Chapter 9

LESSONS LEARNED AND SUGGESTIONS FOR FLOODPLAIN LAND USE MANAGEMENT POLICY

The research reported in this volume was undertaken, in part, to contribute to the theoretical underpinnings of floodplain land use management. To be effective, public policy must be based on a sound theory or conceptual schema which links policy instruments to intended effects. We designed our conceptual model to provide a basis for developing empirical evidence that floodplain managers could use in formulating programs to achieve various objectives, such as diverting development from the floodplain or inducing property owners and developers to adopt hazard mitigation measures. Our research using that model indicates that while floodplain land use management policy has been effective in dealing with the threat of flooding in urban areas, programs would be even more successful if greater attention in the future is devoted to influencing the expectations and behavior of landowners and consumers.

The conceptual model was not designed to tell us whether society is better off or worse off for having achieved various floodplain management objectives. Although the research focused on program objectives and program benefits rather than costs, we obtained enough information, which we summarize later in this chapter, to look at whether, in fact, the benefits of floodplain land use management in the ten cities studied exceeded costs to the public and private sectors. We conclude that it did.

Finally, we tap the experience of the ten cities in managing floodplains to develop a series of practical suggestions for local floodplain managers. The ten cities we studied used a variety of approaches to deal with flood threats; some of them were successful, and some were not. Throughout this chapter we highlight promising approaches which floodplain managers in other localities can draw upon to achieve particular objectives.

Important Findings

The theory of floodplain land use management presented in Chapter 4 is based on the argument that although floodplain policy originates in the public sector, it must influence private sector behavior in order to be effective. Our analyses of decisions by 312 private sector decision makers revealed that floodplain policy does influence land owners, developers and builders, and

consumers--in different ways and with varying degrees of effect. Below those findings are assessed in terms of their implications for three national goals of floodplain management policy--1) decreasing future floodplain development, 2) increasing the use of protective measures in whatever floodplain development does occur, and 3) increasing the proportion of property owners who purchase flood insurance.

Decreasing Future Floodplain Development

Research Findings. The Unified National Program for Floodplain Management succinctly states one of the basic principles of floodplain management:

> Development in or adversely affecting floodplains should be avoided unless it is considered necessary from a public interest standpoint and unless no suitable alternatives exist. Avoidance of development in high hazard areas is the preferred approach for minimizing losses to people, property and natural floodplain values (Federal Emergency Management Agency, 1986, p. III-4).

All in all, the ten floodplain land use management programs we examined varied widely in the degree to which they discouraged private decision makers from locating in flood hazard areas. On the one hand, the presence of floodplain land use management programs did discourage the purchase of vacant floodplain property for future personal residence, and did reduce the proportion of owners who held vacant land in the floodplain for speculative purposes. Floodplain parcels vacant in 1975 were more likely to remain vacant in 1985 in those communities which required greater building elevations above base flood levels and thus increased the costs of building in the floodplain. On the other hand, public policy did not consistently decrease the attractiveness of the floodplain for builders and developers or for consumers. Our analysis indicates that floodplain management in the ten cities reduced potential residential development between 1976 and 1985 by 79% and potential nonresidential development by 89%, but we found that stronger programs were only marginally more effective than weaker programs in diverting development from flood hazard areas.

Builders and developers frequently undertake marketing studies to estimate the profitability of a proposed project; they do not undertake land development or building if consumer demand is insufficient. However, consumer demand for floodplain development met builder expectations over 90% of the time. Consumers who actually acquired floodplain property put

more weight on such factors as the physical attractiveness of a floodplain site and the characteristics of the house they acquired than they placed on the risk of flooding. Once the floodplain is subdivided, consumers who find the floodplain an attractive place to live and do business will purchase building lots, and floodplain encroachment and habitation will follow.

Local public policy is ineffective in diverting development from the floodplain in two circumstances: when developable land outside the floodplain is scarce, and when population growth and the demand for building sites is high. We found people were much more likely to acquire floodplain property for investment (that is, in expectation of higher intensity land uses in the future) when less than a ten-year supply of flood-free building sites was available in a community. In strong development markets, the added costs of development attributable to floodplain building regulations did not dissuade some developers from building in the floodplain, since often they could pass those costs forward to consumers. Those findings were supported by our analyses of floodplain land markets, which showed that population growth rates had a strong positive effect on building in the floodplains of the ten cities. That poses a dilemma for floodplain managers: strong population growth and development pressures seem to stimulate communities to adopt strong floodplain land use management programs (see Burby and French, 1981), but population growth works against program efforts to minimize floodplain encroachment.

Finally, we found that communities' investment in flood control works also tends to stimulate floodplain development by leading to heightened property value expectations on the part of landowners, and to increased purchase of floodplain sites for speculation and future subdivision. Flood control works may be an important tool for reducing damages to existing development in flood hazard areas (and were being used or pursued by each of the communities we studied), but they encourage additional floodplain development and thereby possibly increase rather than decrease property at risk from flooding.

Community Strategies. In dealing with the dilemmas noted above, the ten communities used three strategies--prohibit development, limit development, and limit all but commercial development--to counteract forces leading to more intensive use of the floodplain.

Palatine was the only one of the ten communities we studied to use the prohibit development approach, which it adopted to eliminate future increases in flood damages and to maintain natural floodplain values such as ground water recharge, maintenance of water quality, and preservation of floodplain flora and fauna. Its floodplain ordinance provided that any encroachment, including minor alterations and additions (such as porches, decks, or paving),

would be treated as a special use and would require specific approval of the city council. That requirement was effective in limiting new development in the floodplain. To minimize the adverse effects of the policy on land values, Palatine allowed landowners to transfer density allowed on their property by the zoning ordinance to adjacent flood-free sites.

Six of the communities--Arvada, Fargo, Omaha, Scottsdale, Toledo, and Wayne--limited new floodplain development to the floodway fringe and banned new construction in the floodway. The Fargo regulations required developers of new subdivisions containing a portion of the floodway to dedicate that land as open space. In Omaha, the floodway was rezoned as open space, and in Arvada and Toledo, an open space overlay zone was applied to the floodway which prohibited any building or other damageable development. In Scottsdale, a density transfer approach was used to implement the Indian Bend Wash greenbelt project. That approach allowed developers to increase housing densities in the floodway fringe, provided they excavated the floodway to increase its carrying capacity and managed floodway land as open space or as a recreational amenity. Finally, in Wayne, New Jersey, state regulations required developers to obtain a state permit for floodplain development; engineering studies required for issuance of the permit had to document that proposed development would not encroach upon floodways. Those six communities recognized strong pressures for development, and they tried to minimize adverse effects by restricting it to the least hazardous portions of the floodplain. That approach also had the effect of diminishing growth in the residential use of the floodplain. The communities which made no attempt to eliminate floodplain or floodway development--Cape Girardeau, Savannah, and Tulsa--ranked well below average on the proportion of projected (no program) development they diverted from flood-hazard locations.

The rationale for promoting commercial and industrial land uses while discouraging residential uses is that unlike residential development, commercial and industrial development often does not put public health and safety at risk from flooding (because it is easier to evacuate and often not occupied at night), and can better absorb the costs of floodproofing and other hazard mitigation measures. Indeed, the owners of commercial buildings in the ten cities were much more likely than residential property owners--27% versus 14%--to have spent money on post-construction hazard mitigation measures.

Implications. Our research indicates that if land use management programs are to be more effective in diverting development from floodplains, they must take additional steps to nip the development process in the bud. That is, the expectations of decision makers in the land market regarding the developability (and therefore, profitability) of floodplain property must be

deflated. To do that, policy must: 1) inform and persuade the owners of vacant land in the floodplain of the serious nature of the flood hazard and its potential to do damage; 2) persuade participants in the land market that the risk of flooding should deflate the development potential of floodplain property; and 3) prove to landowners and developers that development which does take place in the floodplain will be more expensive, less marketable, and less attractive to consumers than flood-free building sites, and, therefore, will not appreciate in value as rapidly in response to increasing population and development potential.

Convincing landowners that a real hazard exists is difficult. We found no association between objective measures of the flood hazard and floodplain property values or the likelihood of a parcel vacant in 1975 being developed between 1976 and 1985. Nevertheless, the land market in the ten cities did recognize actual flooding. In communities with more recent and more frequent flooding, land values tended to be lower and parcels less likely to develop than in communities where flooding was less recent or frequent. Those effects may dissipate rapidly, however, so floodplain land use management programs will be more effective where they can bring forth images of actual floods in a community rather than of hypothetical flood threats. Posting the heights of past floods in prominent places, publicizing the ravages of past floods on the anniversaries of those events, and direct mailing of brochures on past flood damages and wise floodplain management may convince landowners, real estate agents, financial institutions, builders and developers, and others involved in the development process of the reality of the hazard.

For policy to influence developers, it must affect the marketability of floodplain property (the gross revenues a project will produce) or development costs. If costs increase only marginally (an average of 5% to 9% increase in development costs with existing policies was reported in the ten cities), developers and builders in most cases will be able to pass them forward to consumers in the form of higher housing prices or slightly lower quality, or backward to landowners in the form of lower land prices. Furthermore, the increases will have little effect on evaluations of floodplain property for development.

There is a significant negative association between the elevation above the base flood level required by floodplain regulations and the likelihood of vacant parcels being developed. Where communities required higher elevation above the base flood level, parcels vacant in 1975 were less likely develop between 1976 and 1985. In very strong markets, however, stringent elevation requirements may not divert development from the floodplain.

When growth pressures are so strong that stringent elevation requirements

will not deter enough developers or consumers from seeking floodplain locations to satisfy local policy objectives, floodplain management policy may attempt to further reduce the revenues possible from a floodplain project by reducing the number of dwelling units per acre that developers can produce on a given site. The density allowed by zoning ordinances did have an effect on land values: lower densities were associated with lower land values in the ten cities. However, with the exception of zoning to prohibit development of the floodway--and, in two cities, to encourage commercial use of the floodplain--the communities we studied were not using low-density zoning to maximum advantage as a way of decreasing future floodplain development.

Because reducing density is associated with lower property values (and landowners recognize that fact), efforts to downzone floodplain property may be met with stiff political opposition. There are two ways communities can neutralize that opposition: one is to limit densities not by regulation but by public purchase of property for open space and other uses that are not susceptible to damage from flooding (land acquisition is expensive, but there are a number of techniques communities can employ to reduce costs [see Kusler, 1979; Burby and Kaiser, 1987]; a second way is to allow landowners to transfer development rights from the floodplain to flood-free sites (which is the approach used by the Village of Palatine) or from the floodway to the floodway fringe (which is used by Scottsdale). The latter two approaches are not without problems, however: transfer of development rights is most feasible where floodplains are narrow and the transfer can be accomplished on a single parcel or within a single subdivision which contains portions within and outside the floodplain, but where floodplains are broad and development rights must be transferred among parcels, transferring development rights becomes so complex (see Pizor, 1986) that it probably could not be justified solely for floodplain land use management purposes.

Another policy option localities might consider is an increase in the supply of flood-free sites available for development. There are several ways to do that: one is to annex vacant land on the periphery of the city and extend urban services to that property; a second is to revise zoning regulations to allow higher density development in flood-free locations within the existing city boundaries (that would work well in conjunction with a program to transfer development rights from flood-prone to flood-free locations); a third way is to invest in flood control works that constrict the area subject to flood damages. The latter policy is strongly supported by current floodplain property owners and was being pursued by most of the jurisdictions we studied, but because it also has the effect of increasing land value expectations among the owners of vacant land and among floodplain occupants, it needs to be coupled with measures to counteract the stimulus it provides for additional unwarranted

development within the remaining areas that are still subject to flooding. Ways of doing that include the adoption of very stringent building standards and the establishment of benefit assessment districts so that property which gains from risk reduction pays the costs of flood control. Both of those measures would increase the costs of floodplain development and offset the benefits from flood control which tend to stimulate development.

The floodplain development process can also be halted in its tracks by consumers unwilling to locate in floodplains. However, floodplain management policy in the U.S. is doing little to dissuade people from locating in hazardous areas. In fact, by making floodplain structures safer through building standards and flood control works, and more financially secure through flood insurance, the policy seems designed to stimulate rather than retard consumers' willingness to locate in floodplains. To the extent that avoidance of development in hazardous areas is a policy objective, the current policy is not properly focused.

If floodplain land use management programs gave more emphasis to the provision of salient information about past flooding and somewhat less emphasis to the provision of hypothetical information about the flood hazard, that might help to increase consumers' attention to the potential for flooding and its psychological and monetary costs. In addition to increasing consumers' appreciation of the flood hazard, consumer demand for floodplain property might be lowered by raising the price of living in flood hazard areas. Among the ten cities we studied, consumer demand for housing and commercial and industrial building sites was sensitive to price in some circumstances. When overall housing demand in a community was weak and there were ample building sites located outside of the floodplain, consumers were sensitive to price and were unlikely to absorb builders' increased costs of developing in the floodplain; when communities were growing rapidly, incomes were high, and housing demand was strong, however, consumers appeared to be less sensitive to price. In those cases, policies designed to raise the price of floodplain locations to consumers appeared to have little effect on demand for floodplain building sites.

None of the communities we studied required consumers to bear the full financial burden created by their decision to live or do business in the floodplain; subsidies came in a number of forms. Although the National Flood Insurance Program was designed to decrease disaster relief costs by requiring that private property owners share the risk of floodplain development through the purchase of insurance, that requirement was not being enforced strictly. In addition, each community was undertaking public investments to reduce flood threats, little of which was being paid for by floodplain occupants. Finally, none of the communities charged special fees to recover added costs of

administering floodplain building regulations or extra user charges to recover added maintenance costs of infrastructure serving floodplain property. If consumers were made to pay the costs currently borne by society, they might be less willing to acquire floodplain property.

Increasing the Use of Protective Measures

Research Findings. Flood losses to existing floodplain development, or to development which localities want in flood hazard areas, can be reduced substantially through the adoption of protective measures such as floodproofing. The ability of policy to increase the use of protective measures depends on two things: its ability to persuade state and local governments to adopt appropriate regulations, and the ability of those regulations to induce developers and builders to adopt protective measures. Our research indicates both of those conditions are being met.

In the case of the ten cities we studied, each had adopted regulations which exceeded minimum federal standards for floodplain management; these, in turn, had a strong positive effect on builders' and developers' adoption of measures to protect property from flooding. In part because required hazard mitigation measures added only marginally to the costs of construction, private sector compliance with regulations was very high.

Policies had little effect, however, on consumer expenditures on additional measures (beyond those required of and installed by builders) to protect their property from flooding. Instead, actual experience with flooding (and the costs of flood damages) was the key factor associated with consumers' expenditures on hazard mitigation measures.

Builders' and consumers' use of building elevation and other hazard mitigation measures was responsible for a 37 percent reduction in projected average annual flood damages--from an estimated $29.840 million without floodplain management to $18.047 million with the programs in the ten communities (in 1975 dollars). The five cities with more stringent floodplain management programs reduced estimated average annual flood losses by 42.4%, compared with an average reduction in losses of 33.3% among the five cities with weaker programs.

Implications. Our research has two important implications for policy to increase the adoption of measures to mitigate flood losses: first, the current focus of policy on builders and developers rather than consumers is well-placed; second, if communities adopt stronger floodplain management programs, voluntarily or as a result of stricter requirements for participation in the National Flood Insurance Program, there will be more attention to loss prevention by builders and developers and a correspondingly further reduction

in potential average annual flood losses.

Regulatory measures are an effective way of securing builders' adoption of loss prevention measures such as the elevation of buildings and infrastructure above base flood elevations, but it is difficult to induce consumers to adopt loss prevention measures for existing development unless they have had flood damages. During the period when flooding is a threat, but has not occurred to any great extent, floodplain land use management programs should focus on promulgating and enforcing regulations aimed at builders and developers. After flooding, however, there is a window of opportunity during which property owners can make corrections to past land use decisions by investing in measures to reduce future flood losses. Flood programs, therefore, should be prepared to help households understand the loss prevention options available to them and finance cost-effective retrofitting options at that time.

We found that property owners who had been flooded were usually familiar with a variety of hazard mitigation measures, so programs to build households' awareness of measures do not seem to be needed. Instead, local floodplain managers should focus on such other measures as:

Help in the form of labor and equipment to do floodproofing (51% thought that would be very helpful).

Free on-site visit to provide technical advice (41% rated that very helpful).

Instructional manuals (29% rated that as very helpful).

Low-cost loans for on-site flood protection work (21% rated that as very helpful).

In addition, federal and state agencies can take steps to foster mitigation. Laska (1986) advocates the following: state establishment of revolving loan funds for mitigation (also see Association of State Floodplain Managers, 1985); reduction of flood insurance rates in communities which are implementing programs to increase the use of loss prevention measures as an incentive for local action; increase in insurance rates for older homes if they are not retrofitted after suffering flood damages; use of federal moneys to assist relocation of flood-prone structures; and use of moneys from the National Flood Insurance Fund for grants to property owners for retrofitting.

Federal policies congruent with two of those recommendations are being promulgated. The Federal Insurance Administration is initiating a community rating program in which flood insurance premiums will, in fact, be lower in

communities with lower risks of flood losses. It is important for that system to create incentives for communities to undertake loss prevention programs. In addition, in 1988 Congress authorized the use of flood insurance funds to relocate structures in imminent danger of destruction from coastal erosion. That action, based on the principle that actions taken now to prevent large future losses can be cost-effective, establishes a precedent for greater use of insurance funds for loss prevention work.

Two of Laska's proposed measures will have little local support, according to our data: converting funds previously spent on flood control to nonstructural hazard mitigation, and relocating structures from flood hazard areas to flood-free sites. Because the owners of vacant and developed floodplain property strongly support various flood control measures which will reduce the threat of flood damages to their property, diversion of funds earmarked for that purpose--no matter how rational from a national policy perspective--can expect little support from local governments with jurisdiction over flood-prone property. Floodplain property owners also indicated little support for relocation of existing structures from the floodplain, either at private or public expense. The political key to successful relocation is likely to be assurance to floodplain property owners that they will be made whole through the provision of adequate relocation payments.

Increasing the Purchase of Flood Insurance

Research Findings. One of the basic premises of national policy for dealing with flood losses is that the beneficiaries of flood-prone property should bear most of the costs of flood risks, rather than shift those costs to society as a whole through disaster relief or flood control projects funded from general tax revenues. Flood insurance, with premiums set at actuarially sound rates, is the primary mechanism Congress chose for shifting costs to floodplain occupants. However, we found that only 26% of the owners of floodplain structures built between 1976 and 1985 in the ten cities carried flood insurance, 21% had carried flood insurance in the past but dropped it, and 53% never carried flood insurance. Aggregate data on insurance coverage in the ten cities indicate that the overall market penetration of flood insurance, including both structures built before 1976 and those built between 1976 and 1985, was also 26%. In six of the ten cities the proportion of dwellings covered by flood insurance, rather than gradually increasing, actually declined between 1976 and 1985.

We found no association between the strength of local floodplain programs and the proportion of floodplain structures covered by insurance (in fact, market penetration was somewhat higher--29% vs. 21%--in communities with weaker programs). The only factors associated with the purchase of insurance

were indicators of property owners' perceptions of the degree of hazard. That finding is contrary to Congress' intent, since if only the most hazardous properties are insured, risks will not be spread adequately, and either rates will escalate to a point where insurance becomes unaffordable, or pressures will mount to subsidize premiums to maintain affordability. In either case, insurance will not be serving as a mechanisms for shifting the costs of flood risks to the beneficiaries of floodplain locations.

Implications. The Federal Insurance Administration has been taking steps to remedy various flaws in the operation of the NFIP (see Comptroller General of the United States, 1983), but it has yet to address the inadequate participation in the program documented here. Instead, the FIA's efforts to make the program self-supporting, principally by raising insurance rates and reducing coverage, may have the effect of further reducing market penetration of insurance policies if households' decisions regarding the purchase of insurance are sensitive to price. To counteract that, it is important for the agency to see that the provisions of section 102 of the Flood Disaster Protection Act, which make purchase of insurance mandatory for property with mortgages from federally regulated financial institutions, are enforced. The high proportion of property owners who once carried flood insurance and have since dropped it suggests that enforcement is lax at present.

If floodplain land use management policy is redirected to the consumer as a target and seeks to decrease expectations of future profit from floodplain development and increase the adoption of protective measures (particularly after serious flooding), communities could begin to play a role in marketing flood insurance. There are obvious advantages to communities if a higher proportion of floodplain property owners are insured against flood losses, since recovery from flood disasters should be eased and flooding will be less likely to disrupt the local economy or create fiscal problems (through lost tax revenue) for local government. Additional incentives for communities to promote the purchase of flood insurance might be provided by the Federal Insurance Administration, which could target a portion of revenues from premiums for local floodplain management programs, and state floodplain management programs.

Benefits and Costs of Floodplain Land Use Management

The Unified National Program for Floodplain Management (Federal Emergency Management Agency, 1986) lists three accounts that are useful for considering benefits and costs: 1) economic efficiency; 2) environmental quality; and 3) individual safety, peace of mind, and social well-being. We were

able to devise measures of benefits and costs of floodplain land use management in the ten cities for each of those accounts, although it was possible to convert only some of them to readily comparable dollar terms. Those calculations, which are summarized in Table 9-1, indicate to us that floodplain land use management is a beneficial policy for dealing with the threat of flooding in the cities we studied.

Economic Efficiency

Reduction in flood damages to private and public property is the most important economic efficiency benefit from floodplain management. We estimate that average annual flood loss reduction benefits were $10.994 million in the ten cities.

By diverting economic activities from the floodplain to flood-free locations, floodplain land use management should reduce losses to business firms that would have resulted from disruption of their activities by flooding. We lack sufficient information to estimate the value of those benefits, but since floodplain management programs in the ten cities diverted 1,590 acres of commercial activity from flood-hazard to flood-free areas, they may be substantial.

Floodplain land use management also leads to the conservation of open space, which enhances the livability of adjacent residential property and is reflected in increased land values. We estimate that benefit at $10,427 per acre for all vacant land zoned for residential use and adjacent to open space preserved by floodplain land use management. Although we estimate that floodplain land use management programs preserved 3,513 acres of open space that otherwise would have been converted to urban use, we are unable to estimate how many residential lots are located adjacent to that open space and therefore cannot estimate a total figure for property value enhancement; we could suggest an illustrative figure, however. Assuming that average lot sizes for new residential development in the ten cities were 0.25 acres and that 10% of residential development in flood hazard areas in the ten cities between 1976 and 1985 was located adjacent to open space preserved by the programs, floodplain management programs would have enhanced residential property values by $0.664 million during the ten-year study period. (Since that figure does not include property value enhancement gains to lots already existing in the floodplains of the ten cities in 1976, it is a conservative estimate.)

Flood damage reduction and property value enhancement benefits must be judged in terms of their costs to individuals and society. Two types of costs are important: program costs and costs to individuals or firms to undertake mandatory floodproofing. We estimate total program costs for the ten cities at