often involves anxiety and attempts by evacuees to reunite families, sometimes by returning to previously evacuated areas. Keeping families united may not be as important as simply having information available regarding the whereabouts of family members (cf. Haas et al., 1977). This suggests that evacuation would be facilitated if some means were available through which families could communicate if separated. The establishment of "family message centers," where evacuees would obtain information on the whereabouts and condition of family members, could be included in evacuation shelter planning. Such a system has been used in Darwin, Australia after the Christmas 1974 cyclone and proved to be reasonably effective.

Both the American Red Cross and the Salvation Army have programs which center upon locating disaster victims and "registration" procedures at shelters. These existing programs may be expandable into "family mesage centers" which would process and disseminate information on families which had evacuated some threatened area.

There is a large volume of field research which indicates that the problem of looting is rare in natural disaster (cf. Quarantelli and Dynes, 1970: 168). However, the best available information on evacuee perceptions suggests that security remains an important concern (Dynes et al., 1972: 34). As part of an incentive program, local communities

could communicate the general nature of whatever official security measures will be undertaken to the public. Such measures need not be elaborate; the purpose of communicating them is to inform potential evacuees that some measures are being taken.

If efficiency is a major concern, it may be worthwhile to incorporate community members into the protection process. This would involve assigning a few selected individuals security duties within their own neighborhoods.

The nature of shelter facilities provided to evacuees has been the source of considerable controversy among disaster researchers. It has been frequently reported that evacuees tend not to use public or planned shelters.

From the standpoint of evacuation incentives, it may be both cost effective and efficient to use temporary "shelter checkpoints" where evacuees could report to gain additional information or material and then either depart to stay with friends or relatives or be assigned to stay in a public facility. Such a plan would minimize the need for elaborate and extensive shelter facilities, permit evacuees choice of arrangements, and allow for a more careful accounting of those who do evacuate.

Another alternative to conventional public sheltering would involve distributing information to residents of frequently threatened areas which would describe in advance safe areas as well as routes to these areas for potential evacuees. Residents, then, could be instructed to make contact with friends or relatives in the safe area and arrange in advance for shelter in that home in the event of disaster impact.

We hope that this review of incentives to evacuate will stimulate planning for and managing the consequences of the impact of natural disasters. We recognize that a list of incentives does not constitute an emergency plan. These incentives should be taken as suggestions for structuring some elements of a plan.

The practicality of each of these evacuation incentives will depend critically upon the conditions which are present when the plan is actually executed. These conditions include factors affecting the ability of the threatened population to evacuate, such as the capacity and vulnerability of evacuation routes, as well as characteristics of the hazard agent. Most significant among the latter are speed of onset and scope of impact. Recognition of the importance of site- and hazard-specific factors suggests that the types of incentives planned for different sites anticipating a common hazard might well be as different as the types of incentives planned for two sites preparing for different hazards.

Regardless of how these incentives are integrated into a plan for a specific hazard, we wish to emphasize that the incentives described here are based upon or drawn from empirical research on people's performance under disaster conditions. This reflects the view that it is important to build emergency planning around people's known reaction

patterns. Too often emergency plans which are administratively devised turn out to be based upon misconceptions of how people react (cf. Drabek and Stephenson, 1971: 202; Dynes et al., 1972: 31) and have created more difficulties than they solve. It would appear to be wise to develop emergency plans which guide citizen actions into effective response to disaster.

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AREA AGENCY ON AGING DISASTER CONTINGENCY PLANNING: THE PRE-DISASTER PHASE

G. Alec Steele
Morgan Lyons
Don D. Smith

In a recent paper (Steele and Smith, 1978) on the evacuation response of the elderly during hurricane Eloise (Baker, Brigham, Paredes, Smith; 1976), several disturbing findings were presented. It was found that immediately prior to the storm:

(1) older residents (61 years of age and older) engaged in precautionary activities less frequently than younger residents.

(2) older residents were less frequent listeners to radio and television prior to and during the storm than younger residents.

(3) of those residents who evacuated their houses, older residents tended to go to the homes of friends and relatives while younger residents tended to go to public shelters.

(4) of those residents who evacuated their homes, older residents tended to be more influenced by family and friends than younger residents.

This paper will discuss the implications these findings have on the warning and evacuation components of Area Agency on Aging (AAA) contingency plans for the evacuation of the elderly. The plans developed for Planning and Service Area (PSA) XI (Dade and Monroe counties) will be used as our example. Pertinent data from residents of Miami's South Beach area will also be presented as support for the applicability of the Hurricane Eloise findings to the PSA XI contingency plan.

Before we discuss the issues of warning and evacuation in AAA contingency plans, we wish to note that this is not intended to be a critical review of the plan developed for PSA XI. However, recent research suggests that older residents possess certain characteristics important in any disaster planning considerations. Elderly residents appear less highly motivated to adopt precautionary measures than younger residents. Older residents also seem to be more sensitive to informal friendship networks as sources of information and influence than younger residents.

Disaster Contingency Plans for the Elderly

The Department of Health, Education and Welfare (HEW), through its Administration on Aging (AoA) has mandated that each Area Agency on Aging develop disaster

contingency plans for the elderly. In Florida the geographic basis for each Planning and Service Area parallels our Department of Health and Rehabilitative Services (HRS) planning districts. All but one of Florida's eleven planning districts are currently served by AAA's. Beginning on October, 1979, all eleven districts will be represented.

The HEW Technical Assistance Memorandum AoA-TA-77-5 describes the role and administrative relationships among AAA's, state and regional agencies on aging with respect to disaster planning. The memorandum instructs AAA's to identify potential natural hazards and vulnerable populations of older persons within their catchment area. It also requests these agencies to work with local agencies charged with disaster preparedness in the development of plans of action to mitigate the effects of natural disasters on elderly target populations. Florida's Division of Disaster Preparedness has developed a guide that has proved very useful to AAA planners in their efforts to accomplish this task.

Although the planning guidelines developed by the Division of Disaster Preparedness explicitly point to the importance of adequate education and warning systems in plan development, this pre-disaster component has not received much attention. As Representative Claude Pepper noted during his hearings on Weather Disasters and the Elderly, the pre-disaster considerations have been too long underemphasized.

Education

The specific warning and evacuation strategies incorporated in AAA contingency plans are determined by the response capabilities of local agencies. Since these strategies may vary considerably within any given PSA, it is necessary to first locate specific sub-populations, or target areas, that have particular vulnerabilities. In PSA XI there are many such sub-populations, each uniquely vulnerable to the effects of a hurricane. In Dade County, the area known as South Beach has become an area of particular concern for local disaster planners. Our discussion will use the pre-disaster plans for South Beach as an example.

The South Beach area is the southern tip of the city of Miami Beach, and is separated from the downtown area of Miami by Biscayne Bay. Miami Beach (north and south) is populated by almost 90,000 permanent residents who rely on three causeways for their link to downtown Miami. The AAA estimates that more than 39,000 residents of South Beach are 60 years of age and older, and of these, more than 7,000 residents are frail elderly. Older residents often live in small apartments called SRO's--single room occupancies. Limited accessibility, the high number and concentration of frail elderly, and the structural conditions of their housing makes South Beach a priority target area in the PSA XI contingency plan.

An information brochure has been made available to all older persons currently receiving services through AoA-funded projects. Project directors were given these brochures by the AAA to distribute to their clients. The brochure may be questioned as an educational device from several standpoints. Perhaps the most glaring deficiency is that it does not put older residents in touch with the evaucation plan devised by the AAA for their specific target population. Rather, it puts on the older resident the burden of having to decide which of four general evacuation plans to adopt. Not only does the brochure require the reader to have a fairly sophisticated grasp of the English language, but it also assumes the reader is interested, motivated, and capable of implementing independently a personal plan of action.

As part of a multi-district needs assessment of older HRS service recipients, a small and fairly concentrated sample of South Beach residents was interviewed. When asked to rate the severity of eleven general problem areas, the residents gave "protection from storm or natural disasters" a relatively low rating--on the same order of severity as concern with "spare time opportunities". This adds support to the finding from the Panama City study that older residents are not highly motivated to seek out information or to adopt precautionary measures.

Warning and Evacuation

If the problems of motivation and lack of detailed, localized information can be overcome, there are some aspects of the evacuation plan that need to be considered. Again, these considerations are not exclusive to the problems of PSA XI, or of South Beach. They are generic to any coastal area possessing a large concentration of frail elderly persons.

It is estimated that efforts to evacuate the seven thousand plus frail elderly of South Beach alone must begin at least twelve to twenty-four hours before storm impact. This simple logistic reality poses several problems in itself. First, someone must issue an early warning to those persons charged with locating and physically moving these individuals while the storm is still well out at sea (possibly 200 to 300 miles out). There is no way to accurately predict landfall timing and strike point for a storm this far from land. The complexity of this decision is further compounded by the knowledge that if the full force of the storm does not hit South Beach, then you have diverted needed resources, filled shelters with people who do not need to be there, and exposed a large number of elderly to the trauma of potentially fatal transfer shock (Spencer, 1975).

The other major problem involved in implementing early mass evacuation has more to do with characteristics of the older residents themselves than with the mechanics and timing of moving people. The plan of early mass evacuation must be instituted well

before a hurricane represents a clear and present danger to the area. As such, it may be difficult to mobilize a large number of older residents who are not predisposed toward precautionary action. Once the plan is set into motion, there will be no time for project staff to individually pursuade seven thousand individuals to leave their homes.

If these older residents can be pursuaded to evacuate, there is no guarantee that they will willingly go to public shelters. Only 20% of the older residents in Panama City who left their homes went to public shelters. Although 93% of the South Beach HRS clients interviewed said that they would leave if asked to evacuate, 25% of these residents said they would go to the homes of friends and relatives rather than to a public shelter. Of course, our small sample is not necessarily representative of South Beach, nor does it describe actual behavior in the fact of a hurricane. However, it does provide additional reason to question assumptions we may have concerning effective compliance with early evacuation efforts.

Conclusions

Clearly, there are differences between elderly residents of Panama City and those of Miami, St. Petersburg, or Jacksonville. Differences in cultural and life experiences, as well as important differences in physical environment, should make us cautious about our conclusions concerning the response of older persons to Hurricane Eloise. On the other hand, can we afford to maintain that these residents will behave substantially differently than those in Panama City? It is our contention that we can devise more effective plans that do not rest on the assumption that older residents will be knowledgeable and willing evacuees. The following suggestions are offered as possible modifications to pre-disaster contingency plans:

Education/Information

(1) Design information brochures for specific evacuation plans. Residents should know exactly what is expected of them and under which conditions (contingencies).

(2) Localize information brochures for particular target areas. Include maps, pick-up points, and local numbers to call.

(3) Write brochures of the reading and comprehension levels appropriate to local target populations. In some areas, bilingual brochures may be necessary.

(4) Enlist neighborhood representatives (Miller, 1977) to serve as block captains and alternates. These individuals can serve many functions during all three phases of a disaster. Personally visiting their constituents and relaying evacuation information may do more to legitimize the evacuation plan than any other form of information dissemination.

Warning

(1) Some mechanism of advance warning should be developed so that the person charged with implementing early evacuation will have sufficient information to make the best possible judgment at least 12-16 hours prior to hurricane landfall.

(2) Block captains, and their alternates, should be in a posture to mobilize their constituents 12-16 hours prior to hurricane landfall.

(3) Every elderly resident should have a telephone number of his or her block captain and alternate block captain.

(4) Lines of communication should be verified periodically both as "mini drills," and to update the evacuation needs (wheelchair, vans, etc.) and intentions of the elderly residents.

(5) Residents should be encouraged by their block captains to recruit newcomers into the communication network and to advise block captains of any changes in health status of their fellow residents.

Evacuation

(1) A mix of over-land and vertical evacuation should be determined for each target area.

(2) Large apartment buildings and other structures vulnerable to storm surge and wind damage should be certified storm worthy (or not) by qualified structural engineers.

(3) Total vertical evacuation capacity should be determined and updated for each target area.

(4) Residents should know, in advance, which evacution plan they are expected to adopt, and what type of assistance to expect.

(5) Buildings certified for storm worthiness should maintain sufficient food, drinking water, and emerging supplies (including back-up light sources) to support a specified number of evacuees for three to five days.

(6) Local hospitals and secure nursing homes should make their facilities available to receive particularly frail or handicapped elderly early in the evacuation proceedings. Block captains should maintain a current list of any names and addresses of these residents.

(7) Letters of agreement should be signed among participating agencies specifying duties and responsibilities. This should be part of the evacuation guidelines distributed to all agencies.

(8) Aging project staff who have shown their willingness to participate in the evacuation plan should also be asked to sign letters of agreement that specify their responsibilities.

Any effort to improve planning and coordination among agencies is, of course, welcomed. The important point is that it be done not only with insight and determination, but that it be done now.

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LOCAL DISASTER RESPONSE PLANNING

LOCAL HURRICANE RESPONSE PLANNING IN ALABAMA

Rose Young

The Mobile County Hurricane Evacuation Plan has been prepared to provide comprehensive guidance for coping with the threat and impact of severe weather conditions resulting from a hurricane. This plan is to serve as an action guide for local officials in effective hurricane preparedness and response and is to be used in conjunction with the Mobile County Basic Emergency Operations Plan.

The plan sets forth actions to be taken to protect lives and property. It includes predesignated evacuation routes and a consolidated shelter inventory for evacuees from the threatened area.

It has been found that the most effective way to establish and maintain contacts when working with local government officials and other representatives is to prepare yourself before calling them together. Commence with meetings that move and provide information. This prevents disinterest and lets those persons present know immediately that disaster preparedness is a serious matter. Also, it becomes clear that those of us involved know what we are doing. There must be no doubt that we are professionals at work.

Those persons involved in writing any plan must consist of: (1) decision makers of local government; (2) a department or service representative who will become involved in its execution, etc. (Control Group); and (3) support organizations and agencies (Support Group).

Under the concept of hurricane planning, all local public officials have an inherent moral duty as well as a legal responsibility to ensure that their jurisdiction is prepared for immediate disaster response.

In keeping with the policies and responsibilities set forth in the Alabama Civil Defense Act of 1955 and the Resolutions adopted locally, a local hurricane plan should contain operational provisions for dealing with all aspects of a potential or actual hurricane situation, including evacuation. The local disaster plan also provides for access to and utilization of all available resources to protect against a threatening situation.

The extent of evacuation activities at any given time is contingent upon the severity and magnitude of the potential threat or actual conditions.

Evacuation will normally commence with evacuees voluntarily leaving the area; however, the State of Alabama has a compulsory evacuation law. Even though some persons may choose to remain in the potential danger areas, planning must be directed toward the evacuation or relocation of 100 percent of the populace.

Evacuation or relocation into less hazardous areas (host locations) will have to be executed along certain specified areas of the coast. These routes have been planned in coordination with the State Emergency Highway Traffic Regulatory Commission, consisting of the State of Alabama Highway Department and the Alabama State Troopers, and working with the Mobile County Road and Bridge Department as well as other local officials and law enforcement agencies. This requires very close coordination with other neighboring civil defense agencies on the availability of shelter areas in adjacent counties that might be used as host areas.

The decision to recommend evacuation will be made by local officials based on forecasts and predictions of the National Weather Service, along with recommendations from the local public safety officials.

The local evacuation plans for the county must be designed based on the peculiarity of the individual county.

Briefly, I would propose that the following outline be used as the agenda for work in preparing a Hurricane Evacuation Plan.

Element Objective

Develop a Hurricane Evacuation Plan to satisfy the needs of the coastal Alabama counties; Mobile County coordinated with Baldwin County. This would include an Emergency Public Information Package (camera ready) to be produced and distributed in time of need. Included in the EPI would be individual actions, routes of evacuation and emergency measures.

Means Objectives

A. Demonstrate through appropriate maps, resource listings and research that the proposed program will effectuate the evacuation or relocation of all the populace in possible primary disaster areas.

B. Demonstrate that the state and local governmental units have cooperated in the construction and the adoption of the said Hurricane Evacuation Program and understand its implications and their respective responsibilities therein.

C. Interpret adoption of, and instruction on, the facets of the proposed program as being a useful method by which the effect of the primary damages of a coastal hurricane might be reduced or mitigated.

D. Identification of hurricane routes, shelters and other pertinent information.

Planning Considerations of the Proposed Hurricane Evacuation Program

Strong winds, driving rain and extensive flooding under severe hurricane conditions could necessitate evacuating residents substantial distances from the coast. Areas seriously threatened should be evacuated by volunteer evacuation, at the discretion of local government. In the event appropriate action is not taken by local authorities, the Governor of the State of Alabama may, at discretion, order compulsory evacuation for the purpose of protecting lives and property.

Local governments are responsible for the movement of local residents and transients to local shelters or to designated evacuation routes. In the latter case, the State of Alabama assumes responsibility for their movement to shelter referral points or motels in safe areas.

After evacuees have been directed onto state-designated evacuation routes, they may at their discretion go to a shelter made available to them, or choose a motel along the route.

Management of state and local resources shall be in accordance with Annex 26 of the Alabama Disaster Assitance Plan and the Mobile County Basic Operations Plan.

The return of evacuees or relocatees back into their homes shall be planned and coordinated with appropriate local and state officials once those areas are safe to re-enter.

Education of the coastal populace through a hurricane awareness program will be undertaken; how the provisions of the hurricane evacuation will function when placed in effect by local government officials will be made clear to coastal residents.

Hurricane Evacuation Plan Work Elements

A review of responsibilities concerned with evacuation or relocation of the populace will be made. Here the existing responsibilities of the local and state governments will be reviewed to determine how the plan will have to be constructed. A review of existing plans for the coastal and inner counties will be accomplished to determine to what extent planning has already taken place.

An analysis of the geographic and demographic data will be used to identify the concentration of populace along the coastal counties, traffic patterns and routes, natural disaster shelters, water levels in relation to mean sea level, flooding information, and the availability of state and local resources.

Development of the Hurricane Evacuation Plan will include evacuation routes to be used in each area. It will also indicate shelters and routes to them by area.

The plan will indicate evacuation time required from low-lying and potential danger areas of each coastal county.

The plan will portray coordinating instructions for both the evacuation and return of the populace to the area after the danger has passed.

A different EPI Package will be prepared to accompany each of the Hurricane Evacuation Plans for each county. It will be made camera ready with enough copies to accompany each of the plans to be issued.

A hurricane awareness brochure designed to give information to the public, educating them on general "need to know" things about hurricanes, flood information, etc., will be prepared. This brochure will lay the foundation for use of the EPI Package when issued.

A method of evaluation of hurricane plans must be developed and the effectiveness of the plans evaluated.

Annual changes will be made and distributed to all holders so that the plan can be kept current.

Plans will be tested periodically in the form of exercises to test the effectiveness and to keep them current.

Conducting coordinated operations in hurricane emergencies as well as any other emergency situation is basically executing or carrying out local emergency plans. The payoff from emergency operations is the lives that are saved and the property that is preserved. This payoff results from the forces that have emergency missions doing "the right thing at the right time," making maximum effective use of existing resources and capabilities.

HURRICANE EVACUATION PLANNING FOR COASTAL GEORGIA

Wendell A. Brinson

The coastal area of Georgia has not experienced any severe weather conditions of hurricane proportion since 1964. Emergency plans that were in effect at that time continued to be updated and periodic exercises were conducted to maintain operational readiness. In 1974, the state emergency plan was replaced by the new State of Georgia Natural Disaster Operations Plan, and each local government participating in the Civil Defense program was required to develop a new local emergency plan based on the state plan. All participating local governments completed their plans in late 1974 and early 1975, and afterwards, various types of exercises were conducted at state and local levels to test the effectiveness of the new plans. The need for additional planning input and operational procedures to cope with the effects of a hurricane striking the Georgia coast was recognized during conduct of exercises in the State Emergency Operations Center dealing with hurricane evacuation.

Annex 5 of the new state plan provided for evacuation; however, the Annex and existing Standing Operating Procedures failed to provide sufficient criteria for effective emergency operations during severe hurricane conditions. Major problem areas included a lack of data on evacuation zones along the coastal area related to rising water and high wind, plus preplanned evacuation routes and designated host areas that would provide reception and care services for the evacuees. The State Civil Defense staff and representatives from the state and federal agencies participating in the hurricane exercises saw an urgent need for development of a hurricane evacuation plan for coastal Georgia to encompass all coastal counties and designated host area counties.

The initial planning session for developing a hurricane evacuation plan was conducted in the State Emergency Operations Center and attended by designated representatives from the various state agencies that were assigned primary or support functions relative to evacuation in the state plan. Agencies represented included State Civil Defense; Departments of Transportation, Public Safety, Human Resources, and Agriculture; and the Public Service Commission. The group identified and recorded various functions that must be included in developing the plan. Main areas included:

1. Establish evacuation zones for the coastal counties through use of elevation relief maps.

2. Develop maps to depict the evacuation zones related to rising water, tidal surges, and high winds. Projected population residing in each zone should be established.
3. Establish feasible evacuation routes from the danger areas to designated reception and care areas. Depict evacuation routes on maps.
4. Select host counties to provide reception and care services for evacuees. Host counties will establish reception centers and designate shelter facilities to house evacuees.
5. Allocate population to be evacuated from the coastal counties to designated host counties consistent with host county resources.
6. Select staging areas outside of the danger area to procure, receive, manage and allocate resources to coastal areas affected by the hurricane.
7. Establish an emergency communications and warning system.
8. Develop a public information program to provide emergency information to the population during pre-emergency, emergency and post-emergency operations.
9. Establish procedures for re-entry and clean-up operations.
10. Provide for restoration and recovery in area affected by the hurricane.

The group felt that future planning sessions should be conducted within the coastal area since most of the data and input needed for developing the plan would have to come from this area. Representatives from the state and local governmental agencies within the coastal area would be included in overall plan development. Federal agencies, to include Defense Civil Preparedness Agency (DCPA), Corps of Engineers, National Weather Service, and U.S. Coast Guard, would also be invited.

The next planning session was conducted in the Civil Defense office in Brunswick, and this session proved to be the main planning event. All agencies that were invited to attend were represented and provided planning input. State and federal agency support from the coastal area was coordinated by Area 5, State Civil Defense Field Coordinator, and the designated state agency representatives assigned by their respective department/agency at state headquarters level. The field coordinator contacted local Civil Defense directors and requested that they invite various department/agency personnel from local government to attend. State agency representatives included the Departments of Public Safety, Transportation, Natural Resources, and Human Resources; Forestry Commission; and the Public Service Commission. Federal agencies provided representatives from the Defense Civil Preparedness Agency, Corps of Engineers, National Weather Service, and the U.S. Coast Guard. Civil Defense directors and local governmental

personnel from five of the six coastal counties were present. Personnel from counties in the host areas were not invited to this session since the primary agenda would include establishing criteria for developing evacuation zones, feasible evacuation routes and department/agency support roles. The host area counties would be included in the next planning session.

Events of the planning session were recorded for inclusion in the evacuation plan. The Corps of Engineers, National Weather Service and Department of Transportation could provide maps of the coastal area, depicting elevation relief and road nets. Representatives from the Departments of Public Safety, Transportation, and Natural Resources would work with Civil Defense directors and local governmental agencies to develop evacuation zones and routes. Human Resources would provide support in the coastal area and host areas on reception and care service and emergency medical service. The next meeting would be held in two months, and the same agencies would participate. Planners with the Disaster Assistance Planning Team at State Civil Defense would participate in remaining planning sessions, since this department would compile the material and develop the finished plan.

Planning sessions continued; however, less state and federal agency participation was involved. Practically all of the work was being accomplished at the local level with major assistance from state agencies located within the immediate area. To enhance the planning effort, the Governor's Hurricane Conference was held on Jekyll Island in June, 1977. This conference provided valuable input from the program participants. A second conference was planned for the following year, at which time a completed hurricane evacuation plan would be distributed to participating governmental departments and agencies, and highlights of the plan would be discussed.

Plan development continued with assistance from the field coordinator and local representatives of the state agencies, consistent with needs. The disaster planners maintained coordination with the field coordinator and local Civil Defense directors. Materials were mailed to the planners upon completion, and the planners attended the monthly area meetings. Handouts on completed parts of the draft plan were distributed and thoroughly discussed. This process continued until the entire plan was completed in draft form. During the next area meeting, copies of the draft plan were distributed and the entire plan was reviewed by the participants from local and state agencies. The plan had a final review by members of the State Civil Defense staff and was then printed in final form.

Copies of the finished plan were distributed at the Second Annual Governor's Hurricane Conference. Participants from state, federal and local governmental agencies

received copies. A brief review of the plan was provided by the Chief Disaster Assistance Planner, Area 5 Field Coordinator, and a local Civil Defense Director from both a coastal area and host area county. Plans were made to have a conference the following year, and at that time the plan would be tested by conducting a tabletop exercise involving the state and local governmental departments and agencies that had a primary or support role in hurricane evacuation operations.

Local Civil Defense directors have made the public aware of the plan, particularly in the coastal counties, through talks to civic clubs and schools, plus support from the news media. Additional public awareness will be generated when an in-house, areawide exercise is conducted to test the plan.

The finished plan was developed to encompass the coastal area of Georgia, which includes all coastal counties and the designated host counties. Major planning left to be done relates to developing local Standing Operating Procedures to support the coastal plan. On May 23, 1979, a conference was held at Armstrong College in Savannah, to initiate action to provide an exercise to test the plan.

This conference also provided input for local Civil Defense Directors to use in developing local SOP's. The Civil Defense directors and local governmental department/agency personnel from the entire coastal area participated in the conference, along with representatives from the State Departments of Public Safety, Natural Resources, and Transportation; and the Forestry Commission. National Weather Service and American Red Cross also participated.

No major problem areas resulted during the time the plan was being developed. State and federal agency support was outstanding during the initial planning sessions, and these agencies continued to support the planning effort, consistent with needs. Local Civil Defense directors and governmental department/agency personnel were most cooperative and provided tremendous support. Area 5 Field Coordinator worked with officials from the counties that had inactive or no Civil Defense organizations. More problems were encountered in these counties than any other since no central agency existed to gather data needed for the plan. Perhaps it is best to eliminate counties as host areas that have no active Civil Defense organization.

The planners and individuals involved in developing the plan feel that the first Governor's Hurricane Conference was most instrumental in generating interest at the local level to develop the plan. This conference was attended by a number of elected governmental officials and department/agency heads from local government, as well as Civil Defense directors.

EMERGENCY PLANNING IN A CITY

J. F. Hickerson

Baytown, Texas is a city of about 55,000 population located on the north end of Galveston Bay. It is on the north side of the Houston Ship Channel, and Houston is one of its suburbs located about twenty-five miles to the west. It is the home of Exxon Baytown Refinery, one of the largest oil refineries in the world. In addition, there are other industrial plants such as U.S. Steel, Gulf Chemical Company, Mobay Chemical Company, and Stauffer Chemical Company.

Since we are at the north end of Galveston Bay, southeast winds that accompany a hurricane, or at other times, bring in tides that are about fifty percent higher than on the open coast at Galveston. Our emergency experience includes hurricanes, tornadoes, flash floods, industrial accidents, and flooding from high tides.

The entire area has subsided significant amounts in the last 30 to 40 years due to the heavy withdrawal of well water. There are parts of Baytown that have sunk more than nine feet since 1915, and most of this has been since 1945. A four and one-half foot tide will cause us to evacuate about 400 families, and this is a continual threat throughout the year.

In 1947, two ships exploded at Texas City causing nearly 600 persons to be killed and hundreds to be injured. This horrible disaster showed the need in Texas for making emergency plans to include all hazards. Four years ago, the state of Texas adopted the 1975 Disaster Act which required all cities and counties to either have their own or be part of an inter-jurisdictional plan. All mayors and county judges had been appointed by the governor of the state of Texas to be emergency coordinators of their jurisdiction.

The emergency plans for the city of Baytown were originally written in 1964 and revised in 1976. From the beginning, the Governor's Division of Disaster Emergency Services has been of great assistance in developing these plans. The decisions on the assignment of responsibility, of course, had to be made by the local planners. In our city Civil Defense means government acting in time of emergency using all available resources for the protection of life and property. These resources include not only the city departments but all the resources of the city such as industry, schools, churches, hospitals, and the entire medical community. Although the city departments are the backbone of the organization, volunteers are used and have been found to be quite

reliable. These include emergency corps, volunteer firemen, radio amateurs, Civil Air Patrol, and CB operators.

The most important action that can be taken for the protection of life and property is the action each individual takes for his own protection. We believe, therefore, that our most important functions are evaluating the hazards that confront the city and giving instructions to the individual on the action that he should take. The news media, therefore, plays an important part in getting the information and instructions to the public. We have tried to develop with the media in our area this team concept of working together.

As we indicated earlier, we are frequently called upon for emergency action which gives our organization practice in facing actual emergencies. In addition, we have annual medical exercises which involve all the hospitals, ambulances, together with partial participation from the public. In April of this year we had our ninth annual mass casualty exercise. In that exercise the National Guard and the State Guard worked with us in solving the problems.

The heart of the operation is the Emergency Operating Center where the chiefs of emergency services work together under the direction of the City Manager in solving the problems. Through the EOC we are able to coordinate emergency activity within the city and with agencies in the surrounding area as well as with the county, state and federal governments. We have had some difficulty in working with some of the organizations, but most of these have been problems of communication. When the Red Cross as well as other organizations work with us in the EOC, we have found that the problems can be resolved by talking them over together.

The process of emergency plan development is one that never ends. It requires continual review and updating.

THE NATIONAL FLOOD INSURANCE PROGRAM

PREFACING REMARKS ON THE NATIONAL FLOOD INSURANCE PROGRAM

Raymond J. Burby

The nature of coastal hazards was ably presented in yesterday's sessions and in Jay Baker's paper on hurricanes and coastal storms. Simply stated, more and more persons are settling in coastal areas and placing themselves at risk. Yesterday, we examined warning and evacuation as means of mitigating the hazard. The National Flood Insurance Program is designed to transfer the costs associated with the use of hazardous areas from the public sector to the private sector. In addition, the program seeks to reduce future increases in losses by requiring that communities adopt various building and land use regulations as a condition of eligibility for insurance. Without appropriate regulations, the availability of insurance could stimulate unwise development in hazardous areas and further aggravate problems stemming from hurricanes and coastal storms.

Very few persons, if any, have questioned the wisdom of the insurance portion of the National Flood Insurance Program. Most everyone agrees that the national interest is well served when persons who benefit from high hazard locations pay the costs associated with their locational choices. This should occur when insurance is offered at actuarial rates. The second impact of insurance availability, on the other hand, has been a subject of some debate. For example, does the availability of insurance stimulate development in hazardous locations? In addition, a number of persons have questioned how well the National Flood Insurance Program and related regulatory provisions work in actual practice. For example, can local governments really withstand political pressures behind the development of high hazard areas? Will the regulations required by the National Flood Insurance Program really reduce future increases in riverine, hurricane and coastal storm flood losses? By how much? What are the fiscal impacts of the program? What are its effects on land values? On construction costs? In other words, can local governments operate an effective land use management program for coastal hazard areas, and, if they can, by how much do the benefits exceed the costs of doing so?

These are some of the questions that will be addressed by our panelists. Before we hear from them, however, I would like to briefly report on some preliminary results from a nationwide survey of local governments that was conducted by the University of North Carolina this spring. The survey was focused on 1400 communities that are experiencing pressure for development of hazard areas and have populations of 5,000 or more persons.

Of the 1400 communities queried, responses were obtained from 1210, a response rate of 86 percent. In general, the survey has shown that most communities--52 percent--believe their flood plain land use management programs to be very effective in reducing the exposure of future development to flood damage. On the other hand, only 13 percent rate their programs as very effective in helping to reduce damage to existing development. Thus, with its orientation to urban growth, the Nationnal Flood Insurance Program has not yet found a way to deal effectively with the problems associated with existing occupance and use of flood hazard areas. At the same time, this survey showed that most communities have yet to experience serious side effects as a result of flood plain land use management. The most commonly cited side effect--increased costs of construction--had been observed in 45 percent of the communities surveyed. Other side effects and the proportions of communities in which they were perceived included reduced land values (20 percent), slowed economic growth (15 percent), reduced tax revenues (11 percent), and increased value of existing structures (9 percent). Forty-one percent of the communities reported that no adverse or positive side effects of flood plain land use management had been observed to this time.

In sum, the National Flood Insurance Program appears to be accomplishing one of its major purposes, at least from local governments' perspectives, without serious local costs. The key barriers to more effective local programs mentioned by local officials include (1) lack of public interest or perception of flooding as a problem, (2) opposition by building, real estate, and land development interest, and (3) lack of state or federal financial support, each of which was mentioned by a third or more of the communities surveyed. These, of course, are problems that can be addressed by many of the participants at this meeting as we strive to develop better approaches for dealing with hurricanes and coastal storms.

CONTEXT AND IMPACTS OF FLOODPLAIN REGULATIONS IN THE UNITED STATES

H. Crane Miller

The national context in which all hazard mitigation efforts are currently operating is suggested in a few snapshot statements.

- Congress has invested over $10 billion in flood control works since 1936.
- Despite the federal investment, annual flood losses are increasing. The U.S. Water Resources Council states that annual urban flood losses now amount to $1.2 billion.
- Over 60% of flood losses in recent years have resulted from storms exceeding the 100-year (1% chance) storm; most of these were coastal storms.
- The federal government spends at least $3.3 billion annually to keep people on the nation's floodplains through flood control works, federal disaster assistance, physical disaster loans, flood insurance, plus funding such influences on floodplain development as housing, highways, and sewerage systems.

Such statements assert the current position of the United States in terms of flood losses and suggest the need for further evolution of United States' policies and strategies for flood loss reduction. We are now in the midst of a third major stage in the evolution of federal strategies for flood plain management. The origins of these stages are traceable from the beginnings of the nation.

During the 19th century and the early years of the 20th century, federal floodplain management strategy was basically that of no government involvement, with the exception of federal flood control activity in the Lower Mississippi River Basin, beginning in 1879. The strategy was rooted in the concepts of laissez faire land use; that is, that each man has the right to use and develop his land as he wishes so long as he does not adversely affect the property of others. During that period the costs and risks of flood losses were borne by the victims. Beginning roughly in 1910, federal policies began to change in recognition of the value of flood plain development to the nation. Milestones in federally-authorized activities until 1936 included stream flow measurements for preparation of plans for navigable stream improvements (1910); flood control improvements of the Sacramento River, California, flood control surveys, and federal assumption of responsibility for Lower Mississippi flood control (1917); and surveys on comprehensive development for navigation, hydroelectric power development, and flood control (1927).

Evolving federal activity in flood control was codified in June, 1936 with enactment of the Flood Control Act of 1936, marking the first major federal strategy and involvement in flood control nationwide. With the Flood Control Act of 1936 a pattern of federal assumption of the costs of water resources development was established, including flood control, incentives for further floodplain development, and disaster relief for mounting flood losses. The pendulum had swung from laissez faire to the other extreme.

A third major stage in the evolution of federal strategies for flood plain management began in the 1950's, and achieved political impetus in the late 1960's. This stage, which is still evolving, is marked by a shift away from sole reliance on structural flood control measures for flood loss reduction to other, nonstructural management methods. It is also marked by the government's attempt to shift some of the costs and risks of flood losses to those who create the risks, the occupants of the flood plains.

Efforts to institute a national flood insurance program date back to 1951 when President Truman requested an appropriation for a flood insurance program, following costly floods in the Midwest. These and other proposals during the 1950's and 1960's were consistently defeated. Not until submission of "A Unified National Program for Managing Flood Losses" (1966) and HUD's "Insurance and Other Programs for Financial Assistance to Flood Victims" (1966) was political impetus given to nonstructural flood loss reduction measures. One result was the National Flood Insurance Act of 1968, which established a voluntary program and provided subsidized flood insurance for existing properties located in identified special flood hazard areas. It also required communities to adopt local flood plain management measures as a strict condition of eligibility in the flood insurance program. However, few communities joined the Program, and by 1973, especially in the wake of Hurricane Agnes, it was apparent that the principal defect in effecting the Congressional purpose was the voluntary nature of the Program. Changes made by the Flood Disaster Protection Act of 1973 mandated community participation in the program in return for the availability of federally assisted financing, and increased the volume of technical studies identifying flood hazard boundaries in flood prone communities. The mandatory provisions of the 1973 Act have been particularly troubling to a number of individuals, associations and communities, and have been the subject of litigation since then. Courts, however, have consistently upheld the constitutionality of the Flood Insurance Act, as amended.

In this century alone we have seen the pendulum of federal strategy for flood loss reduction swing from the extreme of laissez faire to the other extreme of heavy federal involvement and responsibility for structural measures for flood control. The current stage begins to shift some of the risks and costs of floodplain occupancy to those at risk

on the floodplains, and seeks through nonstructural regulations and floodplain management techniques to reduce the annual national toll from flood losses. Until recent no quantitative measure of the economic, social and environmental impacts of floodplain regulations was available on a national scale. Sheaffer and Roland's report, "Evaluation of the Economic, Social and Environmental Effects of Floodplain Regulations," performed under contract to the Department of Housing and Urban Development, is a first attempt to measure the effects of floodplain regulations.

The study evaluated quantitatively the economic, social and environmental effects of regulating the 100-year floodplain. Twenty-three case study communities were selected for analysis according to different locations, flood hazard types, community sizes, and economic conditions.

Effects of floodplain regulations were evaluated by projecting development for 1980 and 1990 under three regulatory scenarios: (1) no regulations, allowing the free market to determine the 100-year floodplain use; (2) moderate regulations similar to the current FIA regulations; and (3) stringent regulations forbidding new development and substantial improvements to existing structures, and "correcting" past land use decisions which interfere with natural functions of the 100-year floodplain.

Economic effects. When no regulations were applied under Scenario I, average annual flood losses increased sharply (29% by 1980; 71% by 1990). Under the moderate regulations of Scenario II, the losses in Scenario I would be decreased by 87% in 1980, and by 85% in 1990. Regulations that prevent development (Scenario III) further decreased losses, producing a small, but measureable absolute decline in average annual flood losses (1% in 1990).

Social effects. With no regulations, the total number of housing units in the 100-year floodplain would increase 13% by 1980 and 35% by 1990; population would increase in the 100-year floodplain 12% by 1980 and 29% by 1990. Using moderate regulations, the increase in housing that would result from no regulations would be reduced 37% by 1980 and 78% by 1990; the increase in population would be decreased 43% by 1980 and 41% by 1990. With stringent regulations, housing units in the 100-year floodplain would decline absolutely from the 1975 level 1% by 1980 and 6% by 1990.

Environmental effects. With no regulations there would be a continuing unlimited conversion of floodplain open land to urban uses an additional 37% by 1990. Moderate regulations would reduce that increase 36% by 1990. Stringent regulations would not allow any further development of the floodplain, would begin to remove existing development, and would result in a 2% absolute reduction of developed floodplain acreage below current levels.

Results of the study are summarized in Table 1 and Figure 1.

The study showed that moderate regulations will greatly reduce the rate of increase of flood losses, but will not produce an absolute decline of such losses from current levels. If the corrective elements of Scenario III (stringent regulations) are added to the moderate regulations, it is probable that the effects would closely approach the absolute decline resulting from stringent regulations. Such a program would allow communities to achieve their comprehensive community development goals while allowing them to reduce their flood losses.

Coastal flooding concerns. Our literature is replete with references to the growth in population in our coastal communities over the last thirty odd years. Bureau of the Census reports fully document the increased densities of population in coastal areas, while population growth rates in those areas have exceeded growth rates elsewhere in the country.

Characteristics of coastal property owners show that they tend to hold and use their properties longer than riverine owners. Coastal residents are more likely to rebuild their house on the same site if it is destroyed by flood than riverine owners. Strikingly high percentages of owners in coasal areas have not experienced coastal flooding in their present coastal homes, largely a factor of an unusually long, quiescent period in which few major coastal storms have been experienced, particularly in the Southeast.

But where major coastal storms have been experienced in the last two decades, they have contributed very significantly to the total flood losses experienced in the United States. Research performed by Sheaffer and Roland indicates that over 60% of the flood damages experienced in the United States resulted from storms greater than the 100-year storm. Analysis of these storms shows that a very high percentage of the greater than 100-year storms were coastal storms.

Hence, if we are to reduce overall flood losses in the United States, it is imperative that we address the problems inherent in a swiftly growing coastal population, especially in those narrow strands immediately adjacent to the oceans. The likelihood of removing expensive hotels, condominiums, and other large structures from the oceanfront strand is not great. But engineering measures can be taken to ensure the structural integrity of such buildings if they are battered by storms. Much can be done with single family residences, preferably through setbacks and elevation to reduce flood damages. A particular regulatory need in the National Flood Insurance Program, and more generally in state coastal management regulations, is to include wave heights in our calculations of 100-year flood levels in coastal areas, and to insist that if property owners are going to build next to the sea they must take into account the forces of flooding, scouring,

battering, and wind. Extra costs of doing so are predominantly costs of additional materials; the reduction in flood insurance premiums alone can pay for the extra costs in short order.

In addition, the benefits of relocation of coastal property owners off the floodplain should be extended as they are presently being offered in certain riverine areas. The opportunity to be made financially whole after a coastal flood disaster is inherent in the standard flood insurance policy, aided especially by the Administrator's recent interpretations of "constructive total loss" under these policies. Where structures are substantially damaged by flooding the Administrator may declare a "constructive total loss" and pay the property owner the full face value of the flood insurance policy in return for his relocation off the floodplain. Active use of this technique means that property owners may voluntarily opt to get out of harm's way, to relocate to flood-free land, and to be made financially whole. The technique has yet to be applied in a coastal context, but we have every reason to believe that it will work as well there as in a riverine context.

Over fifty years ago the Supreme Court of the United States marked the passage of the era of laissez faire, unfettered development in the United States. Recent challenges to the constitutionality of regulations under the National Flood Insurance Program have affirmed the reasonableness of the regulations within the limitations of the Fifth Amendment of the Constitution. Moreover, recent research affirms the effectiveness of floodplain regulations in reducing flood damages. If current regulations are supplemented with corrective measures we as a nation can finally start on that journey enabled by the Congress in 1936, to reduce flood losses absolute below current levels.

IMPLEMENTATION OF THE NATIONAL FLOOD INSURANCE PROGRAM: AN INVESTIGTION AND TEST CASE[1]

Marvin Waterstone

The present paper has three major purposes. First, it will delineate what appears to be a representative, though somewhat preliminary, picture of the process by which communities implement the National Flood Insurance Program (NFIP). Second, it will discuss briefly some difficulties related to empirical measures of NFIP outputs and outcomes (these terms will be differentiated below). And finally, the paper will present findings from one case study in which such empirical data were available.

The Implementation Process

The extent to which any problem-solving program is successful in meeting its intended goals is clearly dependent upon a variety of factors, but ultimately success will be determined by the effectiveness of an implementation process. This is certainly the case with the National Flood Insurance Program whose ultimate aims are to reduce overall vulnerability to flooding through insurance and wise land-use management.

The present paper will focus only on the land-use management aspect of the program, which seeks to prevent further encroachment of flood-vulnerable development into the nation's flood plains. Communities participating in the regular phase of the NFIP (which allows homeowners to purchase insurance at actuarial rates, and allows the community to retain eligibility for federal disaster assistance in the event of a flood) are required to pass an ordinance, which must be approved by the Federal Insurance Administration (FIA), to govern future development within the community's flood plain. The degree to which future, vulnerable development is reduced consequently rests on the implementation of such ordinances. The research presented here results from an examination of this implementation process as it was being pursued in several communities across the country in mid-1978.

As with many regulatory programs, it might be expected that implementation of the NFIP would be carried out through a series of formalized procedures. Indeed, such procedures are specified in the legislation as necessary components of the program. These would usually include strict monitoring and enforcement mechanisms to ensure compliance with program requirements. In fact, one recent evaluation of the NFIP[2] seriously questions the program's ability to meet its stated objectives because of a

seemingly lax view toward monitoring and enforcement. However, the nature of the local implementation process occurring in the NFIP may justify this perception of the amount of necessary monitoring and enforcement.

The process, for the most part, seems to be informal. Although institutional mechanisms (e.g., permit procedures, appeals channels, enforcement guidelines, and the like) do exist, the locus of real decision making concerning flood plain development seems to be outside of these formalized arenas. What seems to be occurring instead, is a series of negotiations between a prospective applicant (builder, developer, etc.) and the appropriate local official. These negotiations are aimed at bringing the proposed construction into compliance with city ordinances. However, most of these discussions take place well in advance of the initiation of the formal permit application process. With few exceptions, by the time a building or development plan reaches the formalized stages of the process, very little actual decision making is necessary. The negotiation phase seems to obviate the need for anything more than a somewhat mechanical review of the application.

In a very real sense, implementation of the intent of the NFIP often occurs before an institutionally formalized apparatus is brought to bear. A typical scenario of the implementation process would begin with a developer contacting someone in the local government (e.g., a planner, a zoning officer, or even a secretary in a planning department) and informing him or her of an intention to develop a certain location. In communities where flood hazard exists, a common first step taken by the local official is to check whether or not the proposed location is in the regulated portion of the flood hazard zone (i.e., either the floodway or the flood fringe area). If the property is in a regulated area, the prospective developer would be so informed and would also be apprised of the requirements which must be met in order to build on that site.

At this point one of two things generally happens. In most cases, if there is no particular pressure to build on that site (e.g., in communities with substantial amounts of developable land), the builder might opt for a location which is outside of the flood hazard area (and therefore not subject to flood-related regulation). If, however, pressure is high enough to justify the cost of compliance (which generally entails elevating or flood-proofing the structure), the builder will proceed.

This is the point at which the informal negotiation process usually begins. The builder will begin to develop more detailed plans, on which he/she will continue to consult with local officials to make sure they are in compliance with regulations (including, but not limited to, flood-related regulations). The builder will then submit such plans, along with maps, application forms, etc., to the appropriate local agency in order to obtain a

building permit. It seems quite unlikely that the outcome of this process will be unpredictable, since the foregoing steps are designed to eliminate any real decision making (in the sense of making judgments) about each application. In some instances, it is entirely possible that the predictable outcome will be negative (i.e., the permit will be denied). Often, however, this will be understood before the application is formally submitted, with the applicant intending to proceed through a formalized appeals process.

Either the permit is granted as a result of the informal process, in which case building proceeds, or it is denied and the applicant begins the appeals process. Most communities have a citizen board of appeals (board of adjustment, board of zoning appeals, or the like) which hears appeals to the application process and actually makes decisions (in the sense of not merely following through with a largely mechanical process). Generally, the decision of such a board is the final step before building or not building. Although communities often provide institutional mechanisms for proceeding further (e.g., appeal to the city council or to the courts), these seem to be employed very infrequently, if at all.

One important implication of the foregoing is that if a permit or a variance is granted and building proceeds, very little monitoring is perceived to be necessary to ensure compliance because of the high degree of on-going understanding achieved between the developers and the officials throughout the process. This is the crucial point in determining the success of the NFIP in meeting its long-term goals. If developers are cooperating during the informal process (which seems to be the case) but then building in ways which do not meet the specifications called for in the approved plans, then implementation and the land-use aspect of the program is failing. This is the issue which was explored in the case study which will be discussed below. However, a brief note on the availability of empirical outcome data is necessary before proceeding further.

Measuring NFIP Outputs and Outcomes[3]

It is essential here to distinguish between two quite different results of the NFIP implementation process. The first, process output, represents the immediate manifestations of the process, and might include: 1) information which is produced and disseminated about flood hazards and regulatory requirements; 2) plat approvals, including the flood-related conditions attached to such approvals; 3) permits which are granted or permit applications which are denied; and 4) monitoring actions, if any, to check as-built compliance. These data are usually readily available.

By contrast, the second result, process outcome, represents the actual land-use changes which occur in response to the implementation process. It is within this context that the real success of the land-use component of the NFIP must be gauged. In other

words, how much development is being directed out of flood hazard zones, or if not redirected, how much of the new development is actually being elevated or flood-proofed to reduce potential vulnerability?

The previous discussion of the nature of the implementation process indicated the perceived lack of need for monitoring the actual building process. This perception has resulted in a dearth of what might be termed "ground truth" data which would include records of actual as-built elevations, or of flood-proofing measures employed. In addition to the notion that the negotiation process largely eliminates the need for these checks, the high cost of obtaining such data further mitigates against their collection and availability. However, given the preliminary understanding of the implementation process, as described above, it seemed imperative to correlate these findings with a set of process outcomes. A community was identified which was suitable for this purpose (in the sense that "ground truth" data were available) and is discussed below.

Columbus, Mississippi - A Case Study

A study by Leo R. Cheatham[4] provided an initial indication of the successful implementation of the land-use management aspect of the NFIP in Columbus, Mississippi (whose 1970 population was 25,795). Cheatham examined changes in the rate of hazard zone development following the adoption of flood plain ordinances to comply with the requirements of the NFIP. His study showed a dramatic decrease in flood plain construction following the adoption of such an ordinance in Columbus. However, the study did not indicate whether the construction which was taking place in the flood plain was being elevated or flood-proofed.

Fortunately, elevation data were available for all properties in the Columbus flood plain,[5] and it was then a matter of checking permit files to identify properties developed after the date of the adoption of the ordinance in order to assess the adequacy of implementation.

As a first step, interviews were conducted with local officials (as in other communities in the study) to determine the nature of the implementation process in Columbus. The pattern identified was quite similar to the one which had emerged elsewhere, and consisted of the informal give-and-take between prospective developers and city building and engineering departments for the application process and a citizens' board of adjustments and appeals to accommodate objections to permit denials. Interviews indicated that developers cooperated fully with the appropriate departments and that, as elsewhere, very little monitoring was believed to be required to ensure compliance.

Columbus adopted an approved flood plain ordinance on July 13, 1976. Between that date and the date of this investigation (June, 1978) a total of nineteen building permits had been issued for properties in the regulated area. The evidence indicates that every structure has been elevated sufficiently to afford protection from the "100-year" flood. In other words, implementation has been perfect for these developments taking place in the regulated area. In conjunction with Cheatham's findings that redirection of construction out of the flood zone also seems to be occurring, it would appear that implementation in Columbus has been quite effective.

Conclusions

Several conclusions emerge from the previous discussion. The first is that the local implementation of the National Flood Insurance Program seems to take place in an informal manner. Second, that this informality has led to a somewhat casual attitude regarding monitoring and follow-up evaluation to determine compliance. But third, the nature of this informal mechanism, with its ongoing dialogue between applicants and officials, seems to be quite adequate for maintaining an effective level of implementation. In most cases, it appears that developers are not looking for ways to circumvent the requirements, and that local officials have managed to communicate the need for such regulations in a manner which effectively ensures compliance.

Of course, these findings are based on a very limited amount of empirical data and would have to be substantiated through further work. However, this preliminary indication yields at least some measure of optimism regarding the potential long-term beneficial effects of the land-use management component of the NFIP.

Notes

[1]Research carried out under National Science Foundation, Grant #ENV.77-13908; Janice R. Hutton and Dennis S. Mileti, co-principal investigators.

[2]General Accounting Office, Formidable Administrative Problems Challenge Achieving National Flood Insurance Program Objectives. Report to the Congress by the Comptroller General of the United States, April 22, 1976.

[3]This section draws, in part, from a paper prepared for the NSF Grant #ENV.77-13908 entitled, "Measurement of Output," by William B. Lord, Research Associate, LTW Associates, Boulder, Colorado.

[4]Leo R. Cheatham, An Analysis of the Effectiveness of Land Use Regulations Required for Flood Insurance Eligibility. Water Resources Research Institute, Mississippi State University, 1977.

[5]Kwang Lee and Harold Day, River Forecast Benefit Evaluation. Report to the National Weather Service, NOAA, under contract No. 6-35357. University of Wisconsin, Milwaukee, Wisconsin, April, 1979. Cited by permission.

THE NATIONAL FLOOD INSURANCE PROGRAM: A LOCAL PERSPECTIVE

Terry Keeling

The National Flood Insurance Program was created in 1968 as a purely voluntary program. As such, it was a miserable failure. It was totally rejected by the American people and by most municipalities. Most communities apparently felt the required price (the enactment and enforcement of the restrictive regulations) was simply too high.

The federal government, in typical and predictable bureaucratic fashion, decided that if the program was unacceptable on a voluntary basis, then the obvious solution was to make the program mandatory. This was done with the passage of additional legislation in 1973--legislation which imposed severe economic sanctions on communities that might choose not to participate in the National Flood Insurance Program (NFIP).

Although the federal government now contends the NFIP is a voluntary program, the facts indicate otherwise. A study of the Congressional debate concerning the 1973 legislation, as reported in the Congressional Record, indicates very plainly that it was the express interest of Congress to make the NFIP a mandatory program. Numerous HUD and FIA (Federal Insurance Administration) publications of the early and mid-1970's refer to the NFIP as a mandatory program.

In mid-1976 the Flood Insurance Litigation Coalition (FILC) was formed in a meeting in Washington, D.C. The Coalition was organized and put together largely by the Texas Landowners Rights Association, along with the city officials of Cape Girardeau, Missouri. In November 1977, 70 plaintiffs in 16 different states filed suit in U.S. District Court in Washington, D.C., challenging the constitutionality of restrictive land use provisions, the validity of punitive sanctions under the NFIP, and the federal government's authority to compel the enactment of specific state and local laws. The suit, filed by the law firm of Rhyne & Rhyne, challenged the constitutionality of the NFIP under the Fifth, Tenth and Fourteenth Amendments.

This suit is presently pending before the U.S. Court of Appeals in Washington, D.C. Oral Arguments were heard on May 3, and a decision is expected shortly. Regardless of the decision of the Appeals Court, it is anticipated this will ultimately be resolved before the U.S. Supreme Court.

Perhaps it would be appropriate to examine the reasons that would compel 70 plaintiffs (most of them being cities, counties, and school districts) to go to the tremendous effort and expense, and to incur the not insignificant risk of retribution from the federal bureaucracy, involved in suing the federal government.

An examination of these reasons and motives indicates the NFIP, for some communities at least, is not exactly the panacea the bureaucrats would have us believe.

Although not all participants in this litigation are in it for the same reasons, the reasons for this litigation fall primarily into two categories: (1) philosophical and (2) economic. Texas Landowners Rights Association, the organization of which I am president, is involved because of philosophical reasons. We are adamantly opposed to governmental land use control. The NFIP is an acknowledged federal land use control program. Through the NFIP, the federal government has seized absolute control over an estimated 15% of the land area of the United States. The "Feds" write the rules and the local governments are required to enforce them. Any program that allows a governmental entity to prohibit a private landowner from building on his own land, with his own money, a structure of his own choice (as does the NFIP) is, to us, totally unacceptable and intolerable.

Most of the school districts involved in this litigation are doing so for economic reasons. In many cases, it (the NFIP) is severely damaging their tax base. As the restrictive land use regulations are put into effect, property designated as "flood-prone" (and remember, these designations are made by the FIA, not by local officials) is severely limited in the uses to which it may be put. In many cases, the property is essentially limited to agricultural use only. It would be very naive to expect the owners of such property to continue to pay taxes based on a previous value of $1,000, $2,000, or perhaps $5,000 per acre, when the property (because of the FIA-mandated use restrictions) is now worth only $400-$500 per acre. These owners will demand (and probably get) a compensating reduction in their taxes. In cases where as much as 40%-75% of the land area within a school district has been designated as flood-prone, the effect on the tax base can be devastating.

Most cities and counties involved in this litigation have done so due to a combination of both philosophical and economic reasons. Most of them bitterly resent the federal government forcing them to enact and enforce a set of FIA-mandated restrictive ordinances. They also have the same problems with the erosion of their tax base as do the school districts. In addition, they are faced with the cost of enforcing the program, which in some cases is a very significant cost. Another factor of concern to many local officials is their potential liability with regard to inverse condemnation suits that may be filed by owners of property adversely affected by the restrictive land use regulations required by the NFIP. Although the FIA dictates the content and form of the regulations and mandates their passage, the local municipality must actually adopt and enforce the regulations. Therefore, there has been considerable speculation that the local municipali-

ties may share potential liability, along with the federal government, on the inverse condemnation question.

One of the more interesting aspects of the NFIP has been the cost-benefit question. The NFIP contends, of course, that the NFIP is a more economical system of addressing the flood damage situation than is the disaster relief program. This is certainly open to debate. Most disaster relief has traditionally been in the form of low interest loans. Although admittedly the interest rate is subsidized, these are loans that are supposed to be repaid. The NFIP, on the other hand, is far from being a self-supporting program. The insurance premiums paid by homeowners cover only approximately 10% of the actual cost. The remaining 90% is subsidized by the federal government. To get a true picture of the cost-benefit question, however, we must consider the cost to the local municipality. Many municipalities contend the cost of complying with the regulations far exceeds all the flood damage they have ever received in their entire history. To further demonstrate this point, following are summaries of the complaints several of our plaintiffs filed in our litigation.

Co-Plaintiff: City of Carlsbad, New Mexico

The City of Carlsbad will suffer an economic loss of $100,000,000 by the refusal of the Federal Insurance Administration to amend the Flood Boundary and Floodway Map for the city.

Carlsbad is entering into a period of economic growth, with millions of dollars invested in the business and residential areas by the Department of Housing and Urban Development, the Bureau of Outdoor Recreation, the Bureau of Reclamation, the Small Business Administration and other agencies. Most of Carlsbad's business district and the most attractive residential areas lie within the proposed 100-year flood hazard elevations.

Records are available on previous floods in the Carlsbad area since 1891 and the proposed 100-year flood hazard boundaries greatly exceed any flooding on record. The Soil Conversation Service has completed several flood control projects around Carlsbad since 1966. There has been channelization in Dark Canyon, further decreasing the possibility of flooding in the south part of the city. Work has begun toward construction of Brantly Dam above Carlsbad, which should eliminate the possibility of flooding.

The request by the city for postponement of enacting ordinances enforcing the proposed 100-year flood hazard boundaries until Brantly Dam is completed and a new study made to determine the smaller flood hazard area was denied. The economic impact statement prepared for the city stated the $100,000,000 cost does not take into account the inestimable future economic costs and all of the fiscal costs which the impending sprawl situation will create nor the additional engineering and construction costs for the substantial number of projects in the flood plain expected in the next three to five years.

Co-Plaintiff: City of Breckenridge, Texas

Breckenridge, Texas, is participating in the emergency phase of the NFIP and has enacted ordinances to comply with program regulations. The cost to the city of administering and enforcing the codes and ordinances required by the NFIP is estimated to be $3,000 per year.

Property in Breckenridge which has been included in the federally-designated flood hazard area has lost value. If the city is forced to lower tax assessments based on the reduction in value, it will lose an estimated $100,000 per year in tax revenue. This loss will drastically impair the city's ability to function as a local government.

Co-Plaintiff: City of Katy, Texas

Katy, Texas (5,000), is participating in the regular phase of the NFIP and has enacted ordinances to comply with program regulations.

The cost to the city of administering and enforcing the requirements of the NFIP is estimated to be $2,000 per year.

Because of the restrictive requirements of the NFIP, property in Katy which has been included in the federally-designated flood hazard area has lost value. If the city is forced to lower tax assessments based on the reduction in value, it will lose approximately $12,520 per year in tax revenue. This will severely impair the city's ability to function as a local government.

The economic development of Katy has been stalled because of the imposition of the NFIP. High costs of construction to be in compliance with program regulations have prevented much-needed residential development, and industry has failed to locate in the city as anticipated.

Co-Plaintiff: Russel, Kansas

Russell, Kansas (5,371), has been identified by defendants as having flood hazard areas, although in more than 100 years of recorded history, the city has experienced no flooding.

On two separate occasions, Flood Hazard Boundary maps were sent to the community, which is not participating in NFIP and has enacted no ordinances to comply with regulations. The city has been placed under economic sanctions of the Flood Disaster Protection Act of 1973 imposed on communities which do not participate.

The city was compelled to hire private engineering firms to produce technical evidence rebutting defendant's identification of flood hazard areas.

Despite the fact that the city fulfilled requirements for appeal, defendants have not attempted to resolve the appeal nor has the community had any opportunity for an administrative hearing.

As a result, property included in federally-designated flood hazard areas has diminished in value by approximately 25%. Anticipated loss of revenue caused by required reassessment will severely impair the city's ability to function.

If the city is forced to join NFIP, expenses of at least $7,250 per year will be required to administer federally-mandated ordinances.

Co-Plaintiff: Wyckoff, New Jersey

Wyckoff, New Jersey (16,500), is participating in the regular phase of the NFIP and has enacted ordinances to comply with program regulations.

Because of costly requirements, the township has incurred expenses in implementing, administering and enforcing program regulations. Additionally, the township incurred expenses in appealing the "inaccurate and imprecise" map issued by defendants.

The "onerous and restrictive" requirements of the NFIP will cause property values in Wyckoff to diminish, necessitating a reassessment for tax purposes. Such a reassessment will result in a loss of approximately $220,600 per year in revenue. To avoid this loss to its operating budget, the township will be forced to increase the tax burden on those citizens whose property does not lie within the federally-designated flood hazard area.

Co-Plaintiff: Brazoria County, Texas

Brazoria County is participating in the regular phase of the NFIP and has enacted ordinances to comply with program regulations.

The economic development of the county has been severely impaired by the imposition of the NFIP. Increased construction costs to be in compliance with program regulations have prevented residential and commercial development, with a loss of potential revenue to the county.

The designations of flood hazard areas in the county is based on inaccurate, erroneous and obsolete data, resulting in inequitable enforcement of flood plain regulations within the county and the placement of unfair economic burdens on those owning property within the federally-designated flood hazard areas.

Co-Plaintiff: Sunburst, Montana

Sunburst, Montana, received a flood hazard boundary map designating flood hazard areas. It will not participate in NFIP and has enacted no ordinances to comply with program regulations. It is under sanctions imposed on communities which do not participate.

All land located within the flood hazard area is owned by Toole County as a result of landowner tax defaults.

Because of the town's failure to qualify for NFIP and enactment of ordinances, the county was threatened by the federal government with loss of its eligibility for federal surplus property.

Town of Sunburst was coerced to enact ordinances to qualify for the program although there was no potential benefit to the town.

Co-Plaintiff: City of Cape Girardeau, Missouri

The City of Cape Girardeau, Missouri (25,000), first entered the NFIP on December 23, 1971, but was suspended on December 31, 1971, when the city council refused to pass ordinances and resolutions specifically required by the FIA.

The City Council on April 3, 1974, passed the required resolutions and re-entered the program's emergency phase effective May 14, 1974.

On May 3, 1974, the city was sent its Flood Hazard Boundary Map (FHBM) and was informed that there is no appeal from the flood hazard designation even though the city disagrees with the FHBM's findings and its special flood hazard area designations.

Because of NFIP's burdensome requirements, the city must administer and enforce the defendants' federally-mandated ordinances, incurring expenses of at least $37,981 for the first year, with a minimum annual recurring cost of $9,981 thereafter.

The city's property tax revenue will be greatly diminished because of a loss of property value which will require property reassessments. A partial assessment of only two blocks of property within the Special Flood Hazard Area shows an immediate tax revenue loss of $12,848.45 per year on this property.

The city will experience a loss of its city sales tax revenue which produces 40% to 50% of general purpose revenue for the city.

Since the Special Flood Hazard Area designated is largely the city's prime commercial area, the city's growth in this area is effectively prohibited and commercial activity will decline with a tax loss of $116,000 to $136,000 per year in future revenue.

Because of the requirements, Riverside Home Builders, which was developing a subdivision within the flood hazard area, was forced to expend more than $52,420 to fill 25 acres of land to the federally-dictated 100-year flood plain level in order to receive bank financing for development, even though lenders in the area would have been willing to finance the project were it not for the flood insurance program. The land in question has never been flooded.

The developer's alternative to these expenses was retention of 25 acres of unsaleable land for which no federally-regulated financial assistance to purchasers could be obtained.

Because of burdensome requirements, construction costs within the city's flood hazard area will increase 35%. Some construction items required by federally-mandated regulations are unavailable in the city or its vicinity and would have to be specially made at additional cost.

The requirements of the NFIP will diminish property values for undeveloped real estate in Cape Girardeau's flood hazard area approximately 95% to a $1,000 an acre agricultural use value.

Developed real estate will lose up to 75% of its value. The program provides no federal compensation to these landowners.

The city has been warned by landowners that if it does not withdraw from the NFIP before more stringent building and zoning regulations become effective, the city will have made their lands worthless and will be expected to purchase the land or face suit for the diminished value.

In view of the horrible experiences many municipalities have had with the NFIP, it would appear a prudent local official might wish to examine very carefully the various options available to the community with respect to the NFIP. Some might wish (as a few have already done) to "bite the bullet," stay out of the program and accept the severe economic sanctions. The county in which I live (Fort Bend County, Texas) has chosen this option. In the approximately 40% of our county that has been declared flood-prone, we are denied FHA Loans, VA loans, SBA loans, federal grants, etc. Yet the federal government continues to collect taxes from us and spend it in other communities. Our tax money has been used, for example, to provide disaster relief for the victims of the winter blizzards in the Northeast and Midwest, the victims of the brush fires in California, and the victims of tornadoes in several states. Yet, if our county were to experience a flood, we would be denied this same disaster assistance.

If we are successful in our litigation, we would essentially return the NFIP to its pre-1973 voluntary status by eliminating the punitive economic sanctions. Each community could then freely choose whether or not it wishes to participate in the NFIP. That does not seem to be too much to ask.

NEW DIRECTIONS OF THE NATIONAL FLOOD INSURANCE PROGRAM

Laurence Zensinger

Although the National Flood Insurance Program (NFIP) has only been in existence since 1968, and has only experienced real growth in community participation and insurance coverage since 1973, it has reached a critical stage in its development. At present the program has provided, or is in the process of providing, detailed flood insurance studies (FIS) and flood insurance rate maps (FIRMs) for close to 10,000 communities across the country. Even though the NFIP has identified close to 20,000 flood prone communities, this first 10,000 represents coverage of what will be a great majority of the population at risk in the U.S. according to our projections.

The mapping program in coastal communities is rapidly approaching 100% coverage. For example, of the 188 communities we have identified with jurisdiction over barrier islands, 130 are participating in the regular flood insurance program as of this date. Of the remaining 58, 36 have studies ongoing and 14 are scheduled for study in Fiscal Year 1979. After Fiscal Year 1979, there will be only six communities with barrier islands remaining to be studied. The statistics for all coastal communities indicate a corresponding proportion of study coverage.

The 10,000 communities remaining nationwide that have not been studied in detail and that are not currently under study are generally small with limited flood prone area and limited existing or potential for development at risk. Most of these communities will not require a detailed Flood Insurance Study because of this low level of activity in the flood plain. These communities will be placed in a group for either conversion to the regular flood insurance program, making them eligible for the higher limits of insurance coverage, or withdrawal from the program completely, depending upon local desires.

As a result of having achieved this stage in the Flood Insurance Program, the Agency will be able to redirect the considerable resources it has historically devoted to the flood plain mapping effort—redirect them toward activities which can potentially provide a much higher dividend in hazard mitigation.

This redirection effort is currently underway. As the study effort diminishes, staff are being redistributed to regional offices. At the same time the role of our regional office staff is evolving from one of assisting communities to adopt preventive measures in the form of flood plain management ordinances to a role of assisting communities in

identifying and implementing corrective measures which will focus on the difficult and expensive problem of undoing past mistakes.

An explanation of the terms "preventive" and "corrective" as they relate to our perception of flood plain management is appropriate at this point. At present there are over 16,000 communities participating in the National Flood Insurance Program. Of this number over 4,000 have regulations in effect which require construction of the first floor of structures, including basement, above the Base or 100-year flood elevation. In coastal communities, with designated "Velocity Zones," regulations also require prohibition of mobile homes and use of fill for elevation. Further, in coastal areas alteration of sand dunes and mangrove stands is prohibited where this would contribute to increased potential for flood damage. While there have been some problems in implementing these requirements, they have been generally quite effective in promoting measures which will prevent future flood damages. While quantitative evidence is still scarce, there are many examples in communities flooded recently of structures which were not damaged because they were elevated above flood levels as a result of the NFIP. As some researchers have found, these measures have also helped to prevent some development from occurring in the flood plain. Preventive measures, however, which regulate new construction in areas subject to the 100-year flood, or which may have an uncertain impact on discouraging development, ignore the development that already exists at risk in the nation's flood plains. A recent study prepared for the NFIP indicates that under our present regulatory approach flood losses will actually increase 10 percent by the year 1990, largely because of the large number of unprotected structures already in the flood plain which will continue to sustain losses. One way that the nation can move in the direction of the Congressional-prescribed goal to reduce flood losses is to take corrective actions to remove structures form the flood plain, where economically justified, and relocate the occupants in safe and sound housing elsewhere in the community. For the National Flood Insurance Program staff, corrective action will consist of providing technical assistance to communities and focusing on the alternatives that may be available locally for protection and restoration of the flood pain. We will also help communities to identify and obtain the local, state and federal resources available for relocation for other activities.

Our efforts to promote hazard mitigation and alternatives to construction (and reconstruction after flood disasters) in the flood plain are part of a larger national effort to reduce costs and explore less costly alternatives to construction of major flood control works as part of evolving national water policy. Some of these efforts involve the creation of a new single federal agency responsible for the federal response to disasters,

the Federal Emergency Management Agency (FEMA). FEMA, as it will be known by acronym, will combine the flood insurance program with civil defense, FDAA and the U.S. Fire Administration, among others, and include the Federal Insurance Administration (FIA). This federal commitment to hazard mitigation is being complemented by a comprehensive re-evaluation of the potentials of non-structural water resources projects, particularly as they relate to flood damage reduction. Another effort underway, as a result of a presidential executive order, is an interagency evaluation of federal programs and policies as they relate to barrier islands under the direction of the Department of the Interior. Specific recommendations from this work group are expected to impact the NFIP as well as many other federal programs.

There are a number of projects underway within the NFIP in connection with hazard mitigation and non-structural flood plain management in the spirit of these federal initiatives which also may help to change the face of the program.

A few of these programs include:

Section 1362 Feasibility Study

One of our most promising tools for reducing future flood loss potential involves use of the NFIP's own authority for acquisition of structures in the flood plain. Under Section 1362 of the Flood Insurance Act of 1968, as amended, the Administrator has the authority to negotiate for the acquisition of flood damaged structures. Structures must be damaged "substantially beyond repair" or three times in five years with each loss amounting to at least 25 percent of the market value of the structure. In addition, the structure must be covered by a flood insurance policy and the owner must be willing to sell--condemnation is not authorized. Land, once acquired, is to be deeded to a local or state government for use in perpetuity for some low damage potential activity such as recreation or open space. The program has never been funded. HUD's Office of Policy Development and Research is currently funding a research project designed to determine the local acceptability, environmental, social, and economic impact, and the extent of net economic benefits that would accrue to the government in terms of reduced flood insurance subsidies and disaster relief payments. As part of this research project, the contractors have performed a detailed hypothetical case study of how the 1362 program would have worked in Panama City Beach, Florida following Hurricane Eloise in 1975. In addition, FIA staff took a more informal look at how 1362 might have worked in New England following the coastal storm of February, 1978. Tentative conclusions drawn from this work in coastal regions have important implications for hurricane hazard mitigation. First, as can be expected, acquisition in coastal areas probably will be strongly resisted by homeowners, especially since their coastal home is often not a primary residence, and the cost of the structure is

sometimes only a fraction of the investment in the site. In cases where an owner of a residential or commercial property may be willing to sell, it may be only to get out from under unfavorable mortgage conditions resulting from a previous Small Business Administration (SBA) disaster loan. In these cases, the proceeds from the sale can be expected to be readily re-invested in a new coastal location. Even when acquisition funds become available, it will take a strong commitment by local and state governments to prohibit reconstruction in the coastal flood plain after a massive storm for 1362 to become effective. Unless the commitment is made before the storms occur and is manifested in a disaster mitigation and recovery plan, the homes probably will be rebuilt while everyone is trying to figure out what to do. Other problems of the program as currently conceived include the potential for creating a patchwork acquisition pattern because of the eligibility criteria and voluntary aspect.

Wave Height

Another issue which is being discussed widely by coastal managers knowledgeable of the NFIP is the effect of wave height in storm damage. At present, FIA's coastal Flood Insurance Rate Studies delineate areas of inundation by the 100-year flood and areas of high velocity waters, but the 100-year flood elevation is based upon still water elevations. Depending upon a variety of factors, wave heights can add to 100-year elevations by a factor of 1.5 or more. As a result, we have seen areas shown as C zones (zones with very little or no flood hazard) battered spectacularly by crashing waves. By ignoring the effect of wave heights, critics argue, FIA is underestimating the degree of hazard in coastal locations, thereby contributing to greater coastal development. To address this concern, FIA is sponsoring two studies related to wave heights. The first of these is designed to develop a sound, defensible methodology for predicting wave heights of the 100-year storm surge in a given coastal location. The second is designed to determine the costs and benefits of adding wave heights to our coastal methodology. We are interested in finding out whether the costs involved in additional elevation of a structure, or lost opportunities for development, will be outweighed by the benefits to be derived from reduced flood damages. At the conclusion of this cost-benefit study, FIA will consider what modifications, if any, are necessary in the NFIP's minimum land use criteria for coastal communities. In the meantime, wave heights are being shown on some new coastal flood insurance studies for advisory purposes only.

Coastal Construction Manual

Under contract FIA is preparing a manual to provide guidance to coastal communities and builders in storm-resistant construction techniques. This manual is intended to fill an important need in an area where practices vary widely and very little exists for the

builder or local building inspector to use assuring that construction is as damage-resistant as it could be.

As an outgrowth of this project, FIA will be developing detailed standards for tsunami resistant construction for use primarily in Hawaii and possibly on the west coast. These standards will be sensitive to the differences, currently not reflected in NFIP regulations, between coastal hurricane flooding and tsunamis.

NOTES ON FLOOD INSURANCE DISCUSSION SESSION

Jerome Degen served as moderator of the discussion session on the National Florida Insurance Program. Panel members included Raymond Burby, Lawrence Zensinger, Marvin Waterstone, Terry Keeling, and Crane Miller.

The session began with a brief summary by the moderator of the presentations made by the panel members at the earlier session on flood insurance. Mr. Degen also briefly described his own current research project for the Federal Emergency Management Agency to develop and test improved methods for performing flood insurance studies and re-studies.

The participants in the session expressed very divergent views of the impacts of the National Flood Insurance Program. Keith Ozmore, Administrative Assistant to Congressman Bob Eckhart of Texas, expressed strong disagreement with Mr. Keeling's viewpoint as stated in the earlier session. He stated that Mr. Eckhart's constituency opposed provision of disaster assistance to anyone who unwisely builds in a flood hazard area. He strongly encouraged land use regulations in the flood prone areas. Mr. Keeling replied that "developers" will seek other sites when their analysis indicates that a development is an unsound investment. However, homeowners already in the flood area do not have that option. Mr. Keeling expressed objections to flood insurance regulations on the assertion that they decrease property values while increasing construction costs.

A building official from a county which has participated in the National Flood Insurance Program for five years disagreed with Mr. Keeling's analysis. He stated that his county has complied with the land use regulations and that land values have indeed risen rather than dropped. He desires more, not less, federal assistance in his county, where seventy-five percent of the land areas is in coastal and riverine floodplains.

A local representative from Texas raised a question regarding the granting of "variances" by local officials. He was also concerned about personal liability of local officials resulting from decisions about compliance with flood insurance requirements.

Larry Zensinger responded that no fixed degree or number of variances is specified as permissible under the program. A judgement must be made regarding the hardship which would be created by the denial of a variance. The federal agency takes a dim view of a community's track record which indicates intent to circumvent flood insurance regulations. Glen Woodard from the Region IV flood insurance office stated that his region takes the stronger view that no variances are really justified. Crane Miller cited

two communities where structures had been elevated in compliance with flood insurance regulations. In those cases, savings and loan institutions would not grant mortgages in areas behind a sea wall until the communities had entered the flood insurance program and until compliance with regulations was assured.

Terry Keeling responded to the personal liability question. He believes that local officials do face a liability problem and that the "inverse condemnation" concept will ultimately be applied to local governments as well as to the federal sector.

A question was raised regarding the relationship between the dollar value of insurance claims and the premium dollars paid. Larry Zensinger responded that currently fifty to sixty percent of claims paid to residents in the regular program are paid from premiums with the balance being a federal subsidy. In the emergency program only about ten percent of claims are paid by premiums, with ninety percent being paid by the federal subsidy.

Raymond Burby asked about the relative accuracies of riverine and coastal mapping. Mr. Degen stated that accuracies vary widely from the best available maps (enlarged quadrangle maps to somewhat outdated but more detailed topographic mapping) to currently obtained two to five food contour interval topography with buildings, streets, elevations and good flood hazard delineations. Crane Miller indicated that riverine mapping is more accurate than coastal mapping, which is only accurate within a two-foot margin of error.

LAND USE AND GROWTH MANAGEMENT

LAND USE AND GROWTH MANAGEMENT CONTROLS

Daniel W. O'Connell

Introduction

I have been asked to address innovative growth management techniques available to state and local governments, and particularly comments about what is potentially politically possible, i.e., the political problems and difficulties with adopting techniques. What kinds of arguments might be effectively mustered to deal with politicians, from local governments to Cabinet members? Has the political process associated with Chapter 161 weakened its effectiveness? (Is this a leading question?)

This means I should comment on three things:

1) Techniques
2) Political limiations on adoption and use of techniques
3) New arguments that will work to overcome or alleviate the political constraints.

Techniques

Toffler and other analysts of society tell us that knowledge has expanded beyond our human capacity to absorb it, and others tell us technology has far surpassed our ability to understand or properly use it. A recent Atlanta Constitution-Journal article points out how people don't change, even in the face of known or predictable harm to life and property in the coastal zone.

> . . .The problem is not only the number but the nature of people. . .People just don't respect the devastation that can occur in a major hurricane. . .Up until the time the damn things hit they're not interested. They could care less. . .Once it hits, they scream like wounded apes. . . .Six months later they're telling stories about what a great storm it was. . . .Another major worry for the officials is complacency among people who have been on the fringes of a hurricane and think they know what they're in for. . . .They say "I have survived;" but they really didn't experience the full wrath of the storm.'

This wrecks havoc on the idea that we can expect a few more disasters to wake up coastal residents to better land use practices.

Growth management techniques have expanded both in number and sophistication. They exceed the capabilities or unfortunately the interest of many local communities. Thank goodness for exceptions like Porter Goss and the Sanibel Land Management Programs.

Several years ago, a book was published entitled, I'm O.K., You're O.K. It started out with a story about an old farmer who was tinkering around with his rusty harrow on a country road. He was interrupted by an earnest young man from the university extension service who was making farm-to-farm calls to sell a New Manual on Soil Conservation and New Farming Techniques. After a polite polished speech, the young man asked the farmer if he would like to buy this new book. The old farmer slowly, but surely, worked up an answer. He said, "Son, I don't farm half as good as I know how already."

That's the case with many local governments and local communities. They aren't doing half as "good" as they know how already. The knowledge and techniques are there:

1. A Model Shoreline Vegetation Ordinance for Counties and/or Municipalities in Florida, University of Miami Ocean Law Program, February, 1974.

2. Development of County and Local Ordinances Designed to Protect the Public Interest in Florida Coastal Beaches by Frank Maloney, et al., July 1977, University of Florida.

3. "The National Flood Insurance Program--A Model Ordinance for Implementation of Its Land Management Criteria," by Maloney and Dambly, Natural Resources Journal, July 1976, pp. 665-736.

4. Federal Insurance Administration set of the Guide for Ordinance Development to assist community officials in preparing flood plain management measures under the Federal Programs Minimum Standards, June 1978.

I have a ton of material on growth management techniques; unfortunatlely, this continues to be an example of supply exceeding demand. Florida, in general, seems to follow the rule of going half as "good" as it knows how already. There are three huge volumes entitled, Compilation of Laws Relating to Florida Coastal Zone Management (June 1976) by the University of Florida Center for Government Responsibility which itemized all the federal, state, and local laws on coastal zone management in Florida: 1) chapter 161, Coastal Setback, 2) chapter 380, 3) the Local Government Planning Act of 1975 which requires all local governments in the coastal zone to have a coastal protection element in their local comprehensive plans (163.3177 (6) G), etc. New evolutions of Florida Environmental Law are also coming from this session of the Florida Legislature, with the exception of coastal zone management. Speaker Brown sent me a note early in April that "We will work a plan for coastal zone based on last year's law." My concerns are with loopholes in current law, e.g., ch. 380, ch. 163. But even with these problems, there are lots of techniques, and many are on the books of Florida.

This leads up to the question someone asked one of the employees at the Three Mile Island nuclear plant about whether or not he thought nuclear power plants were safe and workable. To which he responded, "In theory, yes--but not in practice." This leads us from techniques to political limitations, from theory to practice.

Political Limitations

Laws dealing with coastal zone management such as the National Flood Insurance Act, Florida's Coastal Setback Law, aquatic preserve laws, etc. are effective techniques, if they are implemented and enforced, practicing what our laws preach, or the old saying, "To plan is human, to implement--divine."

In April, we learned of a couple of after-the-fact variances in the Coastal Setback Line in northwest Florida. State officials allegedly drafted applications with inaccurate engineering drawings and presented them to the cabinet for approval. Sanibel Island had to sue a developer to move his project back behind the setback line.

I only have two comments on this. First, any effective program must have an active and ongoing citizens' coastal watch at the local level. The Conservation News of May 1, 1979, had an article entitled "Coastal Vigilantes" describing "The Coastwatchers," a group of Racine County, Wisconsin citizen volunteers who took the problem of shoreline erosion into their own hands. The group makes daily or weekly inspections at 13 stations along the county's 10-mile Lake Michigan coastline.

Second, I agree with political scientist David Morell, of Princeton.

> The Act does not specify that politics must be considered in choosing a form of control, but practically the choice will not be made until state legislators have weighed the political considerations of each course of action. For a coastal zone management plan to be effective, it must be politically acceptable as well as technically competent; any plan that cannot take the 'political heat' is almost assured of defeat, decline, or impotency.
>
> The presence of large cities is one striking political characteristic of an urban coastal zone, and many of these cities wield a great deal of political influence at the state and even the national levels. . .Large, politically powerful cities will be most resistant of all to renewed state authority and will be able to place their political muscle where their interest lie, defeating state legislation which would diminish their power to make land use decisions in the urban coastal zone. Legislation needs to be devised to accommodate this political reality, placing predominantly local decisions within a broader framework of urban coastal planning and providing a variety of incentives to induce city-state cooperation in improving urban coastal areas. Most states

probably will have a primarily advisory role in these areas, rather than exercising final review over city decisions with authority to override them.

Florida's unsuccessful attempt at a state coastal zone management program provides proof on this point. California's Progress Report (June/August 1978, Institute of Government Studies Public Affairs Report) describes how California's program is being forced to accommodate local interests more and more.

New Arguments

First, don't overlook case law in preparing your offense or defense of the coastal zone, i.e., 1) the Prescriptive Easement Doctrine of the City of Daytona Beach v. Tona-Rama,Inc. 294 So2d 73; 2) The Public Nuisance Doctrine in Gardner v. Sailboat Key, Inc. and the hearing officer's order in the southwest Florida D.R.I. case; 3) Ocean Hotels, J. Knott Cir.Ct. case on Mean High Water (The Winter and Most Landward Mean High Water Line.); and 4) Liability of Public Officials for Violations of Property Rights s. 1983 and avoidable disasters (New Orleans, La. Permit Case).

Second, don't forget The Local Act process; i.e., Hillsborough County "Little ELMS" Bill, recent Gasparilla Island Bill limiting growth and charter amendments, Boca Raton and New Smyrna Beach; in other words, don't wait on the state or the feds. Also, don't overlook using the Local Government Comprehensive Planning Act Coastal Zone Management Element (National Resources Defense Council, California Review of Local Coastal Zone Management Programs).

Third, there is no substitute for aggressive citizen participation to keep the process from deteriorating over time. Remember the definition of a statesman: a politician held up straight and tall by equal pressures from all sides.

Fourth, law has been overused as much as abused in our society. We need to go back and use our other institutions, social, religious, educational, professional to raise the standards of political, moral, and professional conduct in our society. This includes our management of our natural resources, i.e., Birmingham AIA chapter "Purple Onion" awards to bad architectural pieces. In other words, don't work exclusively with government agencies. Let's start working also with the private sectors.

SUMMARY OF DISCUSSION FOLLOWING PAPERS ON LAND USE AND GROWTH MANAGEMENT

The panel interaction with the audience underscored the need for responsive and responsible planning and plan implementation at the state and local levels of government, in order to avoid or reduce the damages which would result from hurricanes and coastal storms. While recognizing this need, perhaps the biggest problem raised was a reluctance by state and local government officials to become involved in such a controversial subject. The major aspects of the controversy included 1) the respective roles of state, local and federal governments in land use planning, 2) the acceptability of planning and land use controls in the political arena, and 3) the legal issues associated with "taking" and "liability" associated with governmental land use controls and permitting.

Many of those present underscored the need to provide strong incentives to get state and local governments to act and to address the controversial subject of land use and growth mitigation and controls. Several potential incentives were discussed. It was generally concluded that direct grants for planning are not a sufficient incentive. Potential incentives included:

a) The predictability of actions. A plan will allow governments as well as landowners and developers to invest with some certainty of the future and with the knowledge that their investments will be protected. That is, planning lends some predictability to potential investors.

b) Delegation of authority. One potential for state or local governments which developed responsible plans would be to delegate increased amount of authority or permitting to that unit of government from the next higher level of government, i.e., if local governments developed sound and responsible plans, then state agencies might delegate to them certain permitting functions. Similarly, those states which developed sound plans and growth mitigation techniques would receive delegation of federal agency permitting responsibilities. This delegation would require a strong monitoring and evaluation for future compliance.

c) Consistency with plans. Planning would be more attractive if it were insured that responsibly developed plans would provide a means to govern the actions of the next higher units of government. This is similar to the federal consistency aspects of the Federal Coastal Zone Management Act, which

provides in simple terms that states with approved programs (that is, programs meeting federal requirements) will be able to require that federal agency actions be consistent with their programs. Similarly, Oregon law requires that once local governments develop sound land use plans which meet state standards, then state agency actions must be consistent with those plans. This is attractive in that it provides increased control over controversial actions frequently beyond the control of lower levels of government.

d) Disaster insurance rates could be structured so as to reward those who take the unpopular steps involved in sound land use and growth mitigation techniques. The same might be applied to recurrent federal disaster-assistance payments.

In all cases, it was emphasized that greater attention should be paid to developing positive incentives rather than negative or punitive incentives.

The problem of shifting responsibilities was also discussed. Many attendees commented that it was difficult to get one layer of government to be responsive and responsible, i.e., to take the heat for tough decisions, if other units of government would not back them up, or even worse, would play on the unpopularity of the decisions. Different aspects of this same issue were raised by two panelists, for example. In California, the California Coastal Commission currently has about 600 suits pending against it. It has developed a reputation for making tough decisions. As a result, lower units of government have avoided the political difficulties of making those decisions by simply granting permits and forwarding them to the Coastal Commission, which they know will deny them. The reverse is true in Florida where the responsible state agency has never denied a variance request to the state's coastal setback law. The pressure is then put on local governments to deny that request, and it is increasingly unpopular politically and financially for local governments to take the heat when the state won't back them. In either event, it places one unit of government or one agency in the position of accepting all legal challenge and the expenses thereof from unpopular decisions. The whipsaw effect of special interests playing one interest off against another is used by developers to focus attention and financial costs upon responsible agencies, requiring them to defend their actions.

There were frequent comments that coastal zone management programs would provide a sound base for the necessary land use and growth mitigation techniques. Such programs cannot only address the specific land use issues, but can also gain control over the expenditures of public funds which might tend to promote inappropriate development in particularly hazardous areas. It was also observed that when relying upon planning as a

means for reducing damage, greater effort must be paid to the substance of specific plans. There is a tendency by many units of government that develop such plans to couch the plans in meaningless, non-specific language which will not hold up during actual implementation.

The issue of potential liability for governmental actions was discussed at length. Two aspects of increasing liability were raised. One, there appear to be concerted efforts to make local government officials, including members of voluntary planning boards, individually and severably liable for losses associated with planning decisions. This makes it extremely difficult to get good volunteers for planning boards when they know they may be compelled to defend their actions in expensive litigation. A second liability trend, however, was to hold local government officials who grant permits in hazardous areas liable for negligence in their actions. If this trend develops, it might serve as an incentive to local government officials to develop sound land use plans and growth management mitigation techniques and to apply these based on scientific data and with application to specific resources.

The taking issue is a very real problem associated with land use controls and growth mitigation techniques. The "reasonable use" test was underscored as one means to avoid a taking. Another suggestion was that permits for development could be granted but subject to tough performance standards. Finally, it was suggested that all units of government responsible for making such decisions take precautions against liability, including checking their own coverage and extent of liability. It was also suggested that in areas where it was truly critical to prevent development and a taking might occur, it would perhaps be simplest to acquire the land.

Finally, two last comments were made. The first was that land use controls and growth mitigation techniques require strong public support, and as a result, require education efforts so that the public will understand and support them. Secondly, some units of government complained that state agencies and federal agencies actually worked against sound land use and growth mitigation techniques through their disaster relief and financial policies. Thus, the present system tends to award the failures--those who plan poorly or fail to adequately develop—by bailing them out with disaster relief payments when disaster strikes.

COASTAL CONSTRUCTION

THE EFFECT ON BUILDING COSTS DUE TO IMPROVED WIND RESISTANT STANDARDS

William G. Lesso

Introduction

During the 65th Legislature of the State of Texas, a bill was introduced in the House and Senate that would amend the Catastrophe Property Insurance Pool Act (CATPOOL) as follows. The amendment would require the use of a new building standard in the Texas Gulf area that would make the building more hurricane resistant. In addition, the insurance rates used in the CATPOOL area would be based on building structured strength and exposure.

In support of this legislation, a series of studies were conducted under the auspicies of the Texas Coastal and Marine Council. These included the development of the Model Building Standards (6), estimating the increased building costs (2,7), estimating the reduced damage effects of the new building standards (1,3,5) and estimating the effect on insurance rates (4).

Model Minimum Hurricane Resistant Building Standards (6)

The model building standards were drafted with the help of a task force of experts in the field. Various coastal zones were defined and various degrees of hazards for each zone were defined. A secondary result of this part of the study was the development of hazard maps, especially with regard to surge flooding.

The standard includes procedures for computing inland flooding. The building standard includes an inspection check list for various parts of the construction along with specific design parameters. The section on wave and scour action discusses the design standards for bulkheads, seawalls, piers, docks, groins, setters, breakwaters, and boat-houses. The section on battering includes the effect of debris while the flooding section addresses itself to flood-proofing spaces. Specific standards are given for slabs, columns, membranes and other plastic materials, seams, joints, pipes, etc., and pile foundations. The final section covers various classes of materials; heating, air conditioning and ventilation systems; hot water, electric and plumbing systems. A separate chapter of the standard is devoted to wind loading for maximum design wind velocities up to 140 mph, taking into acount the shape parameters of the structure.

Construction Cost Estimation (2)

Based on the model building standards, Hix, with the aid of some general construction contractors, estimated the cost of meeting these standards. Five types of structures were considered:

a) 1500 sq. ft. beach house on slab, built of concrete blocks

b) 1500 sq. ft. beach house on stilts, frame construction

c) 3000 sq. ft. "deluxe" house

d) small condominum - 3 floors, multiple units

e) 10 floor high-rise building

Three cases for each type structure were considered:

1. Construction to meet minimal requirements (60 mph)
2. Construction to meet Southern Standard Code (105 mph)
3. Construction to meet Modified Southern Standard Code (140 mph)

With this as the basic scheme of analysis, various design factors were considered to increase the strength of the structures. These included: building on block, piles, hurricane clips, straps, anchors, exterior wall sheathing, glass, roof sheathing and roofing. An unusual design feature for the 3000 sq. ft. home that was considered was collapsible walls for the lower portion of the structure to accommodate flood surges. The cost summary is shown in Table 1. The overall result is a 3-8% increase in structural cost and a 1-3% overall finished cost of the structure.

TABLE 1
COST SUMMARY

The first column shows estimated increase in cost required to satisfy the flood insurance program. The second and third columns show increases in estimated costs over the basic building to meet specified code (does not include costs covered under Flood Insurance). These figures do not include an estimated cost for inspection and administration of code.

Category	Flood Insurance	Standard Code	Standard Code as Modified
1500 SF Concrete block	(fill required to elev. 12"+)	0 - 1%	2%
1500 SF frame beach house	5 - 13%	0 - 3%	1 -3%
3000 SF deluxe house	2 - 8% (0 - 2% if non-vulnerable areas placed below flood datum)	0 - 2%	.5 -3%
3-story condominium	(assume parking under)	0 - 2%	0 - 3%
10-story condominium	(assume parking under)	0 - 2%	0 - 2.5%

Potential Wind Damage Reduction (1,3,5)

The next study was to estimate the relative reduction in wind damage to the three classes of structures (60, 105, and 140 mph design). To estimate these effects a Monte Carlo simulation model was developed. The basic scheme of the simulation model is shown in Figure 1. The first study used rather crude assumptions for the model parameters although the best available estimates were obtained. Later, these parameters were explored in much more detail and the model was vastly improved (1). The results, surprisingly, did not drastically change although the model is now better verified and substantiated. The bottom line is that the relative damage factors for the three classes of structures is 1:.236:.024 or 40 to 10 to 1, i.e., forty times more class I structures and 10 times more class II structures are damaged than those built to the improved standards if we consider wind damage alone. If we consider flying debris, the ratio becomes 3 to 1.5 to 1. Obviously, most structures cannot be made impervious to flying rowboats, billboards, stop signs and telephone poles.

Part of this study was to estimate the average loss per $100 of building valuation for the three classes of structures. These were on the order of $4 (class I), $1 (class II), and $0.17 (class III).

Economic Incentives

The final study in this series was to estimate the economic incentives to build the new model building standards. Two main findings were used. The cost to meeting the improved building standards was 1 to 3% of the total cost. The reduction in average loss was a ratio of 24 to 1 or 6 to 1. Since hurricanes are so unpredictable, it is difficult to estimate the expected losses in a particular area. The home buyer is faced with the added front-end costs with the expectation of possible reduced damages. However, the vast majority (70%) of home owners along the Texas coast have never been through a hurricane. So the increased strength of the homes comes in the category of seat belts, air bags, and life jackets insulation. Their value is only realized when the disaster occurs. Then there is either relief or regret, depending on whether the protection was opted for or not.

The added cost of meeting the model building standard is not substantial and may not even be perceived by the home buyer. However, the building standards and added cost are basically opposed by realty groups. They feel the required inspections and added costs will make the marketing of the structures more difficult.

An approach is to consider this option in terms of adding extra insulation to a home. This is a high initial cost with the expectation of reduced heating and cooling bills in the future. It was this approach that was used. An example involving a $50,000 structure on

a $15,000 lot was used. The added investment would be $500 to $1,500 and this could be amortized over the economic or ownership life of the structure by reduced insurance rates. This was done for periods of 5 to 30 years and interest rates of 6, 9 and 12%. (Note: While the study was done in 1977, the method is still appropos and the results still current.) Figure 2 shows the results. The nominal results show that there should be about $0.07 to $0.80 per $100 valuation reduction in insurance rates. An "average" value reduction in loss is substantially higher; there is a middle ground for the owner and insurance members of CATPOOL where both will benefit.

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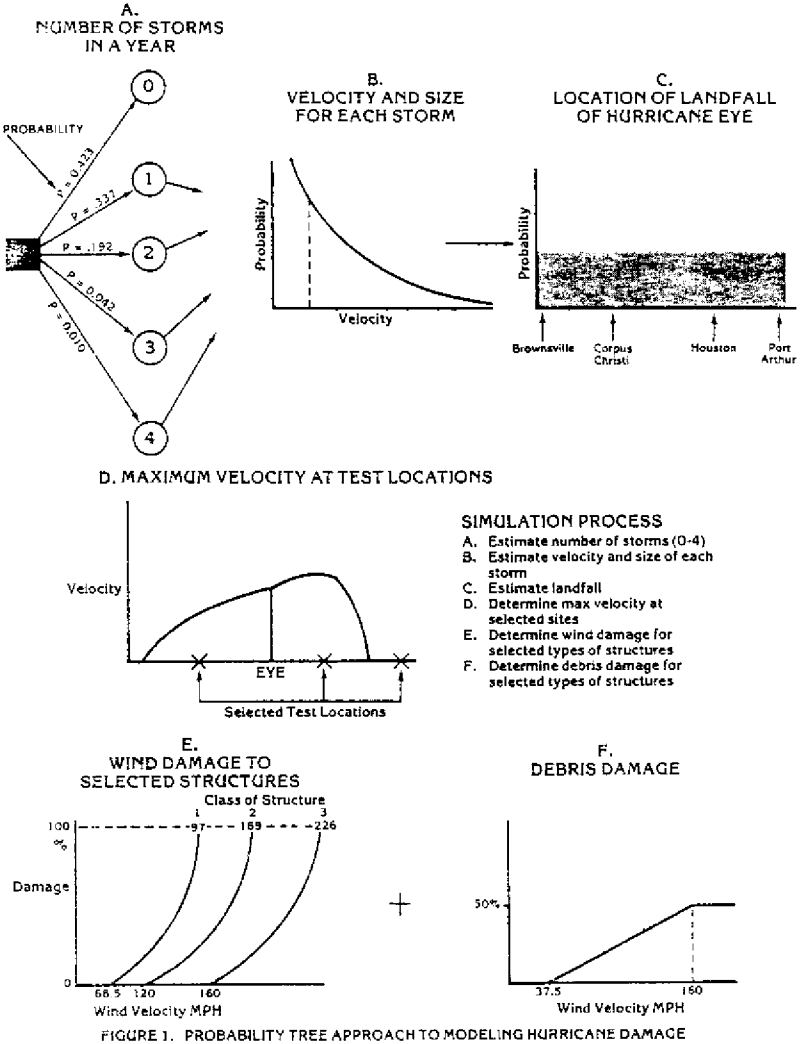

FIGURE 1. PROBABILITY TREE APPROACH TO MODELING HURRICANE DAMAGE

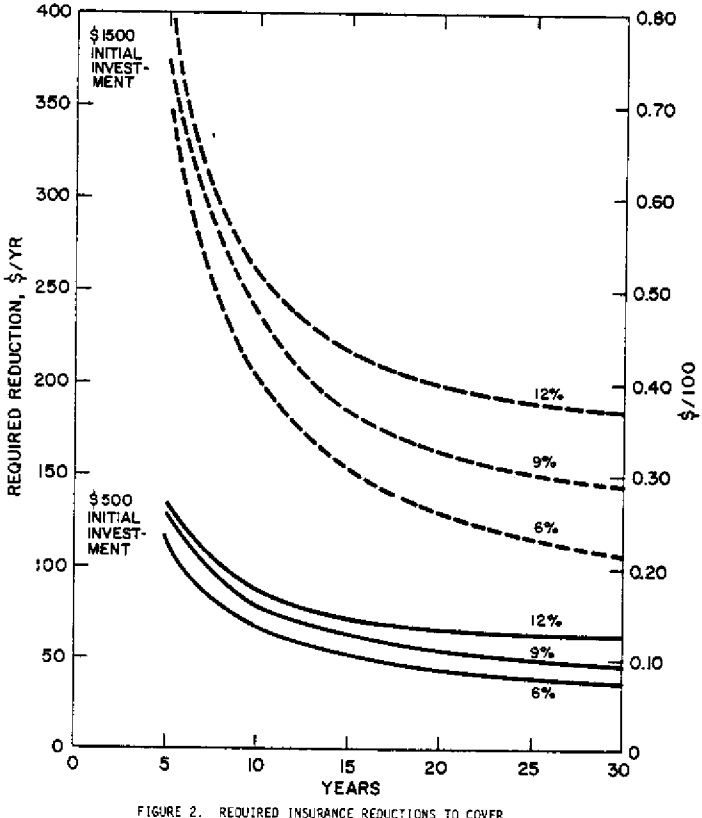

FIGURE 2. REQUIRED INSURANCE REDUCTIONS TO COVER INCREASED COSTS OF CONSTRUCTION

BARRIER ISLANDS AND BEACHES: COASTAL HIGH HAZARD AREAS

Dinesh C. Sharma

The purpose of this presentation is to provide an overall perspective on coastal hazard mitigation. During the last twenty years, the population within the narrow coastal zone has been growing three to four times faster than the national average. Recreation is a major economic activity in the coastal zone. More than 79% of our population lives in coastal or Great Lakes states and over 42% of our population lives in coastal counties (7). Of all recreational resources none has greater appeal than the beaches, but less than 5% of the national shoreline was in public ownership or potentially available for recreation in 1972 (3). Urbanization on the barrier islands and beaches is proceeding as though they are the interior mainland. The positive attributes of the coastal zone such as the sun, surf, beach, blue waters, fishing, and carefree living have been oversold while the hazards have been underemphasized. More than 80% of the people moving to the coast are not aware of the hazards from hurricane, northeaster storms and erosion (5). Typical grid-pattern subdivisions with 10-20 units per acre are unsuited to the natural dynamics and carrying capacity of the island resources (9). Lack of understanding of the dynamic nature of coastal zone resources and processes, inadequate building locations and construction codes, and failure to recognize the carrying capacity of natural resources and man-made structures has caused increased loss of resources, properties and lives from hurricanes, floods, and erosion. Coastal hazard mitigation has not been addressed by local, state and federal government in any comprehensive manner (8,13). We continue to build Ocean Cities and Panama Cities as though they are Kansas City or Iowa City.

The basic premise of this paper is that the barrier islands, beaches and coastal floodplains are by their nature highly dynamic, vulnerable and fragile resources and should be treated with the utmost care if we are to minimize losses to lives and properties from incompatible urbanization. The management of barrier islands and beaches must have a fundamental goal of conservation, i.e., wise use of the island, beach, and estuarine ecosystems at the highest achievable carrying capacity for human and other uses and enjoyments (2). The first priority in coastal hazard mitigation should be public acquisition of the remaining undeveloped and available barrier islands to meet our recreational and conservation needs and to minimize future damages from hurricane and erosion in these areas. Some barrier island systems can be maintained at a high level of health and

productivity while urbanization may be permitted, provided there is effective planning. With effective planning, trade-offs can be accomplished without serious penalties by utilizing innovative growth management programs. However, planning and goal setting are essential for proper island use and management, and island and beach communities should not wait for federal big brothers or state bureaucracies to take the initiative or force the action. Failure to deal with natural hazards on barrier islands and beaches at the local level will lead to enormous losses to lives and properties and cause severe economic disruption of the communities (9).

For this presentation, the natural systems of the barrier islands and beaches have been grouped into four broad categories: (i) sand-sharing system which includes nearshore, beach, dune, inlet, and longshore currents; (ii) interior uplands, freshwater wetlands, ponds and streams, and shallow aquifers; (iii) saltwater marshes, mangroves, submerged grasses, and estuaries; and (iv) upland rivers, nutrients and sediment sources. All of these components are physically, biologically and functionally interlinked in a complex web of relationships. Thoughtless destruction of any one may adversely affect all other components. Therefore, any island and beach development and conservation must be carefully assessed for its impacts on all components. If we recognize that islands and beaches are not the same as the mainland, we can begin to use and conserve them while minimizing future hazards and losses.

Recommendations for avoiding and minimizing hurricane and erosion hazards by adopting nonstructural solutions are presented with specific examples. This research and analysis shows that nonstructural, preventive hazard mitigation programs are economical as well as desirable in the long-run. In most cases, structural corrective solutions are costly and ineffective and create long-term problems. Innovative examples of the barrier island and beach hazard mitigation and evacuation programs and major sources of technical assistance and information for local communities are identified (9).

This multi-media presentation can be classified as an information transfer project: explaining complex scientific, economic, engineering, planning, and legal information and issues in a form and manner that can be easily comprehended by the decision-makers and the citizens. It is only through improved understanding that improved resource policy decisions can be made.

Recent Trends and Future Prospects

Recognizing the values and problems with the development of barrier islands, President Jimmy Carter included a special message on coastal barrier islands in the Environmental Message to Congress on May 23, 1977, and directed the Secretary of the Interior "to develop an effective plan for protecting the remaining undeveloped islands"

from unwise development (11). The Secretary of the Interior has established an interagency and citizen-represented barrier island work group within the Department. The work group has been working in close cooperation and consultation with various federal agencies and is planning to release a Draft Environmental Impact Statement for public comments in the fall of 1979. It is very likely that this Draft EIS will recommend significant changes in federal policies and programs for coastal hazard mitigation on the barrier islands and beaches (1). Specifically, it may impact HUD's National Flood Insurance Program, Federal Emergency Management Agency's post-disaster programs, EPA's water, sewer and solid waste programs, DOT's bridge and road programs, and the Corps of Engineers' erosion control and inlet maintenance programs. The Interior's National Seashore and Wildlife Refuge programs may be expanded and strengthened. Since there is no coherent national policy on hazard mitigation at the present, federal programs are often conflicting and even encourage public funding of costly projects in high hazard areas, thereby encouraging urbanization in such areas and increasing potential loss to lives and properties from coastal storms and erosion.

Possible adjustments to coastal hazards may range from wholly nonstructural to total structural solutions; from strict preservation of the natural resources to uncontrolled and unsafe development; from complete withdrawal of funds from publicly funded projects to total government apathy and a status quo. Such extremes are unnecessary and undesirable. Strategies which combine public acquisition of undeveloped and available barrier islands and beaches and land-use planning, zoning, and improved building-structural codes on developed or developing areas which permit wise use and safe development would be more acceptable as well as desirable. In the present context, the initial approach to mitigate the coastal high hazards on barrier islands and beaches may include, but should not be limited to:

(1) Inventory and analysis of the natural and cultural resources and delineation of critically sensitive, hazardous and available areas for earliest possible public acquisition for recreation, preservation and hazard mitigation.

(2) Assessment of risk to life and property for 100-year and 500-year natural events at various population and growth levels; carrying capacity and life cycle fiscal impact analysis of growth in all coastal high hazard areas.

(3) Adoption of appropriate land uses, densities, and building setback lines landward of the full primary dunes, berms, mature pioneer vegetation, and all freshwater and saltwater wetlands on urbanizing islands and beaches. Multiple setback zones for hurricane, flood, erosion, pollution, hazard mitigation, and adequate public beach access are preferred over single, arbitrarily defined setback lines (9).

(4) Dredging and filling of all wetlands and estuaries should be absolutely prohibited, because this nation has already lost more than 40% of its freshwater wetlands and more than 73% of the estuarine areas to destructive human activities.

(5) Establishment of hurricane-resistant building codes which incorporate horizontal and vertical impacts of hurricane surge, wave uprush, scour, and winds (Figure 1). Since we cannot control or modify hurricanes, we must build safer structures.

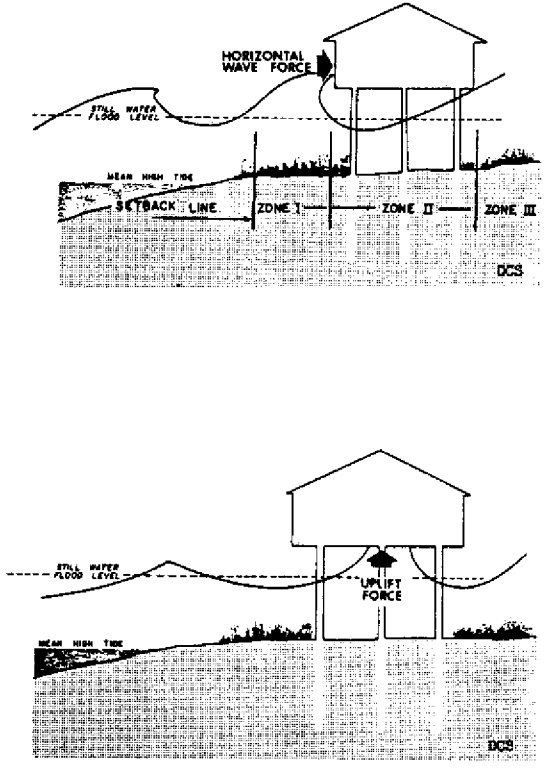

FIGURE - 1

BASIC ELEMENTS OF COASTAL CONSTRUCTION CODES FOR BARRIER ISLANDS
LEE COUNTY, FLORIDA

(6) Public capital improvement projects such as roads, bridges, water, and sewers should recognize the high risk in the coastal hazard areas, and federal and state governments should effectively prohibit and discourage direct or indirect expenditures of public funds. Where necessary, all major roads and bridges should be above 100-year flood levels.

(7) Development of comprehensive hurricane evacuation plans which identify evacuation routes, shelters, and coordinating agencies. Lee County's evacuation plan could serve as a model (12).

(8) Nonstructural solutions for erosion control must be used to maximum possible extent. Relocation of public facilities and buildings to safe areas under post-disaster programs and beach nourishment for erosion mitigation are preferred alternatives. However, relocation has not been evaluated by any federal or state agency in a systematic manner.

(9) Provide additional warning to prospective buyers of properties located in hurricane hazard zone that "this property is likely to be flooded or destroyed from hurricane winds, storm surge, and flood" by incorporating it in the National Flood Insurance Program's floodplain warnings program;

(10) Public information and education programs to improve the general understanding of the nature of coastal high hazard zones and the risks and benefits associated with alternative and wise uses of these resources.

Some of the ongoing federal and state programs reflect the recognition of these problems and have already begun to address them. The National Flood Insurance Administration (6, 14), Office of Coastal Zone Management (4), Federal Emergency Management Agency, and the Department of the Interior's recent actions and programs recognize the dynamic, fragile, and vulnerable nature of the island and beach resources (1). These agencies and others are in the process of improving their programs and policies for hazrad mitigation in the coastal barrier islands, beaches and estuarine areas because this nation cannot afford to lose valuable resources and increase losses of lives and properties from incompatible development. Public hazard awareness programs developed in Texas and local island growth management plans developed for Sanibel and Gasparilla islands are examples of the future directions in hazard mitigation and island planning (8, 10).

Conclusions

During the 1960's and 1970's, scientific research, landmark environmental laws, and the environmental impact analysis process have improved our understanding of the physical nature, biological productivity, and economic and environmental benefits and hazards of coastal resources and development. Significant progress has been made in developing improved methods of coastal hazard mitigation and planning. Interdisciplinary scientific information including physical, biological, economic, and institutional aspects of coastal hazard mitigation are available. However, this information is yet to be applied on

any significant scale. The next decade is likely to witness further research in coastal processes; assessment of risks from hazards; analysis of wind, storm surges, and wave heights; application of relocation and nonstructural solutions; and simplification and rigorous enforcement of the existing laws, rules and regulations to mitigate hurricane and erosion damages in the coastal floodplains. The success of any program will depend upon increased public education and awareness that the barrier islands and beaches are not the same as the interior mainlands. Lack of comprehensive policies and programs to address the coastal hazard mitigation in the 1980's will give a new meaning to the term "natural disaster."

Acknowledgement

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POST-DISASTER HAZARD MITIGATION

POST-DISASTER RECONSTRUCTION PLANNING--OPPORTUNITY FOR HAZARD MITIGATION?

John C. Rosenthal

Introduction

The need to incorporate post-disaster hazard mitigation as part of disaster recovery has increased in recent years due to rising public and private cost of natural disasters, growing occupancy of hazardous areas, and the recurrence of disasters upon certain communities.

For example, an average of one billion dollars' worth of damage is caused by natural disasters on an annual basis in this country. A recent survey by the Federal Disaster Assistance Administration found that 640 counties in 39 states had experienced two or more disasters within a ten-year period, and estimates by various public agencies have revealed that our coastal regions have experienced development investments at a rate three times the national average even with the passage of the Coastal Zone Management Act.

The goal of post-disaster hazard mitigation has been reinforced in recent months as public disaster policy with amendments to expand Section 406 of the Disaster Relief Act of 1974 (PL 93-288), submitted in April 1979 by the Federal Disaster Assistance Administration.

> These amendments would stimulate and encourage comprehensive hazard identification, evaluation, and mitigation at all levels of government, and to enforce the current requirement for mitigation of natural hazards as a condition for Federal Disaster Assistance.

Can significant hazard mitigation measures be implemented following a disaster as suggested by the Section 406 amendments?

The obvious response is why rebuild following a disaster unless reconstruction can provide protection from future disasters (i.e., land use and structural changes).

Yet, it is disappointing to learn that relatively few communities have implemented significant hazard mitigation measures: existing federal disaster legislation limits the opportunity for undertaking these hazard adjustments; and most disaster reconstruction is generally not planned due to the private pressures to rebuild immediately. Therefore, implementing disaster mitigation measures which require changes in a community's structure, under these conditions, is difficult to achieve.

The following examples assist in illustrating these points:

- Communities[1] that have implemented significant hazard mitigation through relocation of land uses, etc., have done so under former federal programs (Disaster Urban Renewal), and generally have been relatively small communities. In some cases, local funds have been used for specific projects.
- Under Section 402 of PL 93-288, a community that wants to relocate a public facility damaged from a disaster can receive 90% of replacement costs vs. 100%, if the facility is rebuilt to pre-disaster location and condition. Thus, no financial incentive exists for a community to undertake land use changes, with the relocation of public facilities assisting in changing community land use patterns.
- Section 1362 of the National Flood Insurance Act of 1968, if implemented, will provide funds for the acquisition of flood damaged properties but would only acquire properties by voluntary sale, not condemnation. Thus, there are no assurances that comprehensive land use changes could be implemented under this provision of the Act.
- The majority of disaster assistance is limited to "emergency and temporary disaster operations" and not long-term disaster recovery. Disaster funds under the Housing & Community Development Act are limited and not available for long-term community reconstruction.
- The opportunity for planned reconstruction exists, but the conventional planning process cannot keep pace with the tremendous private pressures to rebuild immediately.

Therefore, the purpose of this presentation is to identify the opportunities that do exist for post-disaster hazard mitigation, but are dependent upon: the formulation of a post-disaster reconstruction planning strategy to guide rebuilding, and changes in existing disaster policy and legislation to provide appropriate implementation mechanisms.

These recommendations are based in part on current research findings and experience gained from disaster reconstruction events.

Formulation of a Post-Disaster Reconstruction Strategy

Reconstruction following a disaster is not a unique event. Similar problems are faced by every community with some variation caused by the type of natural disasters (i.e., flood vs. earthquake, etc.).

As planners and local officials, we can anticipate these problems and quickly determine what reconstruction options a community can pursue.

The following "basic principles of disaster recovery" have been developed to guide the formulation of a reconstruction strategy that includes hazard mitigation options:

1. The disaster should be viewed as a unique opportunity to rebuild in a better and safer fashion by correcting old problems, including both land use and structural conditions. Existing community plans should be reviewed to establish what pre-disaster objectives can now be achieved or those which must be changed.

2. Disaster recovery and reconstruction must not be considered as "business as usual," especially once the emergency operations (clean-up, etc.) end.

3. Various stages exist in disaster recovery and need to be incorporated into the post-disaster recovery planning program.

4. Time is of the essence and both the public and private sectors must "telescope" decisions and actions.

5. Strong local leadership is essential so that decisions can be made by both the private citizen and the public sector.

6. The provision of post-disaster housing for disaster victims is a major problem and involves emergency, temporary, interim, and permanent housing resources. Past research suggests that over 50% of the disaster victims might return to their pre-disaster housing, 10% purchase new homes, 15% relocate or change housing location and tenure, and 5% require government-assisted housing. The availability of housing sites in non-hazardous locations will be difficult to acquire though an important objective of post-disaster hazard mitigation.

7. Since re-housing disaster victims is a major task, it is essential to retain disaster victims within the community.

8. An unusual "cooperative spirit" for rebuilding will prevail initially after the disaster and must be maintained to achieve a successful recovery. It requires good communication and signs of progress.

9. The anniversary of the disaster is an important benchmark for measuring progress.

10. The "importation" of professional skills will be required to supplement local efforts.

11. The state government is an important actor in recovery, especially State Housing and Finance Agencies.

12. Strong pressures to re-establish homes and employment will be in conflict with creating a disaster recovery plan unless the traditional planning process is greatly telescoped and plan implementation is able to keep pace.

13. Limitations exist for permanent reconstruction within the Disaster Relief Act of 1974 and the Housing and Community Development Act, especially in undertaking land use changes. Attempts must be made immediately to secure other reconstruction funds to change land use, and especially to build subsidized housing and other community facilities.

14. New decision-making mechanisms and implementation vehicles will most likely be needed during post-disaster reconstruction (i.e., Reconstruction Agency with condemnation powers).

15. Vacant land not susceptible to hazards will become a valuable resource, especially in providing relocation options.

16. Implementation of hazard mitigation measures, especially land use changes, requires that options and full compensation be provided quickly to residents and businesses.

17. Overambitious reconstruction plans will hinder recovery.

The establishment of a post-disaster reconstruction plan, based in part on the principles described in this report, cannot be delayed for an extended time after impact, especially if major land use changes are to occur.

A series of "rapid planning operations" must be undertaken so as to produce planned reconstruction within a 90-day time period following impact. Priorities are established and include the following planning options:

A. Cannot be rebuilt immediately due to scope of damage and future hazard vulnerability. Requires extensive analysis and implementation measures.

B. Can be restored immediately, with some change; and

C. Requires no change, and plans are not needed prior to reconstruction.

These "rapid planning" decisions will require an "interdisciplinary" approach where alternatives are quickly presented, reviewed, and refined for public debate and implementation.

A set of deliberate actions are proposed as an initial post-disaster recovery strategy to achieve the objective of initiating a planned reconstruction within 90 days following a disaster.

The following is a hypothetical guide and would be revised depending on the type of disaster, the size and location of the community, and the time of year of the disaster impact. It is divided into two stages:

Stage One (Two Weeks)

- Formulation of ad-hoc "Recovery Task Force."
- Assessment/evaluation of damage and hazard mitigation options (i.e., 406 Amendments).
- Preparation of temporary community plan.
- Clarification of Disaster Relief programs.
- Restoration of vital community facilities.
- Temporary community reconstruction plan.

Stage Two (Ten Weeks)

- Moratorium on rebuilding within heavily damaged and hazardous areas.
- Passage of special local legislation to revise zoning and building codes.
- Development of reconstruction master plan (45 days).
- Master Plan review, refinement and adoption.
- Applications for disaster assistance.
- Establishment of a reconstruction agency.
- Strategy to secure private investment funds.
- "Front end" acquisition funds and appraisal work to be initiated.
- Vacant land (public/private) to be held for relocation.
- Federal/state approval of disaster applications.

Proposals to Implement Hazard Mitigation as Part of a Reconstruction Program

Let's assume that a reconstruction plan has been prepared within a short time period, and that the opportunity for guiding change through hazard mitigation exists. Major proposals include the relocation of land uses to non-hazardous areas and the institution of certain structural changes in less vulnerable areas.

The following recommendations could assist in the implementation of a hazard mitigation program and would provide the tools to achieve the policies set forth in the Section 406 Amendments. These proposals, though not all-encompassing, do identify revisions in existing federal disaster legislation and the creation of new local and state laws.

Federal Legislation

1. Federal contributions for grants to replace damaged state/local facilities should be 100% of replacement costs vs 90% (Section 402) if the facility is relocated or not rebuilt as part of a hazard mitigation program.
2. A special contingency fund for land acquisition of private property should be established and made available for land use changes which comply with a hazard mitigation program.
3. Section 1362 of the National Flood Insurance Act of 1968, to be revised so that funds can be used under condemnation proceedings to achieve hazard mitigation.
4. SBA "forgiveness provisions" for disaster funds, if implemented (i.e., 1972), should be dependent upon the relocation of structures to non-hazardous areas.
5. The Secretary's Discretionary Fund under the Housing & Community Development Act should be expanded beyond the annual estimated $15,000,000 allocation for disasters and made available for reconstruction vs emergency needs.
6. A program to encourage "land banking" of vacant land not susceptible to hazards to be undertaken so that relocation options exist following a disaster. This could assist in pre-planning for disaster reconstruction and the costs shared with local and state governments.
7. A special subsidized housing "set-aside" for disasters to be established, since the provision of housing for low to moderate income households is usually a major problem and can have an impact for guiding the rebuilding effort.
8. Title VIII - Economic Recovery for Disaster Areas (PL 93-288) should be revised to allow for "community grants" vs "community loans" if funds are used to implement a hazard mitigation program. It would be insurance for achieving economic reconstruction that will not be impacted in the future by a natural disaster.
9. A time limit to be imposed upon every federal agency for reviewing and approving applications which involve hazard mitigation policies.

State and Local Disaster Legislation

1. Special legislation at the State level should be established to allow for immediate acquisition of damaged high priority areas.
2. State housing and/or finance agencies should be responsible for assisting in reconstruction due to their powers, availability of professional staffs, and borrowing capabilities.
3. Legislation at the local level should be in place to allow for a "moratorium" on rebuilding in hazardous areas so that a reconstruction plan can be prepared.
4. A local "building permit review" process to insure that new construction incorporates hazard mitigation measures, if appropriate. Funds should be available at a reduced rate to provide an incentive to the individual property owner if these changes are more expensive than pre-disaster building standards.

Conclusion

The major message outlined in this paper is if post-disaster hazard mitigation is an objective of reconstruction, it should be made to work. It can't be expected to be achieved unless sufficient financial incentives can be quickly made available following a disaster, and appropriate legal mechanisms are available.

The main concern of disaster victims (residents or businesses) is to get back to normal as quickly as possible.

Planned reconstruction must be able to keep pace, and tools made available to rebuild in a different fashion.

Disaster research should continue to review this dilemma, and an effort made in planning education to address this continuing problem in which planning could make a difference.

Note

[1] As examples, Hilo, Hawaii (1961); Rapid City, South Dakota (1972); Painted Post, New York (1972); Wilkes-Barre, Pennnsylvania (1972); Robindale, Pennsylvania (1978), etc.

POST DISASTER FLOOD PROOFING OF PUBLIC BUILDINGS

Roger E. Plumb

Introduction

The topic of this paper is the flood proofing of public buildings after a disaster. On July 5 and 6, 1978 the City of Rochester, Minnesota experienced its worst flood. Flood elevations were four feet higher than the previous record, and in most areas the flood approximated the 1% chance flood or that flood which, based on flood statistics, would occur on an average of once each 100 years. The 7" rainfall started at 7 PM on July 5 with Bear Creek peaking at 1 AM and the Zumbro River cresting at about noon on July 6. This wasn't much warning, and most of the initial efforts involved barracading streets and evacuation of residents. The relatively short time frame of two to three hours on Bear Creek and thirteen hours on the Zumbro River requires flood protection measures which can be implemented within a few hours.

FDAA Program

The Federal Disaster Assistance Administration has a program for assistance on the flood proofing of public buildings. The proposed flood proofing must be technically and economically feasible. If the flood proofing measures cost less than 15% of the flood damage, then a 100% federal grant may be available. In addition to the obvious advantage of protecting the buildings, another advantage is that the flood proofing would also reduce the federal flood insurance rates for the public buildings involved.

Determination of Feasibility of Flood Proofing

To illustrate the program, the following examples of flood hazard reduction reports show the decision making process used to determine the feasibility of the flood proofing proposed:

Project 1

1. Project: Old Wastewater Treatment Plant located on Elton Hills Drive one block west of Broadway, this facility is located within the 100-year flood plain. One building is metal construction and the other is masonry. Now used by city for miscellaneous storage.

2. Damages: Buildings did not sustain major damages as they do not contain finished inside spaces.

3. Estimated cost of repair: $5,000.

4. Total facility value: $240,000.

5. Design flood - regional flood:
   A. Type of flooding - overland
   B. Height of water in building - metal building had 8.5 feet. The masonry building is deeper in ground so had greater depth of water.

6. Recommended project features:
   None recommended. The presence of doors and windows plus the substantial depth of flood waters does not lend itself to any cost effective mitigations.

Project 2

1. Project: Mayo Civic Auditorium, City of Rochester. This auditorium is located within the 100-year floodplain. One story masonry structure with depressed arena used for a large variety of public functions and conventions.

2. Damages: Water about 3 feet at entrances but 9 feet deep in main arena because of depressed construction. Water damage to some mechanical equipment and seating. Size of building required large crew for removal of silt deposits. No obvious structural damage.

3. Estimated cost of repair: $267,000.

4. Total facility value: $25 million.

5. Design flood - regional flood:
   A. Type of flooding - overland plus gravity storm sewer backup.
   B. Height on building - 3 feet.

6. Recommended project features:
   A. Provide 21 panels on exterior openings. Three are single pedestrian access doors and rest are vehicle doors or multiple door pedestrian exits.
   B. Determine layout of all storm water drains and roof drains. Provide acceptable shutoffs at appropriate locations to eliminate storm water backflow into building.

7. Cost estimate: $28,300.

Project 3

1. Project: Wastewater treatment plant located 3900 3rd Ave. N.W. Rochester, Mn. This building is located within the 100-year floodplain. Masonry building with equipment rooms principally located below grade.

2. Damages: Lower levels filled with flood waters putting plant out of commission. Motors, controls, etc. were flood-damaged, requiring major repairs.

3. Estimated cost of repair: $230,000.

4. Total facility value: $6,000,000

5. Design flood - regional flood:
   A. Type of flooding - overland
   B. Height of flooding in building - basement full.

6. Recommended project features:
   A. Provide panels for seal of lower 2 feet of 2 single pedestrian doors and 3 double doors (5 feet)
   B. Seal pipe chase in basement middle wall adjacent to wet pit.
   C. Install back water valves on flood drains./

7. Cost estimate: $1500.

Project 4

1. Project: Rochester Public Library, 1st and Broadway, City of Rochester, Mn. Not within the 100-year floodplain but directly adjacent. Building is 2-story with basement masonry structure of recent construction. Used for usual library pursuits. Book storage in basement.

2. Damages: Basement filled with water caused by sewer backup. Substantial damage to books, carpets, and equipment.

3. Estimated Cost of Repair: $70,000.

4. Design flood - regional flood
   A. Type of flooding - sewer-backup
   B. Height of water in building - basement full.

5. Recommended project features
   A. Install backwater preventer valve on main sewer line.

6. Cost estimate: $700.

Conclusions

The flood proofing grant program by the Federal Disaster Assistance Administration is an excellent program which will substantially reduce damage to public buildings when a flood occurs.

There is an aspect of this which needs to be emphasized. The use of removable flood proofing panels will not be effective if the panels are not in place when needed. Accordingly, a program of semi-annual practice flood emergency alerts is necessary to insure that the passing of time and the changeover in personnel does not reduce the effectiveness of the flood-proofing program.

SHORELINE PROTECTION POLITICS: A MASSACHUSETTS CASE STUDY

Reed F. Stewart

In February 1978, eastern New England had quite a blizzard. The storm was comparable to one in 1888 which caused 400 deaths, many of them at sea, and to another northeaster in 1898 which changed our local landscape quite a bit as it caused Massachusetts' North and South Rivers to shift their joint mouth about four miles along a barrier beach. I'll return to that barrier beach in a few paragraphs.

The 1978 northeaster was not unusual in its area of damage—east facing coasts—since there had been a series of rather severe northeasters earlier in the 1970's which had damaged seawalls, houses, and barrier beaches along those same shores. What distinguished the 1978 storm from its major predecesors is that in the 80 years since the Blizzard of '98 we have changed our use of the shore from a place for a relatively few summer residences, on high ground and back from the water, to an intensive use of just about every kind of landform and as close to the water as possible. That change in land use was what prompted me to write an article in 1974 for the local paper, predicting with fair accuracy what eventually happened in 1978, even to the reactions of officialdom. It is no great task to make two other predictions: first that we are going to be hit in the same devastating way by another northeaster because we haven't begun significantly to change our use of the shore, and second that the next hurricane that comes to New England over the ocean from the south is going to make the 1978 northeaster seem benign as it wipes out summer colonies, now increasingly winterized, along our south-facing shores. We have rebuilt what was knocked down in the 1938 hurricane and have pushed farther onto unsafe territory.

This paper focuses on an area created by the northeaster of 1898, a beach built up into sand dunes following the closing of one river mouth and the opening of an alternate. On the map, the site is shown as Rexhame Dunes. The northern edge of the map just includes the present mouth of the North and South Rivers. The map selectively emphasizes the built-up nature of the tombolo to the north and south of the dunes, the salt marshes of the estuary, the older residential nature of the higher area across the marshes, and the residential development of low ridges (B) and filled marshes (A).

The 1978 storm heavily damaged areas to the north with wind, wind-driven waves, and wave-tossed stones, flooded the low areas up to the 10.5 foot contour, and added

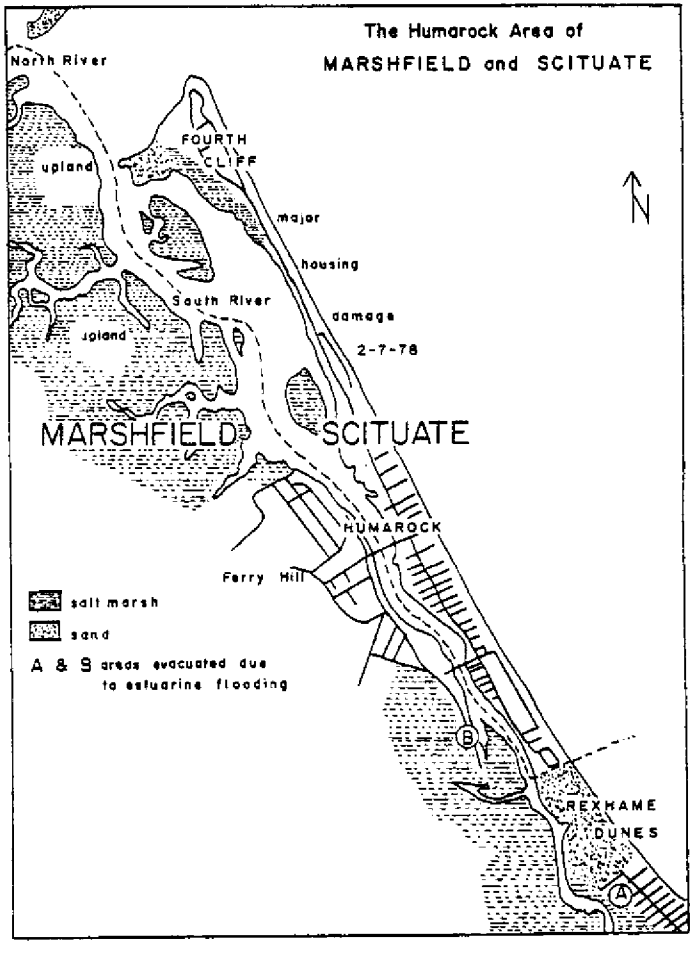
The Humarock Area of
MARSHFIELD and SCITUATE
North River
FOURTH CLIFF
upland
major
housing
damage
2-7-78
South River
upland
MARSHFIELD
SCITUATE
HUMAROCK
Ferry Hill
salt marsh
sand
A & B areas evacuated due to estuarine flooding
B
REXHAME DUNES
A

Figure 1

another three feet of waves to the height of that estuarine flood. The much higher waves from the open ocean swept along the streets leading from the beach and rolled down the backslope, surprising and alarming those residents who thought that they were safe from ocean damage because of their distance from open water. Those waves washed over and through the quarter-mile stretch of Rexhame Dunes, enlarging passes and leaving masses of sand and gravel on the backslope, but leaving the wide and compact beach ridge at least six feet above the flood height. Much of that deposited material came from the face of the dunes as they were cut back by some forty feet. Streets on the marsh side of Rexhame (A) were covered by several feet of water and debris from the flooded estuary. The houses there, it should be noted, are substantial and year-round.

That is where the story really begins. Please remember that the storm was early in February and that March in New England can produce a goodly amount of severe weather and that even April is not always calm. Not only, then, was the problem one of a clean-up after the storm, it was very definitely seen as a task of warding off another flooding, one seen by the residents as coming through dunes from the ocean. The first thing that was done, once equipment could be brought in, was to bulldoze much of the wave-deposited sand and gravel from the backslope into the widened gaps in the dunes. That was done by the town.

Of course, many state and federal agencies were on the spot surveying the damage, not just to this tiny portion, but to the areas of extensive damage to all that goes into seacoast housing. A general state of emergency, both state and federal, was declared, and the many agencies took much needed action with generally good results. The Army Corps of Engineers proposed to build a seven foot stone wall, backfilled, along the former toe of the dunes from the privately built seawalls on the south to those on the north. That was to prevent further destruction of the dunes and, it was implied, prevent the flooding of the homes on the marsh side of the beach. The Corps assured town officials that federal funding was available, but that the application had to be made within thirty days.

Now let me remind you of the New England town's form of government. We have a large measure of autonomy. Zoning, conservation, much licensing, budgeting taxation, and similar matters are jealously, and often successfully, defended against state and federal intervention. There is little county government except for the court system. Not only are the powerful local boards such as the selectmen (aldermen) and planning boards locally elected, but they are further subject to local control through open town meetings. Those annual meetings put budgets and officials through a scrutiny that can often be described, mildly, as an ordeal. I would think that the system exposes its officials to about as much pressure from ad hoc special interest groups as any system could and still

survive. (There are many who think that in towns the size of Marshfield, about 20,000, the system is not surviving.)

We have some virtues and some vices. We can be efficient, as in hiring a town administrator to supplement the part-time efforts of the selectmen, but then we balance that by putting him and them under close and continual scrutiny. Because of our system, we often don't "interface" with federal agencies very smoothly, though the state usually understands us, if its bureaucrats come from small towns. Back to the Corps' proposal: it was submitted to the town engineers and to the Conservation Commission, since that body had substantial moral if not legal authority in the case. All beach and wetlands matters are under the tight control of the Conservation Commission except in cases of emergency. The general feeling of those bodies, of the selectmen and the town administrator, and especially of most of the Rexhame area residents, was in favor of the protective wall. The memory of surf pouring past houses was strong enough to drown other considerations and evidence. Other residents, notably including Marguerite Morris who lived in Rexhame but on safely high ground, were not as sure that the wall was the solution. We sought opinions from geologists, biologists, and engineers, wrote letters and newspaper articles, talked to our fellow townspeople on the relevant boards and commissions, and called various state and federal agencies.

The selectmen held a meeting—not a formal legal hearing, but one of their regular, open-to-the-public meetings—at which the interested parties presented their evidence and views. Feelings ran high, opinions were divided, and the selectmen, as was their responsibility, made a decision. It was to accept the advice of the Corps of Engineers. Work started that next morning and was halted that afternoon because the Federal Disaster Assistance Agency questioned the emergency nature of the work and therefore the funding. Wow!

To return to a more objective style: the divergent opinions, several of which I solicited, were those of geologists, biologists, and engineers from Boston University, Bridgewater State College, the MIT Sea Grant Program, the state's CZM division, the University of Massachusetts, and Marshfield's DPW. Marguerite Morris was, and is, on the Marshfield Planning Board. As part of her undergraduate work she had completed a resource management plan for the Rexhame Dunes and drew on that to suggest a restoration procedure. It was that general approach which was finally approved by the state's Department of Environmental Quality Engineering and the FDAA. With the help of those agencies, money was available to the town for the rebuilding of the dunes with sand, with only a minor addition to the stone work that existed before the storm. Now, after a winter with one fairly severe storm, the dunes are in good shape even though the town has not yet been able to stop recreational vehicles from cruising their frontal slopes.

Ms. Morris was a candidate for election to the Board of Selectmen at the time of the debate over the Rexhame Dunes. She lost that election by a slim enough margin to convince many people that her opposition to wall-building cost her the election. It may well be that resentment of her stand carried over to a subsequent off-season election campaign which she also lost, though there were enough other candidates to make such a statement hard to prove.

The purpose of this paper is not to argue for or against a particular solution to a problem, but to present elective and appointed public officials as caught between their own—and their constituents'--desire for immediate preventative action and the conflicting advice that other interested parties presented. I know that emotions were close to the surface, as an objective analyst could have predicted for the aftermath of a major storm, and I also know that objective analysis was not readily come by. In the meetings and in private conversations, opposing views were received with as much politeness as possible, which was not always as much as was sometimes necessary.

One element in the frustration of the selectmen was probably that an apparently simple solution to a relatively minor problem set off such protracted debate and negotiations. It must have seemed hardly worthwhile in comparison with such problems as roadway reconstruction and the housing and feeding of homeless families. One element in the minds of some of the opponents of the stonework may have been that here was a case where fairly clear geomorphological principles could be applied for the long-range good of the town, perhaps serving as a lesson in beach management, and certainly without the complications of enforcing regulations concerning the rebuilding of homes in areas of high storm hazard.

In the absence of previously agreed upon and clear principles for coastal land-use management there was frustration aplenty to go around, concerning far more than this short stretch of beach, and certainly there was residual shock over the damage of the storm.

There were what seem to me to have been precipitate actions by the Corps of Engineers and tardy decisions by state and federal agencies, though here also allowances must be made for the new experiences that all parties were going through. Feelings were so high that at one point the Marshfield Selectmen approved standby legal measures against the state government to prevent any further interference in the wall-building project.

A year later and from my point of view, the result is satisfactory in that the wall was not built and that the dunes are doing well. Perhaps the town, the state, and the federal entities have learned better how to cooperate in times of emergency, and

certainly the political feelings have died down. My worry is that a coastal community still has no widely shared understanding of the relation between coastal opportunities and coastal problems. If another few years pass without a major re-education—by humans or by nature--then the next environmental problem will also be perceived as an unpredictable and unique event to be reacted to with outrage against those whose responsibility it is to regulate this kind of thing. To coin a phrase, "There oughta be a law." The law that is envisioned by those who would say that is one which would provide absolute protection to the property and lives of taxpayers wherever they may live, even on low land behind a barrier beach.

HURRICANE PERCEPTION AND AWARENESS

AWARENESS PROGRAM COMPONENT ASSESSMENT

Carlton Ruch

Hazard awareness programs are becoming more popular today. However, little has been done to evaluate their effectiveness. This paper constitutes one attempt to evaluate the effectiveness of three components of the Texas Hurricane Awareness Program.

The program was started in 1974 when emphasis was placed on the wide distribution of 10,000 checklist/map brochures. Since 1976 it has been a joint effort by the Texas Coastal and Marine Council, the Texas Catastrophe Property Insurance Association, and the Governor's Division of Disaster Emergency Services. The program has three key components. First, there are eight versions of the checklist/map brochures (written in both English and Spanish) directed to specific coastal areas. In 1975, 30,000 were distributed with an additional 600,000 distributed in 1976. In 1977 and 1978, 750,000 were distributed each year. They consisted of one sheet with one side containing a survival checklist and an area map showing previous flooding, land elevation, and roads. On the reverse side was a tracking map, general hurricane information, and definitions. The sheet folded to a convenient size. Second, in 1977, sixty 5-minute radio interviews were developed, including interviews with the director of the National Hurricane Center and other preparedness individuals, as well as hurricane survivors and others familiar with the potential threat of hurricanes. In 1978 these were revised to thirty 5-minute presentations. Third, there were three 60-second television films with abbreviated 30-second versions. These films depicted vividly the force and destructiveness of hurricanes.

In the fall of 1977 and summer of 1978, 381 interviews were conducted in Galveston as part of a Texas A&M Sea Grant Project entitled "Hurricane Response Model." Households were randomly selected and interviews were conducted by students of Galveston Community College. Utilizing certain parts of the information obtained from these interviews, it is possible to assess the three key components (checklist/map brochures, television spots, and radio interviews) of the Hurricane Awareness Program.

In order to assess the effectiveness of these three components, four categories of persons from among those interviewed were chosen. The first group consisted of persons who recalled having received only the brochures (but recalled neither the television nor radio spots); the second, of persons who recalled seeing only the television spots (but did not recall the brochures nor the radio interviews); the third, of those who remembered hearing the radio intereviews (but did not remember the brochures nor the television

spots); and the fourth, of persons who could not recall being exposed to any of the awareness program's three key components.

Comparisons were then made between the brochure group and the "no-exposure" group, the television group and the "no-exposure" group, and the radio group and the "no-exposure" group. These comparisons included group profile differences, knowledge of certain evacuation and preparation information, evacuation intentions, danger and evacuation beliefs (in relation to wind speed, tidal rise, and hours before impact), and responses to simulated hurricane advisories and bulletins.

Group Profile Differences

Twenty-four percent of the 381 persons interviewed indicated they had obtained a copy of the checklist/map brochure. Fifty-seven percent of these still had a copy and 59 percent had read it. Most received their copies from employers or friends (36%) or local stores (30%). The profile of the 21 who were familiar with only the brochure can be seen in Table 1. When comparing these with persons exposed to none of the three, more owned boats (33% to 6%) and had incomes of $13,000 or over (58% to 37%).

Seventy-six percent of those interviewed remembered seeing some hurricane awareness television spots. Table 1 displays the profile of the 28 interviewees who indicated they had seen television spots only. These had more evacuation experience (53% to 30%) and a higher percentage of non-anglos (35% to 15%) than persons not exposed to any of the key elements.

Sixty-eight percent of those interviewed recalled hearing the radio interviews. Table 1 indicates that of the 18 who had heard radio interviews only, more had evacuation experience (50% to 30%), fewer had lived on Galveston Island over 10 years (24% to 53%), fewer had jobs requiring them to remain on the island (18% to 38%), and more had incomes of $13,000 or over (73% to 37%) than persons not exposed to the key elements.

Evacuation and Preparation Information

Table 2 shows the percentage of persons knowing the correct number of hours needed to evacuate Galveston Island, the tidal rise needed to block evacuation, and the proper "watch" preparation. A higher percentage of those exposed to the brochure had the correct information in all items than did those not exposed to any of the key items. A chi square analysis of the frequencies indicated statistical significance at the .06 level for knowledge of time needed to evacuate and at the .001 level for knowledge of proper "watch" preparation. The checklist/map brochure did make a difference. Tidal rise needed to block evacuation was not statistically significant. In comparing the frequencies for television or radio exposure with those not exposed to any of the three key awareness items, there were no statistically significant differences.

TABLE 1

GROUP PROFILES
(in percentages)

General Characteristics	Checklist/Map Brochure Only N=2	Television Only N=28	Radio Only N=18	No Exposure N=3
Hurricane experience	62	71	72	56
Evacuation experience	21	53	50	30
Lived over ten years on Galveston Island	52	54	24	53
Elderly or sick in family	10	11	18	5
Job requires staying on island	29	21	18	38
Own home	43	50	39	49
Own boat	33	4	0	6
Family income of $13,000 or over	58	50	73	37
Twelfth grade or over education	76	75	59	63
Males	33	42	41	42
Non-Anglos	0	35	29	15
Age:				
10-19 years	0	4	0	0
20-29 years	30	9	33	9
30-39 years	30	26	28	18
40-49 years	25	22	6	24
50-59 years	5	4	6	13
60+ years	10	26	28	18
Residential structure:				
Wood single story	25	25	27	23
Wood single story (elevated on pilings)	25	17	27	14
Wood multiple story	20	21	27	26
Brick single story	15	17	13	11
Brick multiple story	10	21	7	26
Mobile home	5	0	0	0

TABLE 2

KNOWLEDGE OF EVACUATION AND PREPARATION INFORMATION
(in percentages)

Item of Information	Checklist/Map Brochure Only N-21	Television Only N-28	Radio Only N=18	No Exposure N=39
Hours needed to evacuate Galveston Island	26*	11	7	7
Tidal rise needed to block evacuation	28	7	17	22
Knowledge of proper "watch" preparation	75**	39	53	27

* Statistically significant at the .06 level.
** Statistically significant at the .001 level.

Evacuation Intentions

The only item in the interviews regarding intentions was a question concerning evacuation. The question was, "If you were to evacuate because of a severe hurricane, would you evacuate off the Island?" Ninety percent of the people in the brochure group said "yes," compared to 70 percent for television, 71 percent for radio, and 70 percent for "no exposure." None of these responses indicated statistically significant differences.

Danger and Evacuation Beliefs

Beliefs concerning hurricane danger and evacuation are displayed in Table 3. The only statistically significant difference occurs, for both danger and evacuation, at the number of hours before a hurricane would hit. The brochure category, when compared to the "no exposure" category, indicated a less cautious attitude--only 10 percent considered it dangerous at 24 hours while 48 percent of the "no exposure" category did.

Responses to Simulated Advisories and Bulletins

The final comparison is of safety response patterns and perceptions of danger to simulated advisories and bulletins. Figure 1 shows that, compared to the "no exposure" group, persons with radio exposure only had statistically significant depressed response patterns. Figure 2 indicates that the brochure group had a statistically significant depressed perception of danger for the first 13 advisories, that television had a statistically significant difference for advisories 14-28 with an increased perception of danger from the evacuation advisory (Number 23), and that radio had a statistically significant depressed perception of danger until it increased after the evacuation advisory (Number 23).

Summary

When compared to the "no-exposure" category, persons exposed only to the brochure had significantly greater knowledge of hurricane information but a significantly less cautious attitude toward time of hurricane impact. There was also a depressed perception of danger in the early simulated advisories. The differences between persons exposed only to television and those with no exposure were not significant other than the television group's increased perception of danger in the latter stages of the simulated hurricane advisories and bulletins. Finally, persons with radio exposure only had statistically significant differences in the depressed perception of danger and response patterns in the early simulated advisories (there was a greater perception of danger in the latter advisories). These results are consistent with a March, 1979 Mass Emergencies article by Christensen and Ruch entitled "Assessment of Brochures and Radio and Television Presentations on Hurricane Awareness." The article was based on results of a 1350-questionnaire mail survey.

TABLE 3

BELIEFS CONCERNING HURRICANE DANGER AND EVACUATION
(in percentages)

Category		Checklist/Map Brochure Only N=21	Television Only N=28	Radio Only N=18	No Exposure N=39
Wind speed as only item of information					
Considered dangerous at:					
024 miles per hour		11	0	6	6
25-49 miles per hour		37	15	6	30
50-74 miles per hour		37	42	35	33
75+ miles per hour		16	42	53	30
Would evacuate at:					
024 miles per hour		6	0	7	7
25-49 miles per hour		12	12	7	3
50-74 miles per hour		59	48	40	55
75+ miles per hour		23	40	47	34
Water level in feet as only item of information					
Considered dangerous at:					
12 feet		5	0	0	9
1-4 feet		33	33	14	20
5-6 feet		24	19	7	34
7-8 feet		5	19	9	9
9-10 feet		19	7	14	11
11-14 feet		10	7	21	3
15+ feet		5	15	14	14
Would evacuate at:					
1-2 feet		6	4	0	3
3-4 feet		17	19	17	26
5-6 feet		44	27	42	39
7-8 feet		28	23	8	3
9-10 feet		6	8	17	10
11-14 feet		0	0	17	10
15+ feet		0	19	0	10
Hours before hurricane would hit as only item of information					
Considered dangerous at:					
6 hours	*	38	31	37	30
12 hours	*	24	15	13	9
18 hours	*	29	8	26	12
24 hours	*	10	46	26	48
Would evacuate at:					
6 hours	**	33	25	14	9
12 hours	**	39	33	21	27
18 hours	**	11	12	21	24
24 hours	**	17	29	43	39

* Statistically significant at the .02 level.
** Statistically significant at the .06 level.

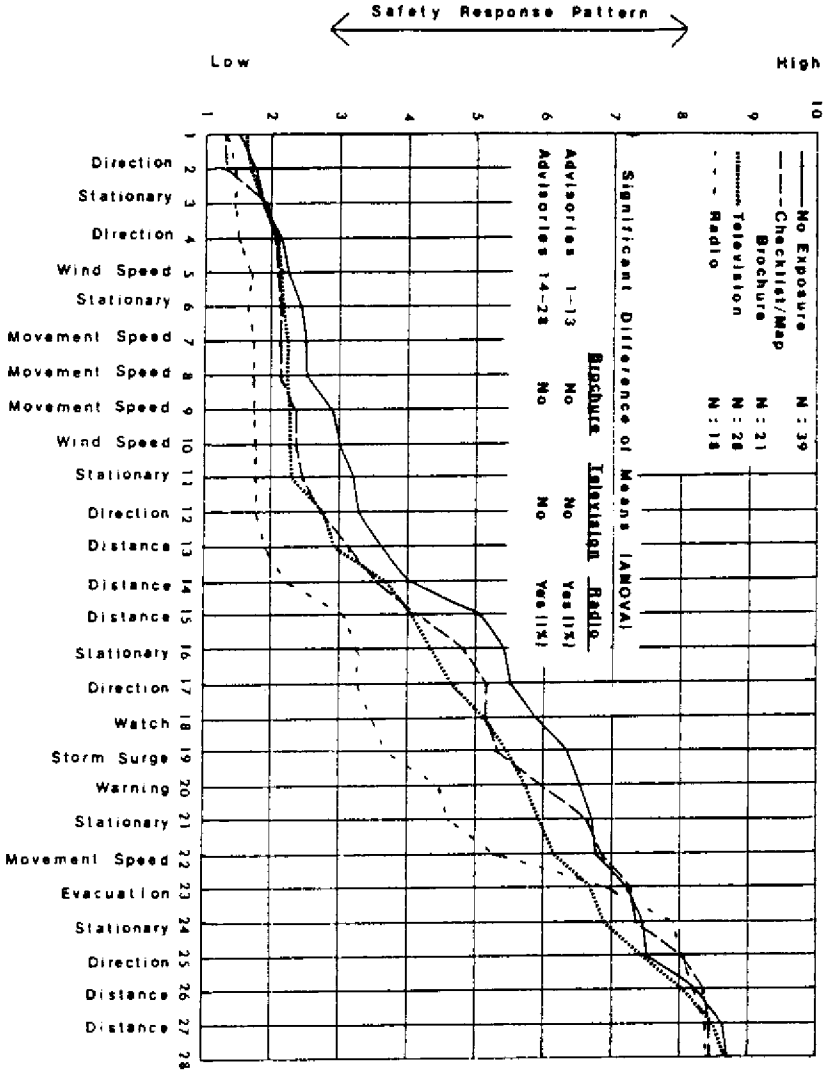

Figure 1

Safety Response Patterns

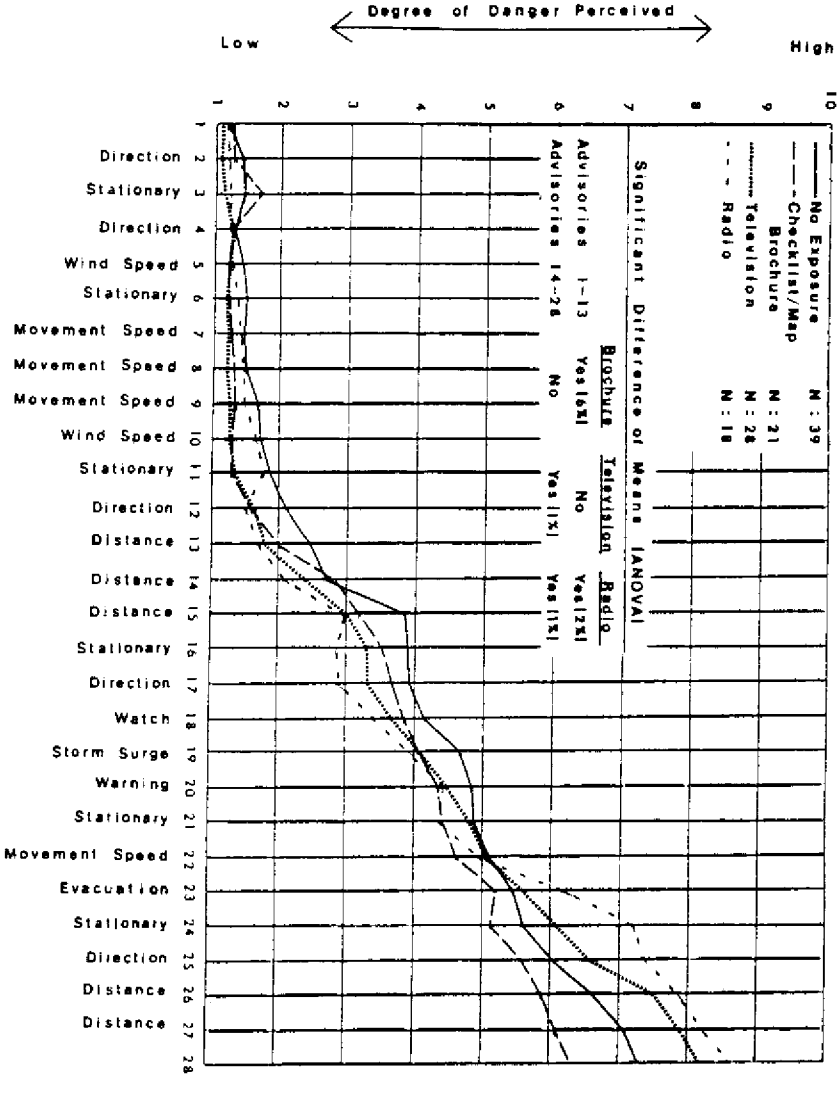

Figure 2

Perception of Danger

INCREASING HURRICANE AWARENESS THROUGH SCHOOL-BASED EDUCATIONAL ACTIVITY

Ira W. Geer

A great need exists to raise the level of public awareness and understanding of weather and its impacts. This is especially true in areas prone to hazardous weather occurrences, where life and property are particularly susceptible. In view of the vulnerability of the Atlantic and Gulf coasts to the effects of hurricanes, it is proposed that efforts be made to develop and implement school-based educational activity in these coastal areas to lay the foundations for adequate hurricane awareness, preparedness and response by the general public. This proposal results from a study entitled Increasing Weather Awareness - Hurricanes which was undertaken: (a) to assess the study of school-based hurricane educational activity in the Atlantic and Gulf Coastal states, and (b) to outline a plan of action for the development and implementation of educational programs leading to adequate public awareness, preparedness and response (Geer, 1978). This paper presents a summary of the findings, conclusions, and recommendations of the study.

Federal and state educational statistics show that during the 1976-77 school year some 18.5 million students (kindergarten - grade 12) were enrolled in 31,400 Gulf and Atlantic coastal state public schools staffed by approximately 943,000 teachers. In the coastal counties of these states there were 7.3 million students in 10,700 schools. It is estimated that in these coastal areas from Texas to Maine there were close to 600,000 students and 30,000 teachers at each grade level. In addition, there were significant student populations in non-public schools in coastal regions. Based on available data, it appears Louisiana may be the coastal state with the greatest proportion of its student population in non-public schools. In its parishes bordering on the Gulf, about 23% of its total student population (k-12) were enrolled in non-public schools. In Florida, about 11% were in non-public schools; in Maryland, 13%; and in Delaware, 16%.

The organizational structures of state school systems are as varied as the number of states involved and range from those strongly controlled at the state level to those which leave practically all decisions to local school districts. Most states have some power over local school districts through various mandates or statutes, state funding, approved textbook lists, accreditation, and/or teacher certification. A few states exert strong authority through their departments of education and stipulate what subjects are to be taught and for how long. But regardless of the extent of central control, the details of

curriculum content and day-to-day instruction in all the states are left up to the local school districts and the teachers.

The state-by-state analysis of science, social studies and civil defense curricula strongly suggest that science and social studies are taught throughout the elementary and early secondary grades. Instruction is largely controlled by textbook content, especially in social studies. Civil defense units are seldom taught except in one or two states where such instruction is mandated. Where civil defense units are taught, the teaching appears to be based on materials developed at the state level or by the Defense Civil Preparedness Agency.

Competition for instruction time is keen. Time allotments to various subjects and activities have resulted from years of fine-tuning by mandates, needs, vested interests, and pedagogical considerations. Consequently, curricular innovations (even if mandated) which require the assignment of new and separate blocks of time and resources face extreme difficulties in implementation. Study findings indicate that curricular innovations which can be introduced into existing courses have far greater implementation potential. But they must be considered highly worthwhile and necessary as they too must displace something which is already being taught.

None of the states surveyed is known to have what could be called a bona fide school-based hurricane awareness education program. Some hurricane awareness education is going on in science and civil defense instructional units in several states. At best, the instruction seems to be restricted to a few pages of reading and/or the viewing of a film or television program. Civil defense materials generally treat hurricanes in a minimal and cursory manner. The "safety rules" approach typical of civil defense materials appears to have prevented their widespread acceptance. Very little instructional material focusing on the local aspects of hurricanes is known to exist. Also, there are few commercial instructional materials on hurricanes available. There is a dearth of appropriate student-oriented printed matter on hurricanes (the "Owlie Skywarn" booklet on hurricanes being the major exception). General descriptive articles on hurricanes and related phenomena written at levels for teacher use are few and generally unavailable or unknown to teachers.

Generally, coastal state education department personnel interviewed in the study did not perceive any great urgency to implement statewide hurricane education programs. Most did see a need to direct efforts specifically to coastal area schools. They and other educators interviewed were almost unanimous in stating that short instructional units containing at least some locally-oriented materials which could be integrated into existing courses would have the greatest potential for widespread use. There was general

agreement hurricane awareness education should be approached from a broad perspective. It was suggested that hurricane awareness might, by itself, be too narrow a topic to gain widespread acceptance. Instead, an introductory unit on general weather awareness might precede hurricanes as a learning topic. This would give students the opportunity to directly relate to things current and observable in their own surroundings. Once introduced to the day-to-day happenings of the atmosphere, they could then be led into meaningful hurricane education learning experiences. There was also widespread agreement that the subject matter content of any hurricane awareness unit should focus on general awareness of the nature of hurricanes and the potential impacts of hurricanes on people and property. It was felt that it would be very important to build a foundation of understandings which would hopefully provide the bases for adequate long- and short-term hurricane preparedness decision-making and actions. The teaching of hurricane safety rules would be relegated to (a) activities in which students would develop guidelines based largely on their own understandings of the crisis they might someday face and (b) printed materials designed to be taken home and perused by the family after school use.

It was found that all public schools in the coastal states appear to be equipped with film strip and slide projectors, 16-mm motion picture projectors and audio tape players. Holdings of more specialized audio-visual equipment and television receivers vary widely. Some states have highly developed educational television systems, but the majority do not. The difficulties of using educational television as a vehicle for hurricane awareness education are compounded since in some states the coastal areas are not completely covered by educational television and/or the schools are poorly equipped with receivers. States with sophisticated television systems often operate with statewide programming and might not be inclined to telecast programs targeted specifically to coastal areas. It was recommended by numerous personnel of state departments of education that only the most economical of instructional materials which use universally available audio-visual equipment be developed.

Resources for educational purposes in the various coastal states are limited. In a number of cases, state funds for the purchase of instructional materials are either not available or restricted to the acquisition of certain kinds of instructional materials or materials appearing on state-approved lists. However, it does appear all states allow the use of locally generated school funds as the district decision-makers see fit. Unfortunately, coastal areas are sometimes the least able to afford the purchase of materials with local funds because of their low tax bases. There is every indication that in all coastal areas expert personnel are available and interested in developing and implementing hurricane education programs. State education department personnel, teachers, state

Marine Advisory Service personnel, local National Weather Service personnel, civil defense officials, and the like would willingly participate. Also, it can be expected that persons involved in teacher training at colleges, universities, and education service centers would become actively involved.

The successful implementation of new curricular materials require adequate in-service teacher training. An analysis of in-service teacher training practices shows that the majority of states require teacher involvement in staff development activity. In these states, teachers must spend a specified amount of time in staff development activity or accumulate in-service or college credit in order to retain their positions and teaching certificates. Numerous school districts offer salary incentives to encourage continuing education activity by teachers. Many teachers, of their own initiative as dedicated professionals, take advantage of staff development opportunities to upgrade their teaching. Teacher training strategies aimed at implementing hurricane awareness should be based on existing teacher training mechanisms in the individual states.

The consensus of persons interviewed in this study was that instructional materials should deal with both the physical and social aspects of hurricanes and related phenomena. After successfully completing a comprehensive learning experience on hurricane awareness, it was felt that the student should be able to (a) demonstrate the acquisition of general scientific knowledge about the physical characteristics of hurricanes and related phenomena, (b) apply these understandings in gathering and analyzing information to describe the impact of hurricane landfalls on people and property, (c) show evidence of being able to utilize basic understandings to propose rational short- and long-term preparedness actions, (d) demonstrate knowledge of local hurricane preparedness plans, (e) apply developed hurricane preparedness recommendations and show evidence of having made efforts to promote adequate hurricane preparedness plans at the individual, family and community level, and (f) show evidence of being able to adequately interpret hurricane watch and warning messages.

Persons interviewed in the study indicated the need to develop both general and locally-oriented instruction materials. There is need for general instructional materials on hurricanes due to the high mobility of the U.S. population and the current lack of such materials through commercial channels. There is a need for locally-oriented materials because of the diversity of environmental conditions in coastal areas and the desirability of focusing educational efforts on those threatening conditions most likely to be encountered.

The following general recommendations or guidelines for action evolved from the assessment phase of the study:

1. The keys to successful school-based preparedness education are the schools, school personnel and school curricula. Efforts to introduce or upgrade school-based preparedness education must be approached from the perspective of the educational systems involved and must take into account the realities of today's elementary and secondary schools.

2. Schools and school personnel are more likely to be receptive to curricular innovations which focus on broad educational goals and include opportunities for student activity, investigation and inquiry rather than those curricula based on narrow training objectives.

3. School-based preparedness education should be directed towards the development of understandings and attitudes which lead to both long- and short-term preparedness considerations. Positive approaches to preparedness concepts should be utilized with attention given to actions which, if taken over the long-term, could lessen or even eliminate the need for some short-term preparedness and response actions.

4. School-based preparedness education should be coupled with instruction which increases general awareness and understanding of the day-to-day weather experienced by the student. Study of weather as it happens will (a) promote desirable habits of listening to weather forecasts, (b) provide experience in interpreting and utilizing available weather information, and (c) set the stage for the study of infrequent by potentially devastating hazardous weather events.

5. School-based weather preparedness education programs should include (a) materials of general interest to be commercially marketable to assure widespread distribution, and (b) materials based on local environments and social conditions, historical occurrences and scenarios of possible future events.

6. Strong implementation and teacher training efforts are necessary if curricular innovations are to gain widespread acceptance and utilization. Specific recommendations or guidelines for action directed towards the development and implementation of hurricane awareness education programs are as follows:

a. Key public educational system personnel in the Gulf and Atlantic coastal states perceive a genuine need to establish hurricane education programs in coastal areas susceptible to the destructive forces associated with hurricane landfalls. These same persons have indicated willingness to participate in program implementation.

b. Mechanisms, expertise and resources exist or are potentially available for the development and implementation of school-based hurricane education programs in coastal schools.

c. The educational content of materials likely to be developed should be broadly based, deal with physical and social aspects of hurricane occurrences, and be of relatively short duration. The materials should be inexpensive and largely self-contained.

d. Instructional materials should be identified with specific school subjects at the fifth-sixth grade and/or junior high school levels to assure exposure to all enrolled students. It is recommended that they be implemented as "science."

e. Technical expertise from the National Hurricane Center, National Weather Service offices, and elsewhere should be encouraged to develop background information on hurricanes and related phenomena for use in the development of general and locally-oriented instructional materials.

f. The actual development of hurricane awareness education programs should proceed with at least one pilot project involving schools, teachers, and students in a vulnerable coastal area.

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RESIDENTS' CONCERNS ABOUT THE HURRICANE HAZARD WITHIN THE LOWER FLORIDA KEYS

John A. Cross

Residents within coastal communities have been shown to be highly aware of the potential coastal storm hazard. Indeed, they are more knowledgeable about potential flooding than residents upon river floodplains (Kates 1967, p. 64). Nevertheless, residents often underrate their vulnerability in future storms by underestimating the hazard probability within their particular community or by failing to understand the damaging forces of coastal storms. Efforts to encourage hazard avoidance behavior may run counter to the residents' attitudes. Hence, an understanding of their attitudes about the coastal storm hazard is crucial.

This paper considers several aspects of the Lower Florida Keys residents' concerns about the hurricane hazard. The Lower Florida Keys (ranging from Big Pine to Saddle Bunch Keys) is one of the most vulnerable areas of the United States, considering that the probability of a hurricane strike is about one in seven years and that 96 percent of its area is less than five feet in elevation.

In considering the residents' concerns about the hurricane hazard, both their voiced concerns about hurricanes, as well as their long-term actions to mitigate the hazard, are examined. The residents' actions as well as their expressed concerns are reviewed since verbalized responses to questions about a potentially hazardous event do not necessarily correspond to the real thoughts of residents (Guelke 1977). Thus, the hazard-mitigating actions of residents may more accurately reflect their concerns about the hazard.

In considering the residents' concerns with the hurricane hazard, the overall expression of their perception of that hazard was sought. As defined by Mileti, Drabek and Haas (1975, p. 23), "Perception of hazard is an individual's understanding of the character and relevance of a hazard for self and/or community. The perception may include notions about the speed of onset, scope, intensity, duration, frequency, temporal spacing, causal mechanisms, and predictability." Although this paper makes no effort to explore all the various notions that comprise the hazard perception of the Lower Florida Keys residents, it does consider their evaluations of hurricanes as being hazardous and the relevance of this hazard to their households.

Hurricane winds and floods are viewed by no more than a fifth of the Lower Florida Keys residents as being "major problems" (Table 1). Even though the entire area would be

TABLE 1

RESIDENTS' EVALUATION OF HURRICANE WINDS AND FLOODING AS PROBLEMS WITHIN THE LOWER KEYS

	Hurricane Winds		Hurricane Floods	
	No. of Responses	% of Responses	No. of Responses	% of Responses
Major problem	93	19	100	20
Somewhat a problem	114	23	100	20
Minor Problem	177	35	164	33
Not a problem at all	107	21	123	25
Unfamiliar with problem*	10	2	10	2

*Category added by respondents who stated that since they had not experienced a hurricane, they had no way to evaluate the problem.

TABLE 2

IMPORTANCE OF THE HURRICANE PROBLEMS TO HOUSEHOLDS IN THE LOWER KEYS

	Hurricane Winds		Hurricane Floods	
	No. of Responses	% of Responses	No. of Responses	% of Responses
Very important	104	21	112	24
Important	145	30	120	25
Neither important nor unimportant	110	23	112	24
Unimportant	78	16	76	16
Very unimportant	44	9	47	10
Unfamiliar with problem*	6	1	6	1

*Category added by respondents who stated that since they had not experinced a hurricane, they had no way to evaluate their importance.

flooded during a 100-year storm and 96 percent flooded during the projected 15-year hurricane, over 55 percent of the survey population consider that these hazards are either a "minor problem" or "not a problem at all" of living within the area.

Half of the heads of households surveyed indicate that the hurricane wind and flood problems are "important" or "very important" considerations to their households (Table 2). Only a quarter of the respondents feel the hurricane problems are "unimportant" or "very unimportant."

A significant relationship exists between the residents' evaluation of hurricane winds and flooding as problems and their consideration of the importance of these problems to their households. Those feeling hurricanes are a "major problem" also feel they are "very important", while residents who consider them as "not a problem at all" also think that hurricanes are "very unimportant." However, such evaluations are not universal, illustrated by several residents who state that hurricane flooding is a major problem, yet one quite unimportant to their households. Nevertheless, generally the more important the hurricane problem is considered by the household, the higher its ranking as a problem.

There are no statistical differences between the residents' concerns about the hurricane wind and flood hazards. This finding contrasts sharply with the observations of other researchers, who generally found that residents are more concerned with hurricane winds than flooding, even within low-lying areas such as Cameron Parish, Louisiana (Bates, et al. 1963, p. 11), the Outer Banks of North Carolina (Martin 1973, p. 71) and the Bahamas (Lewis 1975, p. 29). Supporting previous findings, however, is the observation that within the Lower Florida Keys the most recent immigrants express the greatest concerns about the hurricane wind and flood hazards. In general, the longer the length of residence the less concern expressed about hurricanes.

Hurricanes are not considered by the residents as the most important problem facing them within the Lower Florida Keys. Indeed, only 10 percent consider that hurricanes are the most important problem, while poor water supplies and unsafe highways and bridges are so cited by 42 and 26 percent of the residents, respectively. It has been argued by some researchers that the minimal importance of the natural hazard to residents may be related to the fact that the resident faces many problems (Kates, 1962, p. 441). Nevertheless, the Lower Florida Keys residents' concerns about the hurricane wind and flood hazards are significantly related to their concerns with other problems within the Florida Keys. Generally, the more concerned the resident is with other local problems, the more concern is expressed about the hurricane hazard. For example, residents who feel that inadequate fire protection and poor water supplies are problems also show the greatest concern about the hurricane flood hazard. In contrast, those who state that fire

protection, drainage and water supplies are not a problem, evaluate the hurricane flooding as being midway between being a "minor problem" and "not a problem at all."

A good indicator of the significance of the residents' concerns with the hurricane hazard is provided by their consideration of storm safety when they acquired a home. Although only 2 percent of the area's residents indicate that the "safety of the home in a severe storm" was the most important factor in their selection of their home, it was one of several deciding factors with 49 percent of the residents. Nevertheless, this figure is greater than what Oliver (1978, p. 13) found in Queensland, Australia, where only a third of the residents sought homes to resist tropical cyclones. However, like Brinkmann (1975, p. 46) and others have found, the Lower Florida Keys residents' desires to locate along the waterfront overshadow most hazard considerations.

The importance to residents of selecting their homes for its storm safety is related to when they chose their homes. For example, residents selecting their homes before 1955 and during the 1960's were more likely to have positively considered the storm safety of their home than residents selecting homes during other periods. It is possible that this reflects greater concern following hurricanes, since hurricanes struck the Lower Florida Keys in 1948, 1960, 1965, and 1966. It is surprising, however, that residents who selected their homes since the county's incorporation into the National Flood Insurance Program have paid the least attention to selecting a home for its storm safety.

The residents' expressed desire to select a home for its storm safety, nevertheless, is not totally borne out by their actions. While 65 percent of the residents of elevated houses and 55 percent of those in ground level houses claim that "safety in a severe storm" was one reason they chose their present residence within the Lower Florida Keys, 22 percent of those living in mobile homes also claim such reasoning.

Residents who built their houses are significantly more likely to have sought a home which could provide safety during a severe storm than those who purchased their house on the real estate market. This is not unexpected, for individuals building their house would be able to select the specific architectural style they desired. In contrast, the choice of home buyers was often limited by what was currently available on the market. Nevertheless, among residents who built their houses, those who desired a storm-secure house was not significantly more likely to build an elevated house than a ground level residence. Thus, whatever desires residents who built their homes may have had to incorporate storm safety in their home selection, it is not displayed in their selection of elevated houses, although it did possibly influence their choice of the homesite or of the building materials.

Although nearly two-thirds of those residents selecting stilt houses, the most common form of elevated house, cite flood protection as one of the reasons for their

choice, large numbers of residents choosing the flood-prone ground level house are not unaware of the flood hazard. For example, one resident explained why he decided against choosing a stilt house:

The perpetual inconvenience of stairs outweighed the occasional risk of flooding.

Indeed, the presence of stairs is the most frequently mentioned reason that residents reject stilt houses. Other explanations given include the lower prices of ground level houses and that many residents did not like the appearance of stilt houses. Indeed, 36 percent of the respondents living in ground level houses feel that the presence of stilt houses detracts (or would detract) from their neighborhood.

Some of the responses from residents in ground level houses indicate that they feel their houses are as safe or safer than stilt houses. In fact, 7 percent state there is no need for stilt houses. In addition, 15 percent of the ground level house occupants comment that they did not require stilt houses as their residences are on what they consider high ground or on filled areas. Of particular interest, however, is the explanation given by a few ground level house residents that stilt houses are unsafe, being more vulnerable to high hurricane winds. Several responses to the open-ended question, "Why did you choose a home not built on stilts?" well illustate these concerns:

> Has nothing whatever to do with safety or permanence in storms!!! Stilt homes are first to go.
>
> Do not like stilts--good idea for poeple who don't live here. Not practical in highwinds. Good only in certain areas.
>
> Extreme high tides, and strong winds are a big factor, at any time. Even stilt homes are affected. Mother Nature works in mysterious ways. Who can predicted (sic)???

A question specifically directed towards the safety of stilt houses might discover even greater levels of concern about their safety in high winds.

The vast majority of residents living in both stilt and ground level houses state that if they had to select a new house within the Lower Florida Keys, they would choose the same type they previously selected. However, residents of ground level houses are significantly more likely to desire a change of house type than those who chose stilt houses. Thus, if residents were able to make the choice again, the majority would still select ground level housing, although a slightly greater proportion would select stilt houses.

Thus, while many residents have considered the hurricane resistance of housing within the area, over three-quarters of the homes remain highly vulnerable to hurricane flooding. There is no statistical relationship between the residents' expressed concerns with the hurricane problem, or of its importance to their households, and the type of home occupied. Furthermore, although nearly half of the area's residents have obtained flood

insurance coverage for their homes, the associations between their hurricane concerns and insurance coverage are statistically weak. Thus, while Lower Florida Keys residents are aware of the hurricane hazard, for most residents this hazard is not the most crucial problem facing them, shown by both their voiced concerns and their actions.

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PUBLIC PERCEPTIONS OF DISASTER-RELATED BEHAVIORS[1]

Thomas F. James
Dennis E. Wenger

There appear to be two perspectives on natural disasters and related human behavior: the popular and that reported in the disaster research literature. The images of disaster situations and victims in these two perspectives vary considerably. The purpose of this paper is to discuss these images in light of research concerning the beliefs of residents of both disaster-experienced and "disaster-free" areas.

The thought of disaster brings to mind many popular images. These images include screaming hordes running in panic from the approaching danger, looters pillaging and destroying the homes of helpless survivors, armed soldiers defending the striken area, and highways choked with evacuees. Destruction begets chaos, fear leads to hysteria, and losses precipitate shock.

We imagine total destruction. Within this popular image we see homeless victims huddled in public shelters, unable to care for themselves and needing the assistance of outside relief workers. Finally, at its worst, we see the breakdown of social order. The irrationality and paralysis of victims is matched by the inability of local officials to handle the situation. Disorganization and conflict erupt as the victims and others compete for the aid which flows to the stricken community.

Another view of disaster, however, may also be constructed. This image is less popular and less dramatic. In this conception of disaster we see groups of people and organizations rationally preparing for the approaching danger. Friends and relatives offer shelter to most of those who must leave the danger area although most would prefer to remain. Public shelters are used only as a last resort.

Although death and destruction do occur, equally impressive are the activities of the victims in attacking the problems of recovery. Surviving victims accomplish initial search and rescue; local organizatoins begin the task of restoring essential services; local groups care for the injured. Rather than being paralyzed by the event, the local community responds quickly and rationally to the problems of crisis proportions.

Community morale seems to increase during the emergency period. There is a massive outpouring of assistance on the part of survivors. Local agencies are flooded by volunteers. The community appears to be swept up in a feeling of altruism; helping

behavior becomes normative. In this conception of disaster it is realized that although the devastation may be severe, it is rarely total. The stricken community remains a reservoir of human and material resources; in fact, in some ways the outside aid and material that flow into the area create more problems than they resolve.

These two views differ as greatly in the fundamental assumptions of the nature of humans as they do in their specific expectations for the disaster situation. The first perspective rests on an image of human behavior which is basically "non-social" in nature. Quarantelli has labelled this the "Dr. Jekyll-Mr. Hyde" orientation (1960). It is assumed that individuals are weak, self-centered, independent beings. They are impulsive, irrational and animalistic. Under normal conditions, society or civilization keeps these traits in check. However, society is a superficial and artificial creation which may break down. As paint may mask blemishes in wood, so does civilization hide the basic nature of humans. During periods of crisis this "paint" is stripped away, allowing us to see the true nature of the human beast. Historically, this perspective dominated the earliest social theory concerning crowds and crisis behavior (see LeBon, 1960).

The second perspective sees humans as inherently social beings. Roles, norms, reference and membership groups, and collective opinion are powerful forces influencing their behavior. From this perspective, humans are generally rational, pragmatic, and cooperative. They are socialized to turn toward others to resolve ambiguity and provide assistance at times of need. During a crisis these traits are not "stripped away" but become the base for an effective, cooperative response.

Currently these two perspectives also differ in the primary sources of their dissemination. The former images are most likely to be found in the media, in newspaper headlines, television newscasts, and perhaps most dramatically in the recent wave of disaster films. The latter view receives much less extensive and dramatic attention. The source of the latter perspective is the rather extensive body of knowledge produced by social scientsists engaged in empirical studies of actual disaster behavior.

During the past twenty-five years there has been a steadily accumulating literature on social behavior during natural disasters. (For major overviews of this literature, see Barton, 1970; Dynes, 1970; Miletti, Drabek, and Haas, 1975). One of the major contributions of this literature has been the documentation of the actual behavior of individuals and organizations in disaster situations. As a result of these efforts, it is now known that the first perspective is not accurate. On the basis of direct observation of disaster behavior and information obtained from interviews with officials in emergency-relevant organizations, these studies have shown that panic, looting, martial law, and many other popular images are rare empirical events.

It is known, however, that these myths are widely believed by individuals who have not experienced disaster. Wenger et al. (1975), studying the responses of a sample of residents from a virtually disaster-free urban area, found that the vast majority evidenced very little insight into actual disaster behavior. Eleven separate disaster myths were examined. In not a single instance did a majority of the respondents exhibit knowledge of the actual patterns of disaster behavior.

The present study is, however, the first to investigate the degree of insight into these same dimensions evidenced by individuals who reside in communities with a history of disaster experience. Surveys of disaster victims have been undertaken, but victim knowledge of typical social behavior during the emergency period has not been assessed (for example, see Form and Nosow, 1958; Ikle, 1958; Marks and Fritz, 1954; Moore, 1958; and Taylor et al., 1970).

This recently concluded investigation replicated the Wenger et al. study in communities experienced with specific types of natural hazards. Three communities between 25,000 and 50,000 population with repeated experiences with hurricanes, floods or tornadoes were selected for study. The hurricane experienced community is located on the Gulf Coast and has experienced numerous direct hits and near misses over the years. Most notable among its storms are the hurricanes of 1947, 1965 and 1969. In 1969 hurricane Camille left a toll of 145 dead, 10,000 injured, and over 5600 homes destroyed.

The tornado-experienced community is near the foothills of the Ozark mountains and within the infamous "tornado alley" area. This community routinely experiences National Weather Service "tornado warnings" and "tornado watches" and has been struck twice with major tornadoes since 1968. In 1968, 34 people lost their lives, and property damage exceeded $10,000,000.00. In 1973, the townspeople lost approximately $62,000,000.00 in property damage but considered themselves fortunate that only two individuals died.

The community selected on the basis of its flood experience is actually two communities which border a river in the upper Midwest region. While the two are politically autonomous, they are economically and socially highly integrated. Major floods have inundated this area in 1951, 1952, 1965, and 1969. Most residents, however, remember the "flood fights" of 1965 and 1969 as historical benchmarks. In 1969 the community engaged in one of the most costly "flood fights" in history. Temporary dikes costing in excess of $400,000.00 protected the community and today the Army Corp of Engineers is constructing a concrete floodwall around one of the cities.

Logically we might expect that the residents of communities with extensive disaster experience would evidence greater insight into disaster behavior than the respondents

interviewed by Wenger et al. The Wenger et al. subjects were drawn from an area with no disaster experience for at least two decades. Only a small minority of their respondents reported that they had personally experienced a natural disaster (21.1 percent). In the three disaster-experienced communities 69.7 percent of the respondents contacted claimed to have personally experienced a natural disaster in the past. A total of 907 residents of the disaster-experienced communities (at least 300 in each community) were interviewed by telephone.[2] The Wenger et al. respondents numbered 354. The eleven myths investigated by Wenger et al. included: 1) Panic Flight, 2) Looting, 3) Disaster Shock, 4) Martial Law, 5) post-impact crime rates, 6) Sheltering Behavior, 7) Disaster Shock, 8) beliefs about the accuracy of media reports, 9) the image of the Red Cross among victims, 10) Evacuation, and 11) Convergence. Surprisingly, the residents of disaster-experienced communities also evidence little insight into these disaster behavior areas.

In each community the majority of respondents indicated erroneous beliefs in virtually all of the areas examined. Respondents typically indicated that they felt panic flight was a common problem when, indeed, it is rare in the natural disaster context.[3] Also, our respondents appear to expect that those in a threatened area will cooperate and evacuate when asked to although, in reality, evacuation is generally more of a problem for community officials than panic.

Most subjects believed that looting would be a problem after a natural disaster, that the post-impact crime rate would be higher than normal, and that marital law has, at some time, been instituted as a response to natural disaster. Actually, looting is rare in natural disasters, post-impact crime rates tend to be lower than normal, and martial law has never been instituted in a natural disaster situation in the United States. Clearly our subjects appear to be subscribers to the "Dr. Jekyll-Mr. Hyde" orientation.

In conjunction with this anti-social image, our respondents typically believed that disaster victims are generally in a state of shock and unable to cope with the situation themselves and that victims will turn first to formal agencies such as the Red cross and Civil Defense for help and sheltering. The more likely scene after a natural disaster is that the victims themselves are the first to engage in search and rescue and care for the injured, and assistance will be sought from friends, relatives, neighbors, and local groups such as churches and service organizations before the national agencies come into play.

Finally, the majority of our respondents suggested that the best assistance that a concerned citizen might offer a community stricken by disaster would be to either send money or supplies directly to the community or to go in person to help out. Both suggestions would contribute to the difficulties of the stricken community by adding to

the congestion and problems of coordination. Obviously the residents of disaster-experienced communities do not, in many cases, generalize what they observe in their own experiences to form an image of typical disaster behavior. Many times our interviewers heard such comments as: "That didn't happen here, but . . ." In other words, one's own community is special and handled the situation well but that isn't necessarily expected to be the case in other communities.

Notes

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[2]The surveys were conducted by telephone in order to replicate the conditions of the Wenger et al. study. A total of 1694 randomly selected telephone numbers were used. Of this number, 1216 numbers dialed resulted in someone answering our call (71.8%) and 907 resulted in interviews (74.6%).

[3]See Quarantelli and Dynes (1972) for detailed references concerning previous research regarding these behavioral areas.

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PUBLIC PARTICIPATION IN POLICY FORMATION

PUBLIC PARTICIPATION IN POLICY FORMATION

Janet K. Adams

The subject is clear; it is simple. Webster states it succinctly:

> public, adj. 1. of, pertaining to, or affecting the people as a whole, or the community, state or nation.
>
> participation, n. 1. the act or fact of participating. 2. a taking part, as in some action or attempt. 3. a sharing, as in benefits and profits.

The development of an effective public participation program for policy development should be as clear and simple as the definition: if the fact is accepted by policy setters, the public participates in direct relation to its understanding of a subject--and is asked to help. Public participation can be accomplished through a methodical, enthusiastic and tenacious leader or plan. It won't be easy; it will be rewarding.

Start by supposing that a hurricane hit. No one was hurt. No preventable damage occurred. No one panicked. No one issued contradictory orders. No accusations or recriminations were hurled afterwards in the press or over national TV. That would be the ideal. Is it not obtainable?

Suppose Francis Wheaton's question, asked in On the Law of Negligence one hundred and one years ago, "Why is a hurricane an act of God when by our weather signals we are able to anticipate hurricanes?", could have had a better answer than the record of devastation and death.

Our cautionary system is not adequate or people would live and buildings would stand. Common sense and safety procedures would be routinely practiced. Common, safe construction codes and zoning laws would be uniformly applied. Whether the public's non-responsiveness comes from negligence or ignorance, lack of feeling or interest, or incompetence, it is time to know why an instant response to survival procedures does not prevail. Perhaps, wolf has been cried too many times. Announcements are too routine to be heard. Fear is too minimal to create action. It is time for answers. Time to change course.

If the preventable results from hurricanes and all other anticipated acts of God (the recent Jackson flood is an example) are to be removed from a disaster list, the public must become educated, involved and responsible. How to inspire cautious, constructive, protective activities, not terror, is the fine line of action that must be found; a line that should be as invisible as the line between public participation and public awareness. One cannot be separated from the other.

In the late 20th century multiple ways exist to sell Caution Hurricane Ahead. It can be done; it must be done. It will have to be done with professional, applicable skills. Possibly, the most basic problem in attaining a satisfactory public response will be to first convince competent scientists and competent civil servants that they are not supersalesmen, media experts or a replica of P.T. Barnum. Wholesale, as it must be, public involvement and response cannot be done without first rate community organization and advertising help.

The role of the scientist, the civil defense expert, the agency or individual assigned responsibility in the war against weather hazards, is to be the coordinator, the resource specialist, the data collector, the rock foundation, the identifier of key public participation groups, because he or she, the hazard expert, presumably knows the subject better than anyone else. Certainly, the expert knows the imperatives of what absolutely has to be done; what cannot be left to develop from a public process.

If one starts with the hypothesis that to get a reaction one starts with an action, a spectrum of community leadership must be found and developed. Before seeking the leaders the in-house experts must understand and detail what is needed from the public. What dramatics must be cautioned against? Later let the community leaders determine how stark the message must be. What tough solutions must be sought? Let the public help determine how and when something must be done. Write what needs to be asked and answered in the form of briefing papers. Later use the material as the basis for an expanded questionnaire to be circulated widely.

As the agency/expert starts Caution Hurricane Ahead recall that a government agency turned to the emotional impact of Smokey the Bear to help fight fires; private enterprise developed "brush after every meal" into a household word and had it promoted by the people who presumably would profit the most if it were ignored; Volkswagon labelled a small car a Bug, and it started to sell. The connecting line there is "Simplify"; make your plan simple, your briefing papers brief, your program and needs easy to understand.

As the briefing papers are developed, develop a tough, objective evaluation list of what needs to be asked, what needs to be accomplished, why previous and existing activities were or were not successful. Analyze what the connecting responsibilities and help to be shared within a public participation program must be. List the "How to" activities that will be needed, such as:

- how to reach everyone within a described area;
- how to make the public feel responsible for implementing the program;
- how to accomplish mass involvement with the lowest possible budget;

- how to obtain funding from private industry for information projects;
- how to present a program that will excite, interest, involve every age group instantly or gradually;
- how to have a hazard without anyone being hurt;
- how to let a leaders' committee think every worthwhile thought was theirs!

Do not, while planning or reviewing, ever pre-suppose that because books have been written, pamphlets circulated, answers detailed inside a government agency, the public knows or cares, until it becomes their program and their ideas implemented. Adopt and enforce a house law that no one will ever respond to any idea with "oh, we know that; we've done that; we've planned for that" because the response, silent or aloud, justifiably will be "you don't need me or us." Produce the data, add worthwhile ideas to the program, and let the "we will help" come back as the bright inspiration and cooperation of the public. What is needed is full community participation, whether the community is a small town, the whole south or eastern seaboard or the nation, not in-house credit for past or future accomplishment.

After every conceivable pre-preparation has been made, start with the obvious leader in your area of responsibility, the highest ranking elected public official. With what should become the consistent opening phrase "we need your help," ask the official to host a working meeting of community leaders. Request that all key community decision-makers and decision-influencers from the publisher and editor of local newspapers, owners and managers of radio and T.V. stations, presidents of businesses, civic and professional organizations, unions and service clubs, educators and educational groups, be invited. Work out a key list; prepare a letter to go over both signatures, or only one if it is more politic, inviting the participants and giving the reason for the meeting; avoiding duplication of effort, follow up the written invitation with a phone call to reinforce the importance and assure acceptance. Immediately after acceptance, write a personal thank you note and send briefing papers by hand delivery. Include a brief questionnaire that will start the invitee thinking about the variety of activities and the amount of responsibility he or she will assume. State clearly that:

- we will need your thoughts on how to reach the public;
- what industries would include a fact sheet in each monthly billing;
- what industries would be likely to sponsor information activities, programs and projects;
- would a phone message center or taped information be a good idea;
- whatever seems key in your area.

Don't ask everything you need to know, but put in a tantalizer or more.

Initiate the meeting's program with infinite care. Keep subject introductions brief; let the ideas come from the guests as much as possible. Have an agenda to hand out and keep to it. If there is opposition to a proposal, try to work through the differences on the spot. If the disagreement cannot be resolved within the schedule, set an "area of agreement" meeting immediately. Don't at any point give the attendees reason to think meetings will be limited as to subject or attendance. Explore new ideas; encourage new people be invited. Don't have unnecessary meetings, but schedule the necessary ones rapidly and frequently. Keep the element of urgency in front. Hazards don't wait, neither should good programs. Keep up momentum and enthusiasm with large doses of praise and recognition of progress. By the end of the initial meeting come up with a program plan that can be started towards implementation. If preparation had been made to include the absolutes, they should be in the program by suggestion if not spontaneity.

After the leadership meeting, go public fast. Use the electronic media to the maximum.

Start by getting Public Service T.V. time for a several-hour call-in talk show.

- Find the best professional host; give every bit of data available as briefing material;
- Find the most articulate outgoing experts to participate as a resource team;
- Make arrangements to have it simulcast on radio;
- Have a first class call screening team from the League of Women Voters, because they usually have experience, to get names and addresses and screen out real cranks;
- Have the topic briefly introduced, proposals announced, firm plans detailed; then open the line to questions, answers, and ideas;
- Let the public air their concerns and solutions; have someone with authority prepared to explain how workable ideas could/would be coordinated into policy;
- Have material available, including a complete questionnaire and fact sheet, to be sent to anyone who requests it;
- Have a specific project or activity to suggest to the public at large;
- Encourage, for example, the immediate formation of block teams to plan each neighborhood's response to emergencies; have directions for implementation available to send out.

Schedule a second program if the subject was not covered adequately, and the interest indicates a desire to hear more.

As activities with the leadership team continue and newly acquired support from other sources is incorporated, move into projects that the leadership committee has helped develop. Expand the use of the questionnaire. Have the leaders assist in planning

the circulation, collation and analysis of the results. Ask for help in finding and using company and organization newsletters; finding companies (or patrons) to sponsor the questionnaire as a public service full page newspaper ad. Ask for help in quantity printing to have it available for handout at markets, gas stations, theaters, places where the public gathers. Have all printed materials bi-lingual if appropriate; and distributed door to door if appropriate.

There is always universal appeal in students' art work. There is always room for one more subject, one more poster contest, one more way for the public to be involved. Through the art and communications departments of the local schools, involve the community in producing visual displays. Do not produce a documentary in-house. Get a grant for a student production and give them all the information and support they need, but let a qualified young group produce their day of the hurricane. Get schools and recreation centers involved in a giant poster contest sponsored by local stores. Use the results in every conceivable creative way.

Get your community leaders to insist that the responsible sections of government at the national level have a sustained sophisticated publicity campaign. It would be a public service to question just how many people will know what will happen if a hurricane hits; know how many towns have dress rehearsals, what each householder knows today about what precisely to do, and how much time they might have. Ads can be shockers; ads can be life savers.

Don't restrict your meetings to your leaders. Insist that your leaders sponsor broad public information and planning sessions. Use a field house, a community hall, a large church, a school for a public meeting. Make it entertaining as well as enlightening; provide activities for little children so young parents can attend. Be corny, be serious, but get the message across.

Tailor your program to your community. If your responsibility is state or regional, set up an appropriate leaders' committee and plan activities that will not conflict with or discourage programs at other levels of involvement. Perhaps a state or regional program should restrict itself to involving private funding for major TV and radio programs; include a vehicle for obtaining and using tax-exempt private educational funds. The most major purpose of private funds is giving the ordinary citizen the opportunity to feel it is "my" program not merely something paid for with "my" tax funds--the difference is profound. If your community is small, a true community of neighbors, use the personal approaches intensively. Regardless of size never plan any special project that does not have support from the majority of your leaders' committee.

If your legal restrictions of operation require formal public hearings, hold them. Never expect the rote and routine of a public hearing to be any substitute for a true public participation program, or expect the public will be fooled.

Never underestimate how cooperative people can be if they are asked to help, given enough direction to constructively assist and not too much to dampen spontaneity or the feeling that it is their project. Be the resource, not the star.

Never underestimate that it will not be hard to do. It will take time; it will take patience; it will take flexibility. It will take follow-through and follow-up. It will take sharing of ideas and efforts that will stand cold examination as to practicality for implementation in a specific site. It will be rewarding.

If any of it is to have any long-term value, the people involved, or even peripherally involved, must have access to continuous information and purposeful projects to sustain involvement.

It will be your responsibility, until it is delegated to a professional public information specialist, to ask, entice, encourage, provide enough facts for the media to maintain a responsibility for reporting policies, process and progress.

Once a year have a follow-up Caution Hurricane Ahead meeting to reassess what needs to be done; once a year, at least, re-publish updated fact sheets and/or questionnaires.

Never forget that the public becomes involved, educated, takes care of community responsibilities, makes a process become a personal project, only when it serves a purpose that is recognized. Never forget that the public is your friends, neighbors, colleagues, and family too. to paraphrase Pogo, "Meet the public: it is you; it is me; it is us!"

PUBLIC PARTICIPATION IN POLICY FORMULATION: CONDUCTING PUBLIC MEETINGS

F. Dale Brown and
Duane D. Baumann

Dramatic changes have occurred in the role that the public may assume in the decision-making process which affects policy formulation in a variety of arenas. Only a decade ago, public involvement meant review at a public meeting or at most consultation with a few influential groups, often just prior to decision implementation (Sewell, 1976). Currently, most governmental units are aware of the need and often the legal requirements to broaden the opportunities for involvement by the general lay public. In many areas, citizens are demanding a more active role. The U.S. Corps of Engineers has been one agency that has placed a new emphasis on greater citizen participation as an integral part in discharging its responsibilities for water resource planning (Bishop, 1970; Mazmanian and Nienaker, 1976).

The Corps has been given specific and general directions in broadening this involvement. Policy of the U.S. Army Corps of Engineers dictates that its Civil Works Water Resources Program "be conducted in an atmosphere of public understanding, trust, and mutual cooperation." To accomplish this objective, the Corps outline in ER 1105-2-800 that "its planning program will:

1. Open and maintain channels of communication with the public.
2. Encourage public understanding of federal, state, regional, and local responsibilities, authorities and procedures in conducting water resources planning studies, and implementing water resources programs.
3. Present information which will assist the public in defining its water resources problems, needs and objectives.
4. Solicit the public's comments, views, and perceptions of problems, needs, alternative solutions and related impacts, and any recommendation for federal action, and
5. Give full consideration to public needs and preferences in the planning process." Aside from policy, there are several highly practical reasons for involving the public in the planning process: (1) they have detailed information; (2) they are directly affected (financially, aesthetically, etc.) and should be offered a role; and (3) if they participate, they will be less inclined to dispute or litigate, etc.

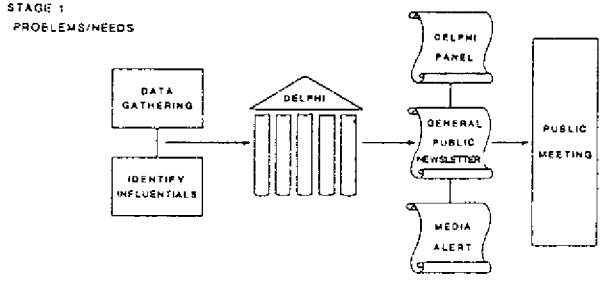
The purpose of this paper is to present a brief summary of one public involvement plan, including the conducting of public meetings, currently being employed for the

Harding Ditch and Cahokia Canal areas by the St. Louis District Office of the Corps of Engineers to devise and implement various public participation techniques at various stages of planning and thus tap previously underrepresented interests in the East St. Louis area internal flood control project. First, Stage I of a three-stage overall framework for public involvement leading up to a public meeting will be briefly described; second, the conduct of the public meeting will be delineated; third, an evaluation of that public meeting will be offered based on participants' opinions; and finally, suggestions will be made for future investigation of the potential offered by public meetings on policy formulation.

The public involvement plan devised for the Harding Ditch and Cahokia Canal area is a flexible model and draws on past experiences within the resources management field (Chevalier and Cartwright, 1971; Bishop, 1975; Borton, et al., 1970; David, 1974; Sewell, 1974; Sewell and Coppock, 1977; and Institute for Environmental Studies, 1968). The plan follows the three basic stages of the Corps of Engineers planning process: problem identification, intermediate plans, and development of detailed plans. The general objectives of the public involvement plan are: (1) to provide the public with complete and factual information on water resources needs and planning efforts; (2) to provide the public with structured opportunities to influence the formulation of the final plan for area water resources management; and (3) to provide the Corps of Engineers with information on goals perceived by the public and feedback on preferences regarding alternatives reached. Figure 1 is a visual representation of Stage I of the public involvement plan.

Figure 1

PUBLIC INVOLVEMENT PLAN
EAST ST. LOUIS & VICINITY, ILL. IFC



The main purpose of Stage I was to identify problems, concerns, and needs of the study area. This included a technical look at problems and needs, such as an indication of where and how much flooding could occur, plus the public's perception of their problems, concerns, and needs.

The first step of the public input was through the use of a Delphi Panel. Some studies have noted the role of the Delphi technique for eliciting and refining local "informed opinion" in the determination of water resource plans (Helmer, 1966; Harman, 1975; Linestone and Turoff, 1975; and Pill, 1971). The local leaders were identified by the use of the Issue Specific Reputational Survey (Bonjean, 1971; Clark, 1968 and 1973; and Willeke, 1974) and were selected to the panel on the basis of residences, involvement, and reputation (Ervin, 1974). The selected Delphi panel was a group of approximately 35 public officials, technical experts, and knowledgeable and interested citizens who were familiar with the water resources in the study areas. The panel also included several persons who had a regional overview of the entire study area.

Prior to the public meeting, a public fact sheet was developed and issued which explained the study and the Corps' planning process, and informed the public of the forthcoming public meeting. Fact sheets were mailed to the Delphi Panel and selected agencies and various individuals. Included in the fact sheets was a preregistration form asking indiviudals: if they planned to attend the public meeting; for mailing of addresses of others they felt should be contacted; for their geographic area of concern and group reference (i.e., farmer, resident, public official, etc.); and for any comments or questions they wanted made known to study officials. In addition to the fact sheet distribution, press releases and announcements were developed and sent to the various media.

The public meeting was held on April 25, 1978 at a high school centrally located in the study area. Approximately one hundred people were in attendance. The agenda was followed and ended shortly before the projected time of adjournment. The first element of the agenda involved registration.

Participants were met at the door by two greeters and given a packet of materials which included the agenda for the public meeting, a copy of the public fact sheet describing the study, and materials to be used in the small group sessions. Participants were also asked to complete a registration form which requested individuals' demographics. Space was provided on the registration form for participants to indicate issues or concerns they had regarding the study. On the basis of registration information, participants were assigned to one of four small groups for subsequent small group sessions within the public meeting.

The next activity on the agenda was a large group meeting of all in attendance with the traditional opening introductions conducted by the Corps representatives followed by

introductions of VIPs in attendance. These introductions were followed by a slide presentation with narration to the group which provided an overview of the study area and the progress of the study to date.

Following these activities, the small group session activities were introduced, and their purpose and the roles of the individuals involved were explained. The small group sessions functioned as a variation of the nominal group process. Several studies have attempted to improve the usefulness of public meetings by using this systematic technique to collect and to analyze citizen viewpoints (Delbecq and Van de Ven, 1971; and Rosenbaum, 1976).

In the small groups, individual topics were raised by the public, were discussed for several minutes so that other factors and concerns about that topic could be brought forward, and finally, these topics were rated by each individual on rating sheets provided. This process continued over a specified time period. At the close of the small group sessions, participants were requested to evaluate the effectiveness of the meeting.

After the small group sessions, the meeting participants reconvened in a final large group session during which the group facilitators presented a brief summary of the small group interaction. Following the summaries, the study schedule and further opportunities for public involvement were explained.

The conduct of the public meeting was designed to provide to the public an opportunity to provide input to the formulation of the study activities and resulting planning. Did the participants believe they had an opportunity to provide input? How did the public perceive the small group process utilized in the public meeting? The results of the evaluation provide some indication that the participants felt the small group sessions were valuable.

One purpose of the small groups was to allow the participants to presents their problems and concerns. Those attending rated the small groups very effective (3.09 on a scale of 0, "not effective," to 4, "extremely effective"). In fact, no one at the public meeting rated the small groups not effective. Next, the participants had been asked to rate the opportunity to provide their input. On this question, the people rated the opportunity a value of 3.25. Again, the respondents "agreed" or "strongly agreed" with the statement that they had an opportunity to give their input. About 3.2 percent of the people stated that they had no opinion and no one disagreed with the statement that they had had an excellent opportunity for input.

Attendees were asked to compare this meeting with other Corps public meetings where the Corps presents information in a large session and accepts questions or comments from the group as a hole. People who had attended other Corps public

meetings rated this meeting 92.3 percent "better" on an exchange of viewpoints, 90.9 percent "better" on facilitating public participation, and 63.6 percent "better" for generating useful information. Concerning small groups, 91.7 percent rated them "better" as a communication device compared to other public meetings where this format was not used. Overall, the public evaluated this type of meeting as being very effective and very useful at providing a good forum for discussion.

It seems that in this case study participants in the planning process assessed their opportunities in the public meeting for input and interaction highly. It is a case where development of mutual confidence and respect appears to have begun. It is an example of how public preferences were collected and how the project has developed, reflecting and combining public viewpoints with professional knowledge, within the constraints and capabilities of the Corps, in hopes of obtaining a more acceptable flood control plan and subsequent policy.

However, it is recognized that this case study was not a controlled research effort on the activities involved. What needs to be done appears to be a controlled research effort whereby traditional and non-traditional formats are utilized to provide the public an opportunity through public meetings to provide their input to the formulation of future plans of action and future policy. Which formats and techniques prove most effective and efficient? How might public awareness and knowledge be increased? These are but a few of the questions which might be addressed. Systematic research may provide additional insight and direction.

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ORGANIZING AN AERA WIDE PUBLIC PARTICIPATION PROGRAM: THE DEVELOPMENT OF NEW JERSEY'S COASTAL MANAGEMENT PROGRAM

David N. Kinsey

Public Participation and the New Jersey Coastal Planning Process

At the outset, it must be noted that there never was a free standing, isolated public participation element in the development of the New Jersey Coastal Management Program. Rather, public participation activities were totally integrated into the activities of the agency responsible for coastal management. As one of the major units with the State Department of Environmental Protection (NJDEP), the Division of Marine Services has responsibility for coastal regulation, coastal planning, shore protection, marine law enforcement and management of the state-owned tidelands resources. Within the Division of Marine Services the Office of Coastal Zone Management has the lead responsibility for the development of New Jersey's coastal management program under the federal Coastal Zone Management Act. No single document was prepared by the agency to spell out precisely what activities would be undertaken to involve various "publics", or what degree of political power would be shared with which "publics" in the development of the coastal management program. Rather, a commitment to involve various "publics" pervaded the activities of the agency as a matter of philosophy of government, in addition to the general requirements for public participation established by the federal Coastal Zone Management Act.

A brief historical review of the development of New Jersey Coastal Management Program will highlight the various techniques used and types of participation sought in the New Jersey coastal planning process.[1]

In the early 1970's, the New Jersey Legislature enacted two major coastal protection laws as a result of citizen and environmental group advocacy, coupled with legislative and administration agency initiative in the heyday of the national environmental movement. The Wetands Act of 1970 led to a series of required public hearings on a county by county basis that provided a forum for outraged property owners to protest the proposed state delineation, to be allowed by strict regulation, of privately-owned coastal wetlands. The Coastal Area Facility Review Act, passed in 1973, required public hearings on each permit application for a state permit for a major coastal development. Attendance at hearings ranged from 0 to 400 people, with hearings lasting from 5 minutes to 4 hours, depending upon the public interest in the proposed project.

The Coastal Area Facility Review Act (CAFRA) also required preparation of a management srategy for the coastal area in four years, with an inventory due in two years, alternative management strategies due in three years, and the final coastal management strategy to be selected by the end of the fourth year, by September 19, 1977. As the timetable and requirements of the state law coincided closely with the provisions of the federal Coastal Zone Management Act, NJDEP coastal planning staff used a single planning process to meet the shared objectives of state and federal law.

The public phase of the coastal planning process began in February, 1975 with the convening of two large, somewhat poorly defined, separate gatherings for public agency representatives and citizen organization representatives. Advertised as the beginning of the coastal planning public participation effort, this project had a false start as the various publics were confused due to the association of the coastal planning process directly with an experiment on "data validation" funded by the Rockefeller Foundation and carried out by the Research Institute of American Arbitration Association.[2]

In addition to the three-step planning process mandated by CAFRA, the preparation of Interim Land Use and Density Guidelines for the Coastal Area during 1975-1976 (at the request of a three cabinet member, Coastal Area Review Board as part of a decision on appeal upholding the first denial by NJDEP of a CAFRA permit application) provided the state coastal planning staff with invaluable proving grounds to develop and test public participation techniques. The Interim Guidelines project provided the vehicle for the involvement of an intentionally limited number of representatives of only key segments of the public, as the public aspect of the coastal planning process began in earnest in mid 1975.

NJDEP's coastal planning staff and its consultant shared draft work products on the Interim Guidelines and met with representatives of New Jersey's environmental organizations, New Jersey Shore Builders Association representatives, and coastal county planning directors. These informal meetings and workshops served the purpose of exchanging information, providing a select audience to try out policies as "trial balloons," building support for the interim policies in advance of the required 1977 Coastal Management Strategy, and developing credibility for the NJDEP coastal planning staff.

Formal public release of the printed Interim Land Use and Density Guidelines for the Coastal Area in July, 1976 provided the NJDEP coastal planning staff with the first visible, tangible policy document that could be taken to a series of open public meetings, held in the evenings at four different locations in the coastal area, in addition to continuing workshops with interested groups and meetings with colleagues in other elements of the State Department of Environmental Protection and other state agencies.

Three months later, the October, 1976 release of the next document required by the state-mandated coastal planning process, Alternatives for the Coast - 1976, provided the opportunity to cast a wider net of open public meetings, workshops with interest groups, and meetings with colleagues to seek and obtain comments and feedback. This time a half-dozen public meetings took place throughout the state, including areas outside of the traditional New Jersey shore area (from Sandy Hook to Cape May Point), such as Hoboken, New Brunswick, and Camden, all urban waterfront locations. Again, informal workshops with groups such as the Economic Development Committee of the State Chamber of Commerce, New Jersey Builders Association, Marine Trade Association of New Jersey, federal agency representatives, and coastal county planning agencies complemented the open public meetings.

Completion of the Coastal Management Strategy for New Jersey - CAFRA Area, which was submitted as required by state law in September, 1977 to the Governor, Legislature and public by the Commissioner of Environmental Protection, provided another opportunity for the same cycle of the statewide open public meetings, informal workshops with interest groups, and working sessions with colleagues in federal, state and local agencies. In addition, prior to publication of the Coastal Management Strategy, the Commissioner of Environmental Protection and his senior staff spent a full day meeting with a half-dozen leaders of New Jersey's environmental movement to obtain their comments and advice after a quick review of the pre-publication draft of the Coastal Management Strategy. A similar informal meeting took place with representatives of the New Jersey Builders Association. Significant revisions were made to that important policy document before its release as a result of those informal high-level discussions.

While the Coastal Area Facility Review Act mandated that the Commissioners of Environmental Protection select a coastal management strategy and submit it to the Governor and Legislature, the law was silent on the next steps to be taken. The state's participation in the national coastal management program provided an opportunity to refine further the adopted coastal policies, provide additional public scrutiny of the developing policies, and give the policies the force of law with their adoption as agency rules following the procedures of New Jersey's Administrative Procedures Act.

Consequently, the next step for the NJDEP coastal planning staff was to analyze fully all of the written and verbal public comments received on the Coastal Management Strategy (September, 1977), based on staff notes taken on the public meetings and correspondence received, to prepare a document with written responses to the public comments on the Coastal Management Strategy. NJDEP coastal planning staff revised the Coastal Management Strategy, placed it in the single document format adopted by the

National Oceanic Atmospheric Administration, Office of Coastal Zone Management (NOAA-OCZM) of a combined proposed state coastal management program and draft environmental impact statement, and subjected the draft to critical review by NOAA-OCZM staff, as well as by the key members of the public involved in the New Jersey coastal planning process.

Again, NJDEP staff used the technique of circulation of a pre-publication draft to a selected group. One hundred copies of a pre-publication draft were duplicated and distributed to a small group of state agency representatives, environmental leaders, business leaders, builders, oil, gas, and electric generating industry representatives, and county planning agencies, who were invited to a special, full-day Saturday workshop to review the draft program and policies. A good turnout and vigorous, helpful discussion took place, largely due to the reputation earned by the NJDEP coastal planning staff over the years, for its willingness to consider recommended policy changes. The spirit of openness that pervaded that exercise also helps explain the success of the review of the pre-publication draft. The Commissioner of Environmental Protection received the same pre-publication draft as the Executive Director of the American Littoral Society and the counsel on coastal management of the New Jersey Shore Builders Association.

To introduce a note of levity to the process, and to provide a test to determine if readers actually pored over the full, multi-hundred page text of the pre-publication draft, NJDEP's coastal planning staff included one humorous policy, to mimick the coastal planning staff's own work. The proposed policy on Unidentified Flying Objects (UFO's) was presented, without a break in stride, in the same format as policies on stormwater runoff and scenic design. The role of humor of public policy formulation should not be underestimated, as the short-lived proposed coastal policy on UFO's did much to maintain the agency's reputation as humane planners, rather than being faceless bureaucrats.

After further state and federal review of the pre-publication draft, the next major coastal planning document included the coastal policies as formally proposed substantive rules. NJDEP then repeated the same cycle of public review, discussion, comment, and agency response. The proposed coastal policies appeared as the core of the State of New Jersey Coastal Management Strategy - Bay and Ocean Shore Segment and Draft Environmental Impact Statement (May, 1978). Three formal joint federal-state public hearings took place on that document, as did additional workshops with interest groups, and meetings with colleagues on the entire document, as well as special sessions on stormwater runoff. State coastal planning staff reviewed all of the hearings transcripts, written comments, and verbal statements and identified more than 1,000 discrete comments. State coastal planning staff then considered and made many policy changes

and prepared a written response to each comment. The Commissioners of Environmental Protection then adopted the coastal policies as agency rules. The Governor then certified the Coastal Management Program as state policy. Finally, the State of New Jersey Coastal Management Program - Bay and Ocean Shore Segment and Final Environmental Impact Statement (August, 1978), prepared by NJDEP and NOAA-OCZM, was published and then duly approved by the Assistant Administrator for Coastal Zone Management of the National Oceanic Atmospheric Administration on September 29, 1978.[3]

A Dozen Lessons Learned

Four years of experience working with literally hundreds of individual citizens, interest groups, federal, state, interstate, regional, municipal, county local agencies, universities, and civic groups in shaping the myriad public policies packaged together to constitute the New Jersey Coastal Management Program suggests at least a dozen lessons on how to involve people and agencies in shaping a program that will affect their lives and programs.

1. Share planning responsibilities between full-time agency staff and the various publics.
2. Recognize a diversity of "publics."
3. Integrate public participation in all aspects of public agency activities.
4. Use public agency leadership in public meetings and other public participation activities.
5. Pay attention to administrative details.
6. Cultivate the media and develop a diverse publications program.
7. Provide feedback to the public.
8. Distinguish participation from advocacy.
9. Monitor public participation efforts and create internal feedback systems.
10. Establish realistic indicators of program success.
11. Be candid and direct with "publics" and expect occasional hostility.
12. Do not expect to be loved by all "publics."

Conclusion

Robert Louis Stevenson, author of Treasure Island, once wrote:

> Politics is perhaps the only profession for which no preparation is thought necessary.

Public participation is politics, and Stevenson was wrong.

Organizing an effective public participation program is not difficult; it simply requires common sense, persistence, an open mind, a sense of humor, and some advance planning.

Notes

[1]For a more detailed explanation of this process, see "Appendix A: The Coastal Planning Process: 1973-1978," in State of New Jersey Coastal Management Program - Bay and Ocean Shore Segment and Final Environmental Impact Statement (August 1978), prepared by the New Jersey Department of Environmental Protection and U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of Coastal Zone Management.

[2]For more information on this research and development effort initiated in the early stages of New Jersey's coastal planning process, see Michael R. Greenberg and Donald P. Straus, "Upfront Resolution of Environmental and Economic Disputes," Environmental Comment, May, 1977, pp. 16-18.

[3]For a summary of the national perspective on public participation and coastal management, see Dallas D. Miner, "Citizen Involvement: Problems, Progress, and Promise," Environmental Comment, November 1977, pp. 11-12

COMPUTER MODELS OF DISASTER EFFECTS

ECONOMIC IMPACT POTENTIAL OF HURRICANES

Don G. Friedman

Information Needs

Rapid population growth is occurring in coastal sections of the Gulf and Atlantic seaboard. Many of of the densely populated areas have not experienced the full force of a severe hurricane since this period of accelerated growth began. Estimates of a hurricane's possible effects upon population are needed for emergency planning purposes. However, casualty impacts of past storms cannot always be used directly as measures of present risk because conditions have markedly changed since the time that these hurricanes occurred.

For similar reasons, loss experience from past hurricanes cannot always be directly translated into a measure of damage potential to present properties. The number, geographic clustering, value, damage susceptibility and cost of repair of properties have changed with time. To estimate present risk it is more important to determine the effect a recurrence of the 1921 Tampa hurricane would have upon present-day buildings and their current damage vulnerabilities than to rely on the original effect of this storm upon buildings in 1921 and their loss vulnerabilities at that time.

Important Factors

The magnitude of a hurricane's casualty and economic impact that is caused by two of its more important damage producers, wind and storm surge (water pushed onshore by the wind as the storm approaches land), depends upon the interaction of the geographical patterns of high winds and coastal flooding with the spatial array of population and properties in the affected coastal areas. A typical pattern of maximum wind speeds resulting from the inland passage of a hurricane has the highest speeds along the shoreline near and slightly to the right of the path of the storm's center. Peak winds decrease as the storm moves inland. The resulting geographical pattern of maximum wind speeds swept out by the hurricane is a nonsymmetrical bell shape with its base on the coastline.

The interaction of four factors determines the magnitude of a hurricane's economic impact, including the possible production of a natural disaster. The first factor is the geographical distribution of hazard severity. For wind, it is the pattern of highest wind which occurred during the storm's passage. The geographical extent and depth of coastal inundation represents the severity pattern for the storm surge hazard. The second factor is the type, spatial spread and density of the property which is exposed to the effect of

wind or storm surge hazards. Types of property can be defined, for example, in terms of commercial, industrial or apartment buildings, dwellings, mobile homes and automobiles.

The third factor is the vulnerability of these properties to damage of a specified severity when they are subjected to a given wind speed or flood depth. Information based on insurance claim files suggests that damage vulnerability of buildings in general increases disproportionately as winds become exceptionally high because damage production is related to wind pressure which is a function of the square of the speed. The fourth factor is the effect of local conditions in modifying the severity of the event at a given location. For the wind hazard, differences in the degree of exposure to high winds caused by topography, urbanized areas, open countryside, or tree-covered valleys can markedly affect speed of the wind. For the storm surge hazard, elevation, distance to coastline, type of shoreline (open beach, bay, estuary), depth of offshore water, or the existence of some form of coastal protection such as a seawall affects the severity of the surge at any given coastal location. The spatial interaction of these factors determines the loss producing potential of the hurricanes.

Method of Approximation

For a number of purposes, including insurance, it is necessary to attempt to determine the economic impact potential of hurricanes to present-day properties using whatever pertinent information that is currently available. One method that has been found to be useful is the utilization of computer simulation techniques for approximating the overlapping and interaction of the storm patterns with the spatial arrays of property. In order to apply this technique a means is needed for obtaining a detailed quantitative specification of the geographical arrays of various properties at risk in the United States. A number of disadvantages tend to discourage use of the county as a basic geographic unit. The most critical defect is that population, hence property, is not uniformly distributed within individual county areas. In addition, because of the large variation in county size and shape, it is difficult to determine a representative wind speed or surge depth that would apply equally to the entire area of each county when it is affected by a hurricane.

To obtain a more detailed representation, a computerized grid system has been constructed which is based upon a one-tenth of a degree latitude by one-tenth of a degree longitude unit grid. About eighty-five thousand units are needed to represent the three million square miles area of the forty-eight contiguous states. There are about three thousand counties in these states so the average sized county includes about thirty grid areas. Each grid unit contains about thirty-six square miles at the latitude of northern Florida. Approximately fifteen hundred and fifty grid units are required to represent the land area of the state of Florida.

Information on various properties-at-risk, their vulnerability relationships and local influence factors can be assigned to each grid. For general assessment purposes, a detailed measure of the geographical distribution of the two hundred and twenty million persons and fifty million single-family dwellings in the United States has been obtained by allocation of a number of persons and properties to the appropriate grid unit addressed in the computerized data bank. In addition to hurricanes, this national grid system also is being used to estimate the economic impact potentials of other natural hazards (winter windstorms, thunderstorm-spawned tornadoes, wind and hail, and earthquakes) in various sections of the contiguous United States.

Specification of the geographical severity patterns (maximum wind speed and storm surge) that can be expected to develop during passage of a hurricane which has a particular combination of physical characteristics (storm intensity, storm size, rate of movement, and path) also had to be made. To provide a means of approximating these patterns, mathematical generators have been developed. These computer-derived patterns are compared and verified with actual storm patterns whenever possible. In general, they provide adequate approximations of observed conditions, although each storm has its own uniqueness. Wind speeds in a hurricane are subject to considerable gustiness so that maximum speeds are stochastic in character. Computed winds represent expected value. In any given storm at a specified location, the actual wind would probably deviate from this average value. However, there are internal consistencies and physical constraints on pattern size, shape, and maximum wind speed among storms with comparable physical characteristics. It is these pattern consistencies on which the mathematical generators are based.

The generated patterns are mathematically superimposed upon the spatial arrays of property in the affected coastal area. Interaction of the damage vulnerabilities of property in the arrays with these severity patterns (wind and storm surge) provides a measure of the impact potential of a hurricane of prescribed physical characteristics (intensity, path, size, speed). Summarization of the computed effects can be made by individual grid unit, county, state, wind speed or storm surge depth category. Economic impact potential of a simulated hurricane to a specific kind of property such as buildings of a given type can be expressed in terms of the number of buildings that are exposed to winds and storm depths of a given magnitude, the number that would be damaged, and the amount of damage to the affected buildings.

Damage Producing Potential of Saffir-Simpson Coded Hurricanes

A "benchmark" economic impact to present-day properties can be estimated for each urbanized coastal area for comparison with computed impacts resulting from the

simulated recurrence of past hurricanes or hypothetical new ones. This reference level impact would result from the occurrence of a severe intensity hurricane that had an optimal combination of physical characteristics (path, size, speed) which would maximize the storm's damage production in the particular coastal area. The combination of physical characteristics with storm intensity must be consistent with the hurricane climatology of the area.

To determine the magnitude of this maximum likely impact, it is desirable to attempt to isolate the effects of two major influences. One influence is intensity of the hurricane which establishes the general level of its damage-producing capabilities. The second influence is the overlapping of the storm's wind and storm surge patterns with the geographical distribution of the properties at risk. This overlapping and interaction determines the degree to which the damage-producing capabilities of the hurricane are actually realized.

The Saffir-Simpson scale (one to five, five being the most severe) can be used as the basis for classification of a hurricane's intensity as measured by its lowest barometric pressure. This scale for hurricanes is, in a sense, comparable to the Richter scale for earthquakes. Both scales can be used as indicators of the overall loss-producing potential of these geophysical events. The scale suggests that all hurricanes do not have the same damage-producing potential. It is not possible to estimate the overall damage potential of a hurricane directly from its Saffir-Simpson code. Wind speeds and storm surges given in the definition of each of the five intensity categories represent the highest values to occur anywhere in the storm area. These maximum winds and surge depths would likely affect only a very small land area near and slightly to the right of the path of the hurricane's center as it makes landfall. Although these highest values could be significant damage contributors, the overall damage production of a hurricane depends upon the entire geographical pattern of wind and storm surge which results from its passage.

To determine the relationship between the Saffir-Simpson intensity and total damage-producing potential of a storm, a number of hurricanes of different intensities were simulated to move across a coastal plain on which exposed properties are uniformly distributed with maximum possible density. Results of these simulations suggest that the overall damage potential of Saffir-Simpson code 4 and 5 storms is disproportionately greater than expected from the weaker hurricanes (coded one and two).

Portion of a Hurricane's Damage Potential that is Actually Realized

The total damage-producing capability of a hurricane is never fully realized because the actual spatial distributions of the properties-at-risk are not uniformly distributed and dense across the entire coastal plain that is affected. The New York metropolitan area

comes closest to having densely clustered property uniformly distributed on a long stretch of coastline. Each urbanized area on the Gulf and Atlantic coastline has its own unique geographical pattern of population and, hence, properties relative to the coastline. This density configuration determines the optimal combination of path, storm size, speed and intensity that a "benchmark" hurricane would need in order to maximize its damage production in that particualr area.

For illustration, the density configuration of the Houston-Galveston urbanized areas is different from that of Miami-Fort Lauderdale or New Orleans so that the respective "benchmark" hurricanes would also differ. For the Houston area a comparison of many simulated occurrences suggests that the "benchmark" storm would make landfall on Galveston Island southwest of that city and would move inland rapidly on a northwesterly course that would sustain and carry its highest winds directly across the urbanized areas which lie some distance inland. However, even under these conditions only about one percent of the total damage potential of the hurricane would be realized. The simulated economic impact of this "direct hit" by a severe intensity hurricane is nearly three times greater than that caused by a simulated recurrence of the 1900 Galveston storm and nearly six times greater than the calculated impact from a recurrence of the 1915 Hurricane.

The question of whether the computed impact of the "benchmark" hurricane is unrealistically large for a given coastal area can be examined by "shifting" the track of recent severe hurricanes so that they make a "direct hit" upon the coastal area under consideration. For Houston, impacts resulting from the recurrence of seven severe intensity hurricanes that affected coastal areas of the northwestern Gulf of Mexico in the past quarter century were computed. These storms were Audrey, Carla, Hilda, Betsy, Beulah, Camille, and Celia. Each hurricane was simulated to pass along two different paths: the original one and a displaced track that would carry the storm's highest winds across greater Houston. Economic impact along each path was calculated and compared with the impact of the Houston "benchmark" hurricane. Six of the seven hurricanes produced greater damage potentials when they moved directly across Houston than when they were simulated to follow their original tracks. The geographical extent and density of property in the Houston-Galveston metropolitan areas results in a greater percentage of the hurricane's overall damage potential being realized. Direct hits on Houston by the seven storms produced simulated damages by four of them that ranged from sixty to one hundred precent of the "benchmark" hurricane's impact. It was just as likely that one of these storms could have moved across the Houston area, so the "benchmark" impact does not appear to be unreasonably large.

Impact Assessment Using Currently Available Information

In spite of some disadvantages, computer simulation techniques provide one means of utilizing the meager amounts of pertinent data and information that is currently available for making an assessment of the economic impact of hurricanes to the present-day array of properties along the Gulf and Atlantic seaboard. Results of the simulation analysis provides at least order-of-magnitude insights into a hurricane's damage-producing mechanism which cannot be obtained using other approaches. Interpretation of the results emphasizes the need for having a better understanding of the characteristics of hurricanes in relation to storm frequency by location, intensity and path; and the size, shape, overlapping and interaction of the storm's wind and surge patterns with the geographical distribution of the properties-at-risk, including the influence of local conditions. Of primary importance is the need to have an up-to-date detailed inventory of various properties (residential and commercial buildings, industrial structures, mobile homes and so forth), their spatial distribution, and vulnerability to the hurricane-spawned hazards.

THE WHARTON INTERACTIVE MODELING SYSTEM

Louis Miller

Introduction

Purpose of WHIMS. The Wharton Interactive Modeling System was developed in order to supply a model-based approach to help decision-makers compare costs and benefits of alternative combinations of adjustments to natural hazards.

The Nature of WHIMS

A. What WHIMS Models Do (Fig. 1)

Micro Models, Entities, and Attributes. WHIMS models deal with representative samples of entities in a flood-prone area. The entities may be homeowners, businesses, farms, or public facilities, although most of our attention so far has been addressed to homeowners. The viewpoint is micro in that WHIMS models operate on individual entities rather than aggregates.

An entity is represented by a set of "attributes" (Stage 1). An attribute is a characteristic having a value specific to a particular entity. An example of a set of attributes and their values is given on Page 7 of An Interactive Modeling System for Disaster Policy Analysis. Prior to running a model every entity involved in the simulation has a "record" of attributes. For homeowners, attributes of interest would relate to socio-economic and financial characteristics, along with physical aspects of the property.

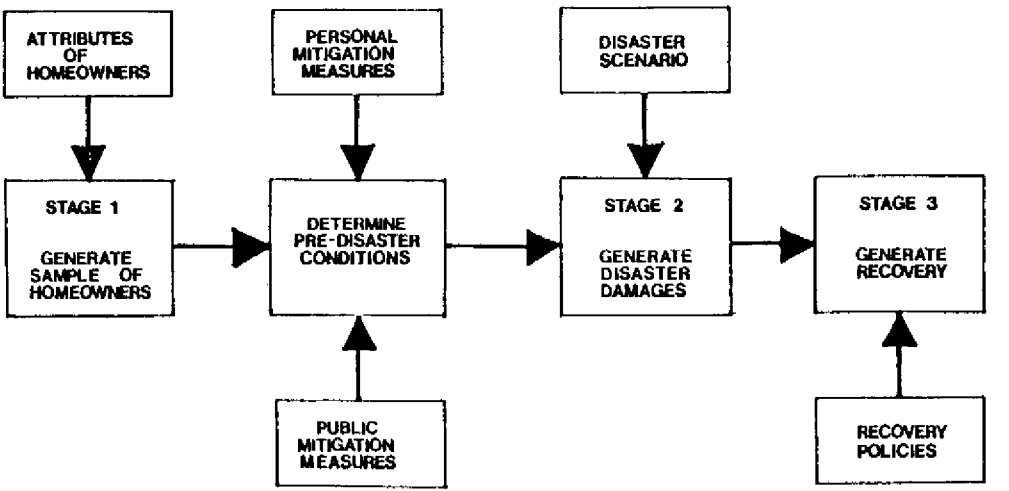
Data for Attributes. Some of the data needed to develop a simulated group of homeowners would come from surveys such as those done by the Corps of Engineers in their Level C studies. Not all of the required data are obtainable in this way. To fill in the gaps we use models that are based on other surveys, including the census, various studies relating to individuals' finances, and our own survey. Efforts along these lines are an important part of the project, and are described in the paper, "Extensions to the Financial Sector."

Scenarios. A "scenario" (Stage 2) to be simulated consists of a specification of a set of mitigation measures and policies relating to opportunities for recovery from a disaster, along with specification of a flood of given severity. It is likely, however, that for some purposes it may be desirable to examine the effects of mitigation measures operating over time without a flood occurring.

Figure 1

DISASTER MODELS

Pre-disaster to Post-disaster Recovery



Computations Performed by WHIMS Models. The action of a WHIMS model is to have the entities interact with the elements of the scenario. All the effects of these interactions are computed and as values for additional attributes of the entities. (That is, WHIMS models extend the length of the entities' attribute records by creating more attributes, and the effects of the scenario on an entity are reflected in the values of the added attributes. For a specific example, see page 7 of An Interactive. . . .)

After running a WHIMS model, the user is left with a "file" of records, each record containing the values of one entity's attributes. An entity record contains the attribute values that existed before the simulation and those that were created by running the model. The file is stored in the computer's "disk file" system, where it is available for further processing by the WHIMS analysis system or even other WHIMS models.

The Analysis System. One may make any number of model runs, varying elements of the scenario. Since the results of a simulation are lots of numbers stored in a file, they are not readily usable by humans. Therefore, WHIMS contains an analysis subsystem for the purpose of aggregating, summarizing, comparing, and displaying results. It is through the analysis system that information provided by models is obtained (Stage 3).

B. Structure of WHIMS Models

A WHIMS model is composed of a number of submodels, and each of these is built up of one or more computer "routines" (sort of mini computer programs). In the model subsystem of WHIMS, a routine is designed to compute the value of some specific attribute or (small) set of related attributes. In general, routines use values of other attributes (e.g., to compute the amount of an insurance claim, the amounts of coverage and the damage must be known). The "used" attributes may either be in the original entity attribute records, or they may have been computed by other submodels.

In addition to attribute values, routines usually need other data that is associated with the routines themselves rather than specific entities. Examples are tables used in damage estimation or parameters for computing the deductible amount of an insurance claim.

C. A Conceptual View of WHIMS

Figure 2 depicts an abstract view of WHIMS in the belief that one should be aware of these elements to understand what we are dealing with.

Operating System. At the top is the "WHIMS Operating System," which is a large interactive (users and the computer hold a conversation) computer program to help users organize and run models and analyses. The main function is to allow users to assemble models and analysis procedures from routines that have been placed in the "WHIMS library." The idea is to have highly modular models to achieve a great deal of flexibility

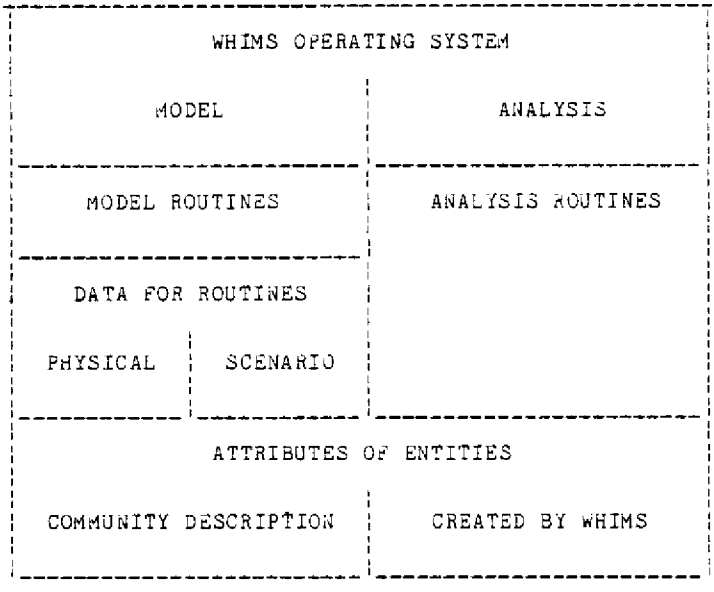


Fig. 2 -- WHIMS Elements

so that new models can be created and old ones can be modified with a minimum of time, trouble and expense.

Routines. The specification of "what happens" to entities during a simulation is embodied in the model routines. It is these routines that incorporate our understanding and theories about the phenomena that take place when policies and hazards interact on individuals in a community. Models vary one from another through the choice of the routines that are selected to comprise the model. The operating system helps the user in selecting routines and it has the job of insuring that a set of routines that comprise a model will all work together.

Data. "Physical data" is the numerical information needed by a submodel to do its job (e.g., tables for damage estimation). "Scenario data" refers to user-supplied information that is associated with an experimental design (e.g., deductible amounts, interest rates). (WHIMS does not make a distinction between these two categories of data, but it is helpful for users to think in these terms.)

Attributes. At the bottom of Figure 1 is the entity attribute data, where a distinction is made between the input attributes, comprising the starting description of the community, and the attributes created by the actions of routines in a model. The attributes are processed by the analysis system in order to produce useful output.

D. A Challenge of Modeling

Although a great deal of effort has already been expended on the development of WHIMS, it must be appreciated that it is not magic. Our particular concern is that one can only model phenomena that are understood. In order to undertake the analysis of a policy, we have to be willing to make a precise statement of how the policy affects attributes of the entities, and the necessary data must be available.

References

Kunreuther, et al. (1978). An Interactive Modeling System for Disaster Policy Analysis. Institute of Behavioral Sciences, University of Colorado.

CONCLUDING REMARKS

AN ADMINISTRATIVE PERSPECTIVE ON HURRICANE RISK

CLOSING REMARKS

William H. Wilcox
Associate Director for Disaster Response and Recovery,
Federal Emergency Management Agency

I am going to take a few minutes to run through some of the things I think I heard at this conference: some of the things at meetings; some of the things in papers; and some of the things that folks have pulled me off to the side to talk about. Then, I would like for you, governor O'Neil, to react to my points.

First of all, John Macy, the Director of the Federal Emergency Management Agency wanted very much to be here; he has specifically asked me to advise you that he is very much committeed to seeing the federal government take more of a leadership role, a more effective role, a more aggressive role, in the whole issue of hazard mitigation in the broad panorama that term means. In fact I think that working on hazard mitigation is going to be the primary thrust of the Federal Emergency Management Agency above and beyond the ongoing responsibilities that you all know about.

Yesterday one of the panels said that the 70's was the decade of good laws and that the 80's ought to be the decade of good implementation of those good laws. I think we've already got the foundation, Governor O'Neil, in the President's Executive Order on flood plain management, the organization of the Federal Emergency Management Agency to bring together a variety of activities, and the barrier island studies--one of them by the Department of Interior and another financed by the National Science Foundation. Even in the area of the new emphasis on Regional Economic Development Commissions with the new legislation which may soon be passed by Congress, I think we see an opportunity for more emphasis on hazard mitigation and finding ways in which we as Americans and human beings can work effectively with Mother Nature rather than as has been our traditional practice of working in conflict with Mother Nature.

Now, there are perhaps four or five things I think I heard come out of this conference. The first one deals with the issue of evacuation in connection with hurricanes, and I think that maybe these comments are most applicable to the southern coastline and the Gulf coast, but I think--particularly given the experience that you have had in Massachusetts--it applies to the northern coast of the

Atlantic area as well. Given the present and expected future hurricane forecasting capabilities, in most cases we cannot evacuate the affected population within the warning time available. I understand the warning time is perhaps 12 hours; the evacuation time in many situations is 18 hours. That means we have to look toward vertical evacuation. I should say that in addition to speaking to you as Lt. Governor of Massachusetts for the Commonwealth of Massachusetts, I think we are speaking to you here today perhaps more importantly as Chairman of the Association of Lt. Governors of the United States. Many of these Lt. Governors are involved in one way or another in environmental issues and disaster response, as the Lt. Governor himself is and the Lt. Governor of Pennsylvania is, as are other states which are involved in mitigation. But with respect to vertical evacuation, which is the only alternative to the traditional method of just moving inland, I think there are two or three steps that are really needed. First of all, we need to inventory available high-rise structures, including an examination of the structural integrity of those buildings. Obviously, they cannot be used for vertical evacuation if they themselves would become victims of a hurricane. Secondly, any future high rise structures, public or private, should be built to accommodate a certain design number of evacuees. And third, various levels of government--and this is very important--should right now begin to execute agreements with the owners of private buildings for the use of those buildings for vertical evacuation. I think I heard at this conference that if we don't do those things with respect to evacuations, we are very likely to have perhaps 4,000 deaths as well as the enormous property damage that has been talked about here.

The second thing I would like to suggest is that we in the disaster business ought to stop fragmenting ourselves. Instead of talking about building standards for floods and building standards for hurricanes and building standards for earthquakes, we ought to be talking about a disaster-mitigation building standard. We could take a leaf from the book of the energy people who have a single nationwide standard for energy conservation. What we need--and I've talked to enough experts so that I'm satisfied that there is a community of interest between the flood people and the hurricane people and the earthquake people (perhaps not quite so much with the tornado people, but even there to some extent)--is a national standard much like the one which serves the people interested in building for energy conservation.

Thirdly, I think we need to put more emphasis on more aggressive use of flood insurance.Certainly my brothers and sisters in the Federal Insurance Administra-

tion, now part of FEMA, are doing everything they can, but we all can help sell more flood insurance policies. I think a good job is now being done by the states and by the Federal government in getting communities to qualify for flood insurance. Now I think we need to get out there and persuade the insurance agents and the individual families that are exposed to floods to purchase flood insurance. We favor implementation of Section 1362, which would permit the FIA to buy properties that have been damaged over and over again as a result of floods.

We hope that the Flood Insurance Administration will address the issue that has been raised here about wave heights. The 100-year flood level is now assumed to be the level of still water. Everybody knows that enormous damage is done by waves, and a gentleman yesterday afternoon showed slides indicating the damage that could occur above a hundred year flood level.

I think that we need to establish liaison with the regulatory agencies in the federal government that are involved with banks to ensure enforcement of statutory requirements in the federal flood insurance legislation which govern loans to individuals who are in the hundred year flood zone and can purchase flood insurance. Are in some communities of the United States loans being made by banks in contravenance to Federal law? That issue needs to be addressed.

Every conference always says we need more research, and I think we have to say that too, but I think we have to shoot with a rifle with respect to more research rather than just say we need more research. There are some specific areas that I would like to suggest, Governor, that need more research in the area of hazard mitigation. We need more studies such as the study sponsored by the Texas Coastal and Marine Council on the cost effectiveness of flood mitigation and hazard mitigation activities. I heard a figure yesterday that a 3% front-end investment, a capital addition to an investment in a home could reduce certain aspects of the damage and destruction done from one quarter of the value of the home down to something like 4% of the value. If I understood those figures correctly, we certainly need more information of that sort in going to legislative committees, going to Congressional committees, and saying, "Hey, we have data that shows hazard mitigation pays off in dollars saved." That would be a very persuasive point.

I have been somewhat impertinent in suggesting other agencies ought to do more. My own agency, the Disaster Response and Recovery Arm of FEMA, also ought to do more. We ought to try to combine our temporary housing program with permanent housing and use those dollar resources to encourage people who have

had substantial damage to their homes to move from the flood plain up to higher land. We need to use our public assistance program for restoration of publicly-owned facilities to encourage more relocation of public buildings out of the flood plain, and these cost-benefit studies that I just suggested would help justify those additional expenditures. I hope more states will give attention to mobile home tie-down legislation, which I didn't hear mentioned here but is a matter of interest to us because we can see the damage that occurs without tie-downs. We hope that more states would give attention to good, effective tie-down legislation, and we hope that even more states will start to enforce the tie-down legislation for mobile homes that we already have.

We think we need a quantum jump in the quality of local civil defense in this country. There was a paper this morning that indicated many of the shortcomings, the failures to coordinate with other emergency agencies, the failure to get out in the community and get to know other people in other agencies whose help is going to be needed in disasters. We think that there needs to be an upgrading in training, and this is perhaps a federal responsibility, with respect to local civil defense people. I think to some extent--and, of course, there are in many cases very able local civil defense people--but I think to some extent our civil defense capabilities at the local government level are often built on sand.

We need to encourage local governments to undertake hazard mitigation zoning. The National Flood Insurance Program is in aid in that. In Pennsylvania a flood plain management law has been passed. In Arizona they have just recently passed a law that permits the exchange of public lands to private lands when those public lands can be used to move the people out of the flood plain.

And, the last point--which was mentioned at some length by one of the panels this morning--is that we need to exploit the latent public interest that is there in the mission which we have. We cannot do it by ourselves. We need the help of other agencies and citizen groups which exist principally for other purposes. There was some discussion this morning about the need for more involvement of labor unions and particularly labor union leadership. The League of Women Voters is an enormous resource that has not been fully exploited in working for hazard mitigation, in flood plain management, in hurricane control and so forth. And, lastly, we know that the government can't do it all. Awareness campaigns to educate individual citizens and individual families to plan their own family disaster response are perhaps the most important things of all that we can do, because the individual citizen can do more to help himself than we in government can otherwise do.

CLOSING REMARKS

Lt. Governor Thomas P. O'Neil, III

Walter Mondale, the Vice President, was in Massachusetts just a couple of weeks ago, and he was talking about his sojourn out to Three Mile Island. He had an opportunity about three weeks after the accident to run into an older woman who lived within a three-quarter mile proximity of Three Mile Island, and he said, "How do you feel about that accident? Were your anxieties low or high? Were you comfortable with the way the government handled the problem?" She said, "Everybody around here felt very good. All the tensions were really relieved. You know the reason for it?" He said, "No, why?" She said, "Well, the President of the United States himself came in. If the President can do that, then I guess everything must be all right. Everybody knows that if there were any problem here at Three Mile Island, the President would have sent the Vice-President." That's why I am here.

The storm in Massachusetts in 1978 was a blizzard. We had about 20,000 people who were directly affected by it. It is considered to be one of the ten major natural disasters in the history of this country. Economically it dislodged approximately 750 million dollars from our economic cycle. We had an awful lot of devastation, and only through the leadership of not only the state and local governments coming together, but primarily because of the FDAA and Bill Wilcox and the leadership which he demonstrated over that four or five-week period of time, we got through it.

Some of the things Bill has already talked about really begin to address some of the needs that must be addressed in order to bring to conclusion here the final refining of preparation both within a state, or regions within a state, as far as mitigation is concerned. That is tremendously important. What I thought I would do in just, hopefully, a few well chosen words here is relate some of the experiences we have had, some of the problems which have evolved because of those experiences, and then, perhaps, you will allow Bill and me to come back and answer questions you might have.

In the immediate days after the storm in Massachusetts, all effort was concentrated on a task of basically doing nothing else but saving lives and in restoring essential emergency services. The Governor suspended automobile traffic for a week to permit the Army National Guard, the state and local crews to

clear the roads and to make the necessary emergency repairs. He did all of the bad things; I did all of the good things. I closed down a university for the first time in its history, and I also moved Ash Wedsnesday. I don't know if any of you know what Ash Wednesday is, but I moved Ash Wednesday from Wednesday to the following Saturday to keep people off the streets.

But anyway, following that first week period, the emphasis then shifted to one of assisting local communities, businesses and, as I said earlier, homeowners, in dealing with the staggering financial losses due to the storm. It was at this point where I believe major improvements can be made in the management of disaster overall. Among the myriad of federal agencies providing reimbursement, compensation, grants, or loans, were the Federal Disaster Assistance Administration, HEW, Housing and Urban Development, the Small Business Adminstration, the Individual and Family Grant Program, the Farmers Home Loan Administration, and the Department of Labor, as well as the Internal Revenue Service. These agencies have different programs with different eligibility requirements, and different application forms which must be filled out. Many of the programs have broad areas which overlap with some of the other fedreal programs. Inevitably, this creates substantial confusion for the potential recipient of needed assistance. It also reinforces the negative connotations associated with governmental bureaucracy. In some cases, most notably the SBA and the Individual Family Grant Program, one can't begin the application process for one program until the process has been completed for the other. This creates frustrating and unnecessary delays, particularly for families with the greatest needs.

Now, let me just stop here for one moment to tell you what we did do. At Bill's suggestion, we broke all those counties, which had been designated as disaster areas, up into fourteen different areas and we put a federal representative into each one of those offices and along their side a state counterpart, understanding that we had somebody from the local community or local region of the state involved in the office and running that office. Somebody in the office knew the people coming in looking for assistance, and anything that had to be dealt with quickly either by the state or by the federal government could be addressed immediately.

The long variety of programs can also lead to unintended consequences when applied in combination. One recent study concluded that a poor family which took advantage of all available disaster aid programs could recover only about 80% of disaster losses while a family with a higher income could conceivably receive more than 100% of their actual losses.

The final problem associated with a large number of agencies involved in dispensing assistance is that they rely largely on the normal personnel to assume their disaster responsibilities. This means that the agency is often swamped with a large amount of work at the same time the normal operation has got to continue on to proceed. In addition, the agency personnel are often not totally familiar with the special disaster programs or with dealing with people who have suffered a major trauma. When an agency is forced to hire short-term new personnel to relieve the workload, even greater problems can evolve.

One possible solution would be to create a single program of financial assistance to replace the programs currently in effect, with its own staff of trained personnel. Such a solution would probably require new legislation, and I would hope that this committee could consider investigating the feasbility and benefits of such a consolidation.

I might also say that in the follow-through in about the third or fourth week, Bill thought it was tremendously important that we get together for future planning for mitigation opportunities. We put in place a disaster recovery team which we have operating to this day. We hope that that disaster recovery team will terminate some time in the next six months. At that point, we believe, every single person who was impacted by the storm some 22 or 23 months before will have been taken care of as far as housing is concerned, as far as site location is concerned--and that means back in the original community or in a community they wanted to be--and back in a place of business, either as an employee or as employer. We think we have gone a long way.

Bill did talk about some of the problems confronting him on mitigation--and he is often modest in the way he approaches it. He is the only one in the federal government who is talking about it. As a matter of fact, no one in state government is talking about it, as a matter of fact, no one at the local level is talking about it. The reason they are not talking about it is because it is politically intangible and difficult to get people to really come back and objectively look at what is good and what is not so good for the future conditions involving another disaster of any magnitude. It is a difficult problem to work with, and therefore, what we do is separate the whole area of preparation from mitigation.

In the state of Massachusetts we have a civil defense mechanism which works quite well. It has a linkage with every single local city and town. Then, within the state we have a regional breakup so if there is a fallback of support of that position where anything does happen, auxilliary forces of secondary supportive levels can

come into action as quickly as possible. The truth of the matter is that on the night of the storm nothing was moved. As a matter of fact, the civil defense didn't come into it until almost 18 hours after the storm had finished. And that is because people who get involved in civil defense have a problem leaving their own homes and coming into work and going out into the communities where they are really needed.

So, it is wisely responsible to have everybody at the local level be as responsive as they possibly can as quickly as they possibly can so that if the need for evacuation arises you have people on the scene who know how to deal with it. If you have people who have been knocked out of their homes and need lodging quickly, you have somebody on the scene in the local municipality who can deal with it. If you have people who have a need for clothing or food, you have somebody on the scene working with charitable institutions who can deal with those issues.

Well, we have that. And, we have it largely because of the immense personality involved. I am one of those people that think the power of the personality has an awful lot to do with leadership in this country today, and if you just have one person in the right position standing up and saying we need mitigation, maybe some kind of trickle-down effect will take place. Bill is doing it, and therefore we in the state of Massachusetts are doing it. I said earlier that we do it fractionally and that the proposed improvement is going to take an awful lot of time, but at least people within our local communities are beginning to feel it, are beginning to realize these problems, understanding that if there is a hundred-year flood zone or a hundred-year flood plateau that people should not be moving back after a flood, that there is something that people of the local level and people of the state level can do to create an incentive not to have people move back there. If it means that they have to go out into another community, but still be near a school, a place of business, or near friends, we can do that because we have the power within our jurisdiction to do it. The incentives, however, can't come from the local level, wholely, nor can they come from the state level. My feeling really is that incentives must come from the federal level, and as Bill said, I think if you put the correct inducements in place, if you put the correct economic incentives there, then you can get states to react and local governments in turn to react, and even fractionally, in time we will improve, with age.

CONTRIBUTORS

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Janet K. Adams is President of Adams and Associates, a public and community relations firm. She is a specialist in public involvement in policy making. She has been Vice-chairman of NOAA's National Coastal Zone Management Advisory Committee, campaign director of Proposition 20 which enacted the California Coastal Conservation Act of 1972, and creator and President of the California Coastal Alliance.

Earl J. Baker is Associate Professor of Geography and Director of the Environmental Hazards Center at Florida State University. He has published numerous articles and research reports concerning individual and societal response to various environmental hazards. His work relating to hurricanes has involved response to warnings, techniques for preventing the growth of impossible evacuation situations, and public attitudes toward land use controls in coastal hazard areas.

Duane D. Baumann is Associate Professor of Geography at Southern Illinois University, Carbondale and heads a private research/planning firm dealing with environmental problems. He is a leading authority on the psychological reaction of individuals to natural hazards and on the management of water resources. Recently, Dr. Baumann directed a pilot project for the Corps of Engineers to develop improved methods for holding public meetings on proposed projects.

Wendell A. Brinson is Field Coordinator for Area 5, Georgia Civil Defense. He has participated in development of the Georgia Emergency and Disaster Operations Plan, the prototype crisis relocation plan for the state, and the Hurrican Evacuation Plan for coastal Georgia. Active in civil defense at the state level since 1964, Mr. Brinson has been a consultant on civil defense education to the Georgia Department of Education for ten years.

F. Dale Brown is an Assistant Professor and Instructional Designer in the Learning Resources Service, Southern Illinois University and a consultant to Planning and Management Consultants, Ltd. His work involves small-group discussion techniques, workshop development, instructional technology, and the systematic development of communication models. The project described in this volume was conducted for the St. Louis District of the U.S. Army Corps of Engineers.

Raymond J. Burby, III is Assistant Director for Research, Center for Urban and Regional Studies, University of North Carolina. Dr. Burby has written extensively on a wide variety of planning issues, including water resources, downtown revitalization, new communities, and energy. He is Principal Investigator of the NSF-funded study "Requirements for Evaluating the Effectiveness of Flood Plain Land Use Management."

T. Michael Carter is a Professor in the Department of Sociology at the University of Minnesota. He is Co-principal Investigator on the Natural Hazards Warning Systems project, a mult-year endeavor funded by the National Science Foundation. Among his responsibilities have been numerous field interviews with heads of emergency response groups both before and after warning response situations. His research concerns social stratification and mobility and social research methods, as well as natural hazards.

John P. Clark is a Professor in the Department of Sociology at the University of Minnesota. He is Co-principal Investigator of the National Science Foundation-funded Natural Hazards Warning Systems project and heads the part of that activity dealing with household response. His research areas include social control organizations and other social organizations, and with deviance. In addition to disaster research he has studied police departments and corporate control of worker behavior.

John A. Cross recently completed Ph.D. work in geography at the University of Illinois. His doctoral thesis is "Residential Adjustments to the Hurricane Hazard within the Lower Florida Keys." He has presented papers on the subject of individual response to hurricanes at other national meetings.

Richard A. Frank is Administrator of the National Oceanic and Atmospheric Administration. Prior to his appointment at NOAA he was Director of the Center for Law and Public Policy, the nation's first multipurpose and largest public-interest law firm. In that position he was active in a number of marine and coastal areas and in weather modification issues. Earlier, he served as Assistant Legal Adviser for Economic Affairs in the U.S. State Department and has taught courses at George Washington University.

Don G. Friedman is Director of the Corporate Research Division, the Travelers Insurance Company. A meteorologist by training, Dr. Friedman is an internationally recognized leader in the computer simulation of natural disaster effects. He has written extensively on the subject, including the monograph Computer Simulation in Natural Hazard Assessment. He serves as a consultant and

adviser to several research and policy groups. In 1976 he was awarded the National Award for Outstanding Contribution to the Advancement of Applied Meteorology by the AMS.

Ira W. Geer is Professor and Chairman of the Department of Earth Sciences, State University of New York College at Brockport. He is Chairman of the American Meteorological Society's Board of Education in Popular and Meteorological Education. His activities center around the promotion of increasing weather awareness through school-based weather study.

J. Fletcher Hickerson is Director of Civil Defense in Baytown, Texas, a position he has held since 1963. He has been President of the Texas Gulf Coast Civil Defense Association, Secretary-Treasurer of USCDC Region Five, recipient of the USCDC President's Citation three times and recipient of the Texas Gulf Coast Civil Defense Association's Outstanding Service Award in 1973. Mr. Hickerson worked for Exxon in Baytown from 1935 to 1974.

Thomas F. James is an Assistant Professor in the Department of Sociology and Anthropology, St. Lawrence University. He is Co-principal Investigator of the NSF-funded study "Research to Assess Public Knowledge of Natural Hazards and Disaster Behavior and Its Relationship to Emergency Planning."

Terry Keeling has been employed with A and K Properties, a farm and ranch brokerage firm in Houston, since 1969. He is President of the Texas Landowners' Rights Association and Chairman of the Board of Governors of the Flood Insurance Litigation Coalition, of which the former association is a participant.

David N. Kinsey is Chief of New Jersey's Office of Coastal Zone Management, Division of Marine Services, Department of Environmental Protection. He supervises the coastal permit program under CAFRA and headed the state's preparation of the state's bay and shore portion of the coastal management program. He has worked in several other agencies in New Jersey and has been an adjunct professor at Rutgers University.

William G. Lesso is Professor of Mechanical Engineering and Assistant Dean of Continuing Professional Education at the University of Texas. He has worked with the Texas Coastal and Marine Council in formulating hurricane-resistant building standards and in evaluating the increased cost in new construction resulting from application of the standards. Author of numerous articles and technical reports, Dr. Lesso also works in the areas of production management and energy economics.

Michael K. Lindell is a Research Scientist with Battelle's Human Affairs Research Center in Seattle. A social psychologist, he has specializations in quantitative methods, decision processes, and interpersonal conflict. Lindell worked earlier on the Assessment of Research on Natural Hazards project at the University of Colorado and, in addition to the work reported in this volume, has studied individuals' reactions to energy alternatives and the psychological impact of natural disasters.

Morgan Lyons is Director of the Florida Research Center, Inc. Dr. Lyons is a sociologist working in the area of social gerontology, particularly regarding planning and delivery of services. Special applications include issues in health, manpower and criminal justice.

H. Crane Miller is Vice President and General Counsel of Sheaffer-Roland, Inc. His professional focus as a lawyer is on the interaction of the law and other disciplines to solve social and legal problems, emphasizing environmental management and natural hazards. Mr. Miller was a member of the National Research Council's Building Research Advisory Board panel on Wave Effects Associated with Storm Surges; a consultant to the National Academy of Sciences Advisory Committee to NOAA; and counsel to the U.S. Senate Subcommittee on Oceans and Atmosphere, Committee on Commerce.

Louis Miller is Associate Professor of Decision Sciences at the Wharton School, University of Pennsylvania. His research interests are in scheduling, theory of waiting lines, simulation and management information systems. Before joining the Wharton School, he spent eight years with the Management Sciences Department of the Rand Corporation, and he is now an associate editor of Management Science.

Daniel W. O'Connell is General Counsel to the Florida Secretary of State. While a visiting professor of law at Golden Gate University in 1978 he chaired the National Conference on Land Use and Growth Management. Earlier he was Executive Director of the Florida Environmental Land Management Study Committee. He is a specialist in Environmental and Administrative Law.

Thomas P. O'Neil, III is the Lieutenant Governor of Massachusetts. Governor O'Neil was actively involved in relief and response activities in Massachusetts following the winter storm of 1978. He has served as Chairman of the National Conference of Lt. Governors and in numerous other policy-group roles such as Chairman of the U.S. Department of Interior Advisory Board on the Outer Continental Shelf.

Ronald W. Perry is Research Scientist at Battelle's Human Affairs Research Center in Seattle. His research concerns collective stress and disasters, measurement and behavior prediction models, community structure and organizations, and evaluation research. He has studied various aspects of social response to natural hazards and is currently Principal Investigator for a study of flash flood warning systems.

Roger Plumb is Director of Public Services in Rochester, Minnesota. Trained in civil engineering and public administration, he has 25 years of experience in the public works field in three different cities.

John C. Rosenthal coordinates a Comprehsnive Land Management Planning Program for the Real Estate Division of International Paper Company. He has worked for several years in disaster reconstruction planning and research with the New York State Urban Development Corporation, the Ohio Department of Economic and Community Development, and the firm of Raymond, Parish, Pine, and Weiner, Inc. He has presented papers on the subject at numerous professional meetings and teaches a course at Pratt Institute.

Carlton Ruch is a Research Economist for the Industrial Economics Research Division of the Texas Engineering Experiment Station of Texas A & M University. He is currently the project director of a two-year Sea Grant study to develop a hurricane response model. Previously, he was involved in assessing the effectiveness of the Texas Hurricane Awareness Program.

Robert H. Simpson is a Research Professor in the Department of Environmental Sciences at the University of Virginia and is head of Simpson Weather Associates. An internationally recognized expert on hurricanes, he is a former Director of the National Hurricane Center and a former Associate Director of Operations for the U.S. Weather Bureau. He was the first director of Project Stormfury and the first director of the National Hurricane Research Project. In 1973 Dr. Simpson chaired the Miami Federal Executive Board Hurricane Shelters Committee, which laid the groundwork for Dade County's vertical evacuation plan.

Dinesh Sharma is an environmental resources consultant in Ft. Myers, Florida. He was awarded a Public Service Science Residency as part of the National Science Foundation's "Science for Citizens" program. In that role Mr. Sharma has been active in the Barrier Islands Coalition, in which he developed educational materials and held workshops concerning barrier islands. He has also worked as a planner in coastal counties in New Jersey and Florida.

Don D. Smith is Professor of Sociology at Florida State University. He is a social psychologist with research experience in the socio-psychological factors involved in effecting successful evacuation of populations. Dr. Smith participated in a study of the social impacts of Hurricane Eloise and is especially interested in the effects of disasters on the elderly.

G. Alec Steele is Director of the Florida Research Center, Inc. A sociologist, Dr. Steele's work concerns social gerontology, especially problems of the rural elderly. He has been involved in studies of hurricane warning response, particularly the ability of the elderly to respond to warnings.

Reed Stewart is an Assistant Professor in the Department of Geography and Anthropology, Bridgewater State College, Massachusetts. His research interests are in the areas of water-related land use and public participation and education in environmental issues. He is a member of the Marshfield, Massachusetts Zoning Board of Appeals and Director of the Plymouth County Wildlands Trust.

Thomas Urbanick II is Assistant Research Engineer at the Texas Transportation Institute, Texas A & M University. He has held the positions of Transportation Engineer and Transportation Planning Engineer in Ann Arbor, Michigan, and works primarily on public transportation problems. He recently headed a study assessing hurricane evacuation problems and capabilities on the barrier islands of Texas.

Marvin Waterstone is Vice-President and Research Associate at LTW Associates. A geographer, his activities relating to natural hazards have included an assessment of recreation potential of floodplains, a benefit-cost study of NOAA's Earthquake Information Program, a survey of the adoption of flood hazard mitigation measures by floodplain residents, and contributions to a handbook on natural hazards management in coastal areas. The paper included herein was part of a National Science Foundation-funded investigation of community adoption of floodplain regulations.

Mitchell Wendell is General Counsel to the Interstate Sanitation Commission of New York, New Jersey, and Connecticut. For almost 30 years, he has been involved in matters related to disaster law, often through his affiliation with the Council of State Governments, the National Governor's Association, the National Association of Attorneys General and numerous governmental agencies. Dr. Wendell is currently participating in a study of flood warning systems for the Corps of Engineers.

Dennis Wenger is Associate Professor of Sociology at the University of Delaware. He has been prominent in pointing out discrepancies between beliefs

about disaster behavior and reality. His research more generally concerns the concepts of a disaster subculture, community power structures, and collective behavior.

William H. Wilcox is Associate Director of Disaster Response and Recovery for FEMA, previously serving as Administrator of the Federal Disaster Assistance Administration. His principal duty has been implementation of the Disaster Relief Act of 1974, and he has been widely regarded for integrating hazard mitigation goals with those of relief and rehabilitation. Before joining HUD, Mr. Wilcox was Secretary of Community Affairs for the Commonwealth of Pennsylvania, where he coordinated state disaster recovery activities for tropical storms Agnes and Eloise and the Johnstown flood of 1977.

Rose Young is Deputy Director and Training Officer of the Mobile, Alabama County Office of Civil Defense. She has worked with civil defense for 20 years, serving offices and committees of state and regional civil defense organizations and is involved in other emergency response activities as well. She has received the Distinguished Service Citation from the U.S. Civil Defense Council and the Special Commendation and Services Award from the Alabama Civil Defense Association.

Lawrence W. Zensinger is Acting Director of the Floodplain Management Division of the Federal Insurance Administration, FIA. Previously he served as Director of the Section 208 Water Quality Management Program for the East-West Gateway Coordinating Council in St. Louis. His professional experience includes land use, recreation, environmental management, and public facilities planning at the state, regional, and local levels of government.