

AT-RISK RESIDENTS' KNOWLEDGE AND BELIEFS ABOUT STRUCTURAL
AND NONSTRUCTURAL FLOOD MITIGATION ACTIONS

Shirley Laska
Department of Sociology
University of New Orleans

Introduction

Recently a newspaper editorial appeared in the local newspaper of a Louisiana community which is in the process of determining how best to protect itself from a repeat of three devastating floods which have occurred in the last six years. The editorial was in response to the final public meeting held by the U.S. Army Corps of Engineers on a proposed levee system. The community has been informed that the cost to the community (with the proposed new cost-sharing ratio of 65/35 will be 7 million dollars). The community has several concerns: whether the federal government will actually fund the project, how they will fund the community's portion of the cost and why the levee will not protect all affected neighborhoods.

Some six years after the first major flood and two years after the initiation of the Corps's study to suggest flood mitigation action the editorial states:

"In view of this (the problems cited above), local officials and the public might do well to explore *other flood control protection measures* (italics mine) that wouldn't require federal dollars."

(Slidell Daily Times, April 19, 1985)

It is the contention of this author that to have such a statement made by a seriously and repeatedly flooded community some six years into the process of determining flood mitigation action is an indicator of a planning and decision-making process much in need of revision both in terms of the steps taken and second in terms of the options provided.

While the actual implementation of the flood mitigation actions has been generally in the hands of government officials, the decision-making process as to which mitigation actions are to be taken is a shared one between residents and officials. It is evident from the violations of FIA flood elevation requirements that when the

government decision to implement a mitigation action is not supported by the local community, limited effectiveness will be realized (Houck, 1984). It is also evident that as the local community is forced to pay a larger portion of the bill, the community will become even more the locus of the decision-making. And, in addition, to the extent that individual homeowners come to determine that individual household mitigation actions may be cheaper and more controllable than public ones, the locus of decision-making will become even more "local," in this case household based.

If these proposed assumptions about the locus of decision making are correct, it follows that affected residents of flooded communities should be seen as key "actors" in the efforts to reduce the impact of flooding and the cost of damage. However, as the above editorial implies, the level of knowledge about possible flood mitigation actions may be very limited and may be quite uneven among types of action and types of residents. It is the goal of this research to examine empirically the level of knowledge and beliefs which are held by at-risk residents about both structural and nonstructural flood mitigation actions.

Methods

The community of Slidell, Louisiana is a small-town turned suburb of New Orleans some 30 miles northeast of the city. It is located in St. Tammany Parish, one of the 12 fastest-growing counties in the United States. The topography of the community is flat and laced with rivers and bayous. It is located both within the floodplain of the Pearl River and the coastal zone adjacent to Lake Pontchartrain, a brackish body of water some 30 by 50 miles wide connected by passes to the Gulf of Mexico. The residents of the community have migrated there either from the inner-city areas of New Orleans or from out-of-state as a result of federal government aerospace industry and other federal government facilities. The income of the community does vary although the middle and upper middle classes predominate. The community experiences three types of flooding: flash, river and lake (ocean) and has been seriously flooded three times since 1979, the last time in 1983 when over 750 houses were flooded and some 3500 people were affected.

The data reported herein were collected by the administering of a 10-page, 135-item questionnaire to residents living on streets which had been flooded in the 1983 flood to the extent that at least one house had been flooded. Some 31 neighborhoods

--distributed among the three types of flooding--were identified as the most seriously flooded and residents in them surveyed. The response rate was 43 percent which yielded 897 questionnaires.

Findings

Residents were asked to review a list of flood mitigation actions. Included in the list were both structural and non-structural actions which could be taken either prior to residential development to prevent flooding or after development to reduce future flooding and damage. The actions were obtained from numerous studies of flooding and were restricted to those which appeared to have relevance to the flooding in Slidell. Respondents were asked to indicate (1) if they were familiar with the terms, (2) if they believed in general they are useful and (3) if they believed the actions would be useful in their neighborhood or home.

Out of the 23 mitigation actions mentioned the average number of actions with which respondents were familiar was 16.4 (71 percent) (see Table 1). The structural actions were the most well known (84 percent) while the non-structural the least (65 percent). House floodproofing actions were in the middle (74 percent). Resident knowledge of specific actions also shows that structural changes are much more commonly recognized than is floodproofing and especially the nonstructural actions. The least well known of the structural--diverting the flow with dams--was familiar to 75 percent of the respondents.

The nonstructural actions were sharply dichotomized between those with which the respondents had familiarity and those which they did not. Four nonstructural actions--acquiring flood insurance, restricting neighborhood density, having flood gauges in place to provide early warning and the purchase of homes by the government ranked high in recognition. However, considerably less well known were those actions which would result in the government controlling floodplain development: restricting of the types of use of the floodplain, the transferring of development rights and the actual acquisition of the floodplain by the government. Also included in the group with which the residents had little familiarity was the enforcement of the 100 flood elevation. That only a small percentage (40 percent) indicated knowledge of this action is very surprising. Two possibilities exist. First the phrasing of the question may have been confusing. It was phrased, are you

TABLE 1
KNOWLEDGE AND BELIEFS ABOUT FLOOD MITIGATION ACTIONS (STRUCTURAL AND NONSTRUCTURAL) BY AN AT-RISK POPULATION

TYPES OF ACTION	FAMILIAR WITH ACTION	ACTION USEFUL IN NEIGHBORHOOD				
		ACTION USEFUL IN GENERAL	TOTAL	TYPE OF FLOODING Flash Lake River (Ocean)	PAST SEVERITY High	FUTURE RISK High
Composite Score (mean # actions out of 17)	12.8	9.1	4.6	3.3 3.5 6.2*	6.6*	6.0*
Structural Composite Score (out of 9)	7.6	5.8	3.2	2.5 2.3 4.2*	4.4*	4.0*
Non Structural Composite Score (out of 8)	5.2	3.3	1.4	.9 1.2 2.0*	2.3*	2.0*
<u>Structural Actions (percent)</u>						
Remove obstructions	92	85	60	54 35 75*	80*	72*
Improve storm drains	92	81	62	76* 55 54	63	69
Build pumping stations	92	71	40	47 51* 29	33	44
Adjust roadbeds	90	80	54	43 36 71*	71*	67*
Build general levee system	86	62	28	10 15 48*	43*	36
Breedge waterways	85	64	35	10 14 66*	66*	48*
Build holding ponds	79	44	13	12 9 18	12	18
Build ring levees and walls	77	51	21	2 8 43*	43*	30*
Divert flow with dams	75	45	13	4 6 25*	25*	21
<u>Nonstructural Actions</u>						
Acquire flood insurance	93	78	54	37 49 70*	74*	72*
Restrict neigh. density	82	54	20	25 17 20	21	24
Flood warning: flood gauges	81	54	22	10 18 36*	38*	27*
Govt purchase of homes	81	26	9	1 4 17*	24*	18*
Restrict type of use	55	44	15	8 12 23*	21	20
Govt acquire floodplain	55	26	9	8 8 12	14	13
Enforce flood elevation	40	35	16	9 12 25*	24	20
Transfer development rights	36	16	6	6 2 7	9	9
Floodproofing Composite Score (out of 5)	3.6	1.6	.6	.3 .6 .8	1.0*	.9*
<u>Floodproofing Home</u>						
Flood walls or mini levees	85	46	19	5 12 34*	42*	34*
Pier construction or modif.	77	26	12	1 22* 17	22*	17
Fill construction	75	37	17	11 23 17	15	18
Uninsulated sealed walls	67	29	8	6 8 9	11	12
"Wrapping" house	65	27	8	7 9 9	11	16*
			n=250	133 300	142	188

*Significant <.001
Minimum n=498

familiar with: "enforcing the 100-year flood elevation"? If the low rate cannot be attributed to the phrasing, the finding is particularly significant given the fact that the elevating of structures to above predicted flood levels is at the core of the FEMA program and ignorance on the part of the homeowner that such a requirement exists puts all of the responsibility of compliance on the developer and the permitting agency.

Turning to the floodproofing actions it evident that a good deal is known about such activities. Even the "wrapping" of homes--a relatively recently-proposed, and not well developed technique was known by 65 percent of the respondents. That "pier and fill construction" (phrased this way) were less well-known than flood walls or levees may be an artifact of the phrasing. If it is not, again the implications of only 77 and 75 percent recognition are considerable given that these actions are so commonly used to elevate homes above the flood level.

Examining the residents' perceptions of the utility of the mitigation action in general, it is evident that the opinions vary considerably more than the knowledge level. The belief that providing for a more rapid drainage of the water from flooded areas is the direction mitigation action should go is strongly held. Much less confidence is expressed in levees, flood walls, and adjustments to major waterways such as dredging and dams. These opinions are interesting in light of the Corps levee proposal. Local support for raising the community's cost sharing contribution may not be forthcoming.

Nonstructural actions take a dramatic decline from recognition to utility. Only flood insurance is seen by more than half of the respondents as being useful in general and only one restriction on development of the floodplain--limiting neighborhood density--was considered useful by even half of the respondents. Floodproofing actions likewise fell considerably in support from the level of recognition. Only flood walls or mini levees were perceived by about half of the respondents as having general utility.

Turning to the question of specific utility of the mitigation actions for the neighborhood and home of these at-risk residents, it is possible first to see that there is limited support for the appropriateness of the mitigation actions for the respondents. The average number of structural/non structural actions which respondents support is 4.6. And for floodproofing, only .6. Noteworthy also is the considerable range of opinion.

In order to consider the perceived utility of specific mitigation actions for these residents it is useful to separate the residents according to the types of flooding which they experience as well as the severity of their flooding and their perceptions of future risk. It is evident from the breakdown of the composite scores that those individuals who are flooded by river floods, those most seriously flooded and those who perceive that they will be most likely to flood in the future are supportive of the greater number of mitigation actions. Specifically, those residents who experience river flooding are significantly more likely to be supportive of all structural actions except for storm drains and pumping stations, the latter both more useful in flash floods. As severity is very strongly associated with type of flooding (river flooding) and perceived risk likewise somewhat strongly associated, the same structural actions emerge as significant for these two sub-groups.

Turning to the nonstructural actions, the first striking finding is the low support for any of the actions. Flood insurance is seen only by half of the respondents as useful to their neighborhoods. Managing the density is only approved of by 20 percent of the residents while those actions which would give government considerable control over the floodplain are almost universally rejected. Looking at the differences between types of flooding, the river-flooded emerge as more supportive. However, those most severely flooded and who anticipate future serious flooding are only more supportive (at a statistically significant level) of flood insurance, flood gauges and government purchase of homes.

Finally, support for the floodproofing of homes is almost unanimously rejected by the total sample. Several actions emerge as more popular with residents experiencing different types of flooding: flood walls for river flooding and pier construction for the lake flooding. Those most severely flooded are in favor of flood walls (the highest support given with 42 percent) and pier construction. And those who perceive future risk are twice as likely to support the "wrapping" concept.

Conclusions

In summary the findings indicate considerable knowledge about structural mitigation solutions with considerably less awareness of the nonstructural and floodproofing actions. The findings also indicate limited support for the utility of the

actions in general and specifically in the respondents' neighborhood or home, especially the nonstructural and floodproofing. As it has become increasingly evident that floodplain development has not been curbed sufficiently by regulation nor structures adequately protected by the hoped-for elevation of structures above flood stage, it has become popular to emphasize nonstructural and floodproofing actions as viable alternatives. The findings of this study however indicate only limited support for such actions by flooded residents even when the actions are proposed for floodplain residents in general and the respondent does not have to come to grips with whether they themselves would wish to "endure" the solution. Such a limited acceptance of the nonstructural suggests considerable difficulty in developing a community consensus for their use. The response to the question of the utility of such mitigation actions for residents' own neighborhoods and homes reinforces the pessimistic outlook. Once a person owns a homes in a floodplain, they are unwilling to accept or perceive as ineffective most possible mitigation solutions, especially nonstructural and floodproofing.

It appears evident from these findings that more emphasis must be placed on developing nonstructural actions (U.S. Army Corps of Engineers, 1983) and that educational programs must be developed to inform at-risk homeowners and communities of mitigation possibilities (Mutz, 1983). But it is also evident that care must be taken to (1) be sure that those actions proposed are viable, useful solutions and (2) that the reluctance and uncertainty with which residents appear to approach mitigation are taken into consideration. Homeowners appear to have a perceived personal benefit/cost ratio which causes them to reject mitigation solutions, especially non structural and floodproofing. This ratio must be understood by floodplain managers and greatly modified--both the perception and the reality (Illinois Department of Transportation, 1984)--in order for mitigation to actually be the fruitful program which it appears floodplain managers are counting on.

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