

Economic Incentives and Disincentives: A New Approach to Floodplain Management

Floods are a serious problem in the United States and, to date, most floodplain management programs have been failures. Despite a massive attack on the problem by various levels of government, floods are inflicting larger total and per capita losses than ever before. Average annual property losses due to flooding exceed two billion dollars (White et al., 1973:3).

The floodplain is generally defined as the area of land that would be inundated by the worst flooding likely to occur in a hundred year period. Approximately 9.5% of all cultivable land, and 16.5% of all urban land, in the United States lies within a floodplain (Mad-dock, 1977:44). Furthermore, urban development encroaches on 1.5% to 2.5% of the total floodplain area in this country each year, even though much of this new development gains no special benefit from a floodplain location. In order to control further losses from flooding, land use management would have to prevent 80-90% of the uneconomic part of this expansion (White et al., 1973:xviii).

Public action in the management of floodplain use is necessary in order to protect the public health, safety, and welfare. Most importantly, floodplains are hazardous areas in which to live, and occupants impose costs upon themselves through the risk of death, injury, dislocation, and loss of property. In many instances occupants are aware of the risks involved with locating in a floodplain; however, new buyers, renters, and other temporary residents may be unaware of the risks if not warned of the hazard.

Floodplain management is also important because of the spillover costs, direct and indirect, which development of these areas imposes on society as a whole. Direct costs are imposed as paving increases the amount of impervious surface, thereby preventing infiltration of water into the soil. Buildings, roads, dikes, and levees, which may block flows or end up as debris, add to flood heights, velocity, and erosive scouring. Fires, explosions, and pollution may result from breached containment of industrial chemicals stored or used in floodplains.

The indirect spillover costs include the costs of warning systems, evacuation, relief, rehabilitation, and flood control structures. Public utilities and services may need special protection against floods and taxpayers who reside in the larger political entity, of which the floodplains may be only a part, may have to pay a portion of the extra costs. Costs are also imposed on friends, relatives, taxpayers, and charitable donors who provide aid to flood victims.

A third concern in floodplain management is that floodplains are often sensitive environmental areas serving vital ecosystem functions. They include estuaries, marshes, aquifer recharge areas, flats, or dunes. In addition, floodplains are often associated with scenic, wildlife, and recreational amenities requiring buffer zones for protection. Tight alluvial soils created by river floodwaters are poor sites for disposal of wastes, either in septic tanks or industrial waste containers.

TECHNIQUES FOR FLOODPLAIN MANAGEMENT

In the past, most floodplain management efforts have been *structure oriented*. The Army Corps of Engineers, alone, spends \$500 million a year in capital costs for the construction of flood control structures; that figure does not include operation and maintenance costs for previously built projects (Kusler, 1976:1). Such structures are expensive, disrupt the environment, are rarely paid for by beneficiaries, and often provide only limited protection while encouraging further floodplain encroachment. Flood control dams have not been successful in preventing the increase in flood damage. In recognition of this failure, the Water Resources Management Act of 1974 gave the Corps of Engineers authority to

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include non-structural alternatives in their flood control strategies.

Some state and local governments have turned to *direct regulation* of land use in the floodplains in an attempt to reduce flood losses. These methods, which include zoning, subdivision controls, building codes, and designation of critical environmental areas, have, for the most part, also proven ineffective. The laws are often weak, and enabling legislation frequently contains clauses that make it difficult to remove existing uses. Strict regulation will be most effective in the long run by reaching the root of the problem--the encroachment of more and more of the floodplain by intensive uses.

Given the inadequacies of structural and regulatory techniques, a new approach based on economic incentives and disincentives may be preferable. A system of taxes or subsidies can be prepared that would limit development to desirable activities without prohibiting it altogether. The economic approach ensures that those who reap the benefits of floodplain development bear the risks and social costs of using that land. This alternative, which is more efficient, equitable, and effective than direct regulation, has been virtually ignored in the literature of floodplain management. It has, however, been successfully applied in controlling water pollution in Germany, and has been proposed for limiting sulfur emissions by major air pollution sources in the United States.

This paper will focus on the elements of effective floodplain management. Since other researchers have dealt with the problems associated with structural control measures (James, 1968; Kusler, 1976; United States General Accounting Office, 1975; White et al., 1975), I will emphasize the relative merits and disadvantages of direct regulation vis à vis the economic approach to floodplain management.

THE OBJECTIVES OF FLOODPLAIN MANAGEMENT

Kusler (1976:110-113) identifies a number of desirable characteristics for a successful floodplain management program:

1. avoidance of losses to existing uses;
2. avoidance of losses to future uses;
3. congruence with the characteristics of the natural and social systems of the specific area;
4. consideration of regional welfare objectives;
5. minimal environmental impact;
6. permanency of protection;
7. inherent safety;
8. feasibility of implementation;
9. inexpensive to formulate and operate;
10. low requirements for expertise and personnel;
11. equitable incidence of benefits and costs;
12. congruence with the demand for land and supply of alternate sites;
13. ability to offer immediate control.

The choice of floodplain management policies depends on the multiple objectives of national and regional economic efficiency, equity, environmental quality, and other aspects of social well-being (Water Resources Council, 1973). Political feasibility and administrative effectiveness are also basic concerns affecting the design of a floodplain management program. Obviously, vested interests are likely to oppose any regulation of the floodplain, and any policy should be strong enough to overcome the objections of these groups.

The equity objective demands that management policies be fair to all concerned, although that does not imply treating everyone identically. A good policy will treat people in similar situations in a similar manner, while giving special consideration to the poor and others facing special hardships as a result of the policy. The objective of achieving



Many floodplains are sensitive environmental areas

Photo by M. Fahay

equity involves addressing the relations between the residents of the floodplain and those in the region outside the floodplain, as well as the relations *among* floodplain residents.

Environmental quality is another important objective, whether it is interpreted with regard to human values alone, or ecosystem functioning values as well. In the first sense, floodplains often are associated with scenic, wildlife, and recreational amenities important for enhancing the quality of life. In the second sense, floodplains serve vital ecosystem functions, such as aquifer recharge, or are important for the preservation of other sensitive areas such as estuaries, marshes, or dune systems.

Economic efficiency is concerned with the maximization of social welfare at a given level of resource expenditure. The concept goes beyond cost-effectiveness because the analyst must determine the appropriate level of resource utilization. Even if a policy is economically efficient, it is not necessarily desirable. Regional economic development, for instance, can be a valid goal, even at the expense of national economic efficiency.

ECONOMIC EFFICIENCY AND FLOODPLAIN MANAGEMENT

Economic efficiency is concerned with reaching the highest level of economic well-being. It is achieved through the proper level of resource utilization and the allocation of resources for maximum advantage. Economic theory assumes that individual self-interest is an important motivating force in human behavior, and that prices act as signals guiding economic decisions. Public policy can change relative prices and modify consumptive behavior by restricting the supply (direct regulation of floodplain land) or by decreasing demand (taxing floodplain occupancy or subsidizing out-migration).

Floodplain land may be a valuable resource and, in some cases, development may be economically desirable. Alluvial deposition may have built up rich soil for agriculture, or sand, gravel, phosphate, or gypsum for mining. A waterfront location is important for river or ocean transportation. Historically, urban centers have developed at strategic locations along water bodies, creating an impetus for further growth in the floodplain. Also, the location may be convenient as a source for inexpensive irrigation or industrial process cooling water. Effective floodplain management must determine *how much* land development is economically efficient and at *what* intensity of use.

Figure 1 provides a simplified rationale for economic efficiency in floodplain manage-

ment. The object is to minimize the total social cost of floodplain management. Total social cost is the sum of the costs of relocation and floodproofing, less the cost of damages avoided by relocation of development, or the restriction of further development in the floodplain.

If society as a whole could make the decision, we would choose an amount of floodplain use represented by point *M* at a total social cost of *A*. In fact, floodplain land use activities are now subsidized because the government builds flood control projects and bails out victims of flooded areas. Because of this subsidy, the sum of damages that floodplain residents would avoid by staying out of the floodplain are less than the damages that society would avoid if the floodplain were preserved as open space. As a result, aggregating economically rational decisions results in more land development in the floodplain (at a level represented by point *N*) and higher total social costs (equal to point *B*). The economically efficient amount of development (*N*) could be achieved by 1) eliminating subsidies, 2) taxing floodplain occupancy, or 3) subsidizing relocation out of the floodplain.

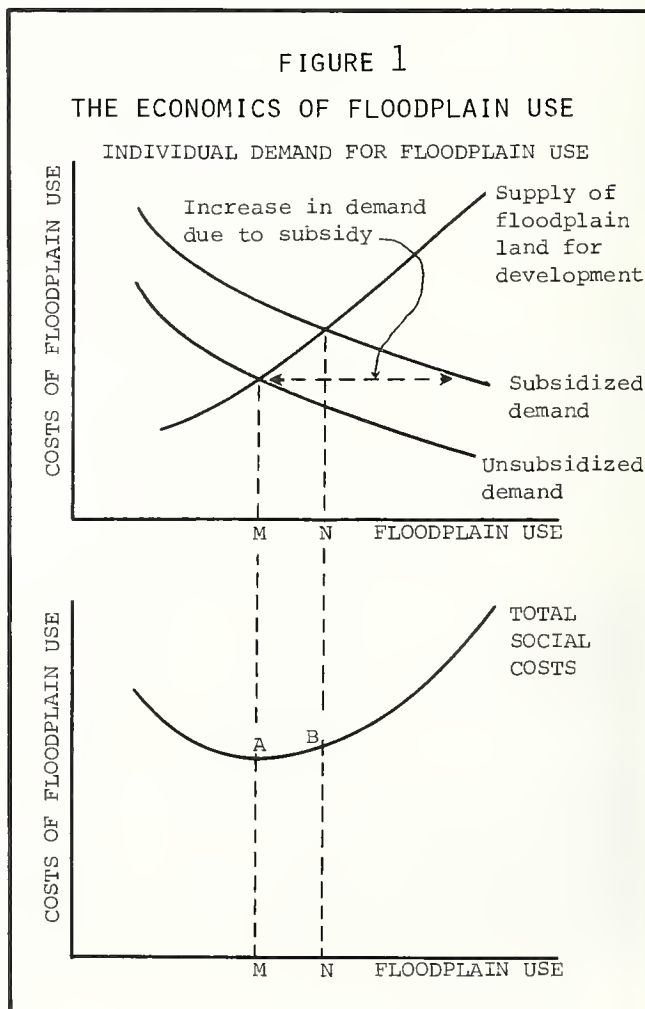


Figure 1 captures the main idea behind the economic approach, but a more detailed analysis of benefits and costs should be carried out. We need information to derive probabilities for the frequency and length of flooding by area, and also the amount, values, and expected losses of damageable property within the floodplain. Additionally, we must translate into

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cost figures the expected loss of life and limb, and the social, environmental, housing, transportation, employment, health, and security disruptions. Actually, the same information is needed to set up a rational system of direct regulation like floodplain zoning. If no floodplain management policies are implemented, society is making implicit default estimates of these values.

In a rational world, with an ideally functioning market, "people would suffer [economic] damage only when every alternative course of a action was more expensive They would withdraw from floodplain locations when expected damages are greater than or equal to the value of land They would floodproof as long as the expense is less than or equal to the damage reduction" (James, 1968:7). Governmental intervention distorts locational decisions, but there are also problems with leaving everything to the market. Individuals may not perceive risks and benefits properly because of a lack of knowledge or ability to deal with complex multivariate probability distributions. People may also have an excessively short time horizon in mind, or they may deny the hazard altogether. Individuals may base their decisions about location or floodproofing on "anchoring behavior" (an excessive reliance on a small amount of concrete data or previous experience), or "gambler's fallacy" (what happened last year is unlikely to reoccur this year). The poor may be the least likely to be aware of the extent of the hazards.

THE PROBLEMS OF DIRECT REGULATION

In general, the direct regulatory technique of floodplain management is not economically efficient because it ignores differences in the marginal costs of relocation and floodproofing among firms and individuals in different locations and industries. It does not provide a mechanism for balancing the marginal costs with the marginal benefits to the company.

From an administrative point of view, the relative inflexibility of direct regulatory mechanisms can present several problems. Because of "grandfather" clauses and other exemptions included in most land use control ordinances and enabling legislation, direct regulation is often ineffective in dealing with existing problems. Zoning laws in eighteen states exempt agricultural uses, while enabling acts in twenty-nine states exempt pre-existing uses unless they constitute a nuisance (Kusler, 1976:5). Zoning systems are further prone to irrational variances, which are unfair to other floodplain landowners and society.

The inflexibility of direct regulation is also a problem in the achievement of social equity. It does not preserve the right of individuals to make their own decisions, nor does it make direct allowances for reducing the heavy burdens that it may impose on individuals --especially the poor. Indeed, direct prohibition of floodplain residence may increase the cost of housing by restricting supply, but more importantly, it may make housing unavailable to the poor.

A final problem with direct regulation is that vested interests are likely to oppose regulatory laws, particularly when development is forbidden. Coalitions of these interests may be able to apply enough pressure to result in a weakening of the regulatory effect. Even when laws are strong, there exist problems with inspection and monitoring for building codes, floodproofing requirements, and conformance to zoning requirements. There may be little power to impose meaningful sanctions for violations, and even when the power is available, individuals and firms may escape by delaying compliance until the regulatory agency is overburdened and unable to go through lengthy legal proceedings.

THE ECONOMIC APPROACH AND ECONOMIC EFFICIENCY

Economic disincentives can deter or upgrade the safety of floodplain activities. In parallel, economic incentives for moving out can decrease the intensity of land uses without prohibiting residents from continuing the same activity in the same location. They are simply penalized or encouraged for behavior depending on social costs caused by their activities. When infrastructure is already built up, it may be more economical to stay in the floodplain and pay the tax or forego the subsidy. Areas with some flood hazard may still be the most desirable locations for certain land uses. As long as all the benefits of floodplain use exceed the social costs, and the beneficiaries of floodplain development bear those costs rather than taxpayers in general, use of the floodplain should not be restricted. In short,

North Carolina's Growing Problem

Steven P. French

While the exact amount of flood-hazard area in North Carolina is unknown, a reputable 1973 study estimated this area to be 3,652,000 acres, or twelve percent of the total land area of the state (Goddard, 1973). A total of 174 communities have been identified as flood-prone by the National Flood Insurance Program. Based on the number of flood insurance policies in force in November 1978, North Carolina has at least 18,647 structures located in flood-hazard areas.

Traditionally, flooding has been less serious in North Carolina (and the Southeast, in general) than in several other parts of the country. North Carolina did not develop urban concentrations along major rivers or in coastal areas around seaports, and the concentration of development in the piedmont area of the state, where flooding is relatively less severe, has been a major factor in North Carolina's past record of small flood losses.

Recent changes in the pattern of development, however, are likely to lead to serious flood problems in the future. The records of the National Flood Insurance Program (NFIP) show that there is continuing encroachment by new development on hazardous areas. In 1977, the most recent year for which records are available, 1,927 construction permits were reported for flood hazard areas in North Carolina.

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Assuming an average value of only \$30,000 per construction permit, this number of permits represents an investment in hazardous areas of \$57 million in 1977 alone.

NFIP records also indicate that the seriousness of the flood hazard and the rate of encroachment vary among the regions of the state. For example, the number of *flood insurance policies* issued in the coastal area (5,034) is more than four times the number in the Piedmont region (1,183), even though the Piedmont contains the bulk of the state's population and urban development. The number of policies in the coastal area is nearly ten times greater than those issued in the mountain

area (531), even though the most recent floods have been in the mountains. If the purchasers of flood insurance are acting rationally, the potential flood hazard is considerably more severe in the coastal area than in the rest of the state. Additionally, the number of *construction permits* issued in hazardous coastal areas in 1977 was ten times the number issued in either of the other two regions.

Given that there is a significant amount of urbanization in hazardous areas in North Carolina, what are the causes of this problem? The natural amenities offered by hazard areas seems to be one of the most important factors.

"ACCESSIBILITY TO URBAN SERVICES AND PROXIMITY TO NATURAL AMENITIES WERE TWO ADVANTAGES MOST OFTEN CITED IN A SURVEY OF FLOODPLAIN OCCUPANTS."

A 1971 study found that many floodplain residents were willing to bear the risk of flooding to enjoy the perceived advantages of locating there (James et al., 1971). Accessibility to urban services and proximity to natural amenities were two advantages most often cited in a survey of floodplain occupants. Given the location of encroachment in hazardous areas of North Carolina, proximity to natural amenities would seem to be the major factor.

Flood insurance poses another problem for controlling the urbanization of flood-hazard areas. The existence of such insurance may encourage banks to provide financing that would otherwise not be available. Furthermore, underpricing of insurance may encourage undesirable urbanization since occupants do not bear the full cost of their location decisions. Current methods used to determine flood insurance premiums have been questioned. Since the methods for computing flood probabilities were developed for riverine flooding, wave and wind forces may not be accounted for correctly in calculating premiums for coastal areas. A study of losses associated with Hurricane Eloise indicates that actual losses significantly exceeded the losses predicted by the Federal Insurance Administration (Shows, 1977). The nearly ten thousand flood insurance policies in emergency program communities in North Carolina may be stimulating the urbanization of hazardous areas by actually sub-

sidizing such development in some cases and by making financing available in others.

The final factor leading to urbanization of hazardous areas in North Carolina is the lack of a state program for floodplain management. The Floodway Regulation Law adopted in 1971 has never received funding from the state or federal level (Stewart et al., 1978). This lack of funding places the entire responsibility for managing and regulating flood hazards with local government, except in the coastal areas which are covered by the Coastal Area Management Act (CAMA). Even under CAMA, however, local government has the primary role in regulating hazard areas; this job is too difficult for local government to handle alone, especially considering the fiscal incentives local government has to increase the property tax base through new development.

In summary, there has been little or no effort by state or local government to discourage the trend toward large scale urbanization of flood hazard areas in North Carolina. Without some form of planned intervention, flood losses of life and property in North Carolina can be expected to continue climbing in the coming years.

REFERENCES

- Goddard, James E. 1973. *An Evaluation of Urban Flood Plains*. Springfield, VA: National Technical Information Service.
- James, L.D., E.A. Laurent and D.W. Hill. 1971. *The Floodplain as a Residential Choice: Resident Attitudes and Perceptions and their Implication for Flood Plain Management Policy*. Atlanta, GA: Environmental Resources Center, Georgia Institute of Technology.
- Shows, E.W. 1977. "National Flood Insurance and the Coastal Zone: A Case Study of Hurricane Eloise," *Water Resources Bulletin* 13(5).
- Stewart, J.N., R.C. Heath and J. Morris. 1978. *Floods in Western North Carolina, November 1977: A Lesson for the Future*. Raleigh, NC: The Water Resources Research Institute.

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tax and subsidy policy maintains efficient land uses while discouraging socially unproductive uses that are also uneconomical to the entrepreneur.

We can use taxes and subsidies to change an individual's awareness and perception of flood hazard, and provide artificial price incentives for more economically efficient responses. Taxes should be structured to provide periodic reminders to floodplain occupants and should be collected frequently enough so that occupants can contemplate leaving or floodproofing; annual or semi-annual tax payments should suffice. It must be remembered that if the tax is too low, the program will not be effective. Nor should the tax be set so high that it tries to prevent all potential flood losses, especially rare, low-probability floods. The 100-year flood is a generally accepted standard. As for subsidies, decisions of individuals and firms to relocate outside the floodplain are affected more by a one-time payment, since moving is a one-time event, whereas the decision to remain is made continuously or at certain discrete time intervals. Taxes and subsidies may be adjusted until the right levels are achieved, but they should be stable enough so that decisions can be made more readily.

THE ECONOMIC APPROACH AND EQUITY

The economic approach allows long-term residents with sentimental ties to an area to remain, providing they pay the social costs and bear the risk for their own decision. Thus, residents retain more freedom of choice. Disincentives and incentives are more equitable than direct regulation because people are not forced to take specific actions.

Equity is also served because people who live outside the floodplain are not forced to pay as much to protect floodplain residents. This savings occurs even if subsidies are used to encourage relocation because less money will be paid out for structural projects, damage, relief, and rescue expenditures.

If the taxing option is chosen, the tax burden may go up in the floodplain itself, but the overall tax burden in the region will go down. Still more critical from an equity standpoint, third party taxation of non-floodplain residents for the benefit of floodplain residents will decrease. The burden will fall on those individuals and firms whose activities are more closely associated with the flood hazard. Furthermore, states are relatively free to impose new tax and subsidy programs on existing residents.

Economic tools can also be tailor-made to minimize impacts on those who can bear them the

least. A tax disincentives program will not cut the supply of housing as much as stringent land use regulation, although a tax program will increase the price. Cash or in-kind payments could be used to compensate the low income residents. Better still, in terms of the efficiency and effectiveness goals, subsidies can be given to these individuals to help them move out of the floodplain and into decent housing elsewhere. Tax rates could be set on a progressive basis or could be subject to minimum income thresholds, or taxes could be combined with subsidies up to a maximum income level.

Equity may also be of concern to regional development. Seldom is an entire region in a floodplain, and development that is periodically inundated does not go very far in promoting a stable economic base for a less developed area. It would be to the mutual advantage of both the residents and outsiders if development were located outside the floodplain and compensation paid into the area.

Economic disincentives and incentives go a step beyond the federal flood insurance program. Economic measures are set up to account for spillover costs such as the costs of public structures and rescue, relief, and rehabilitation rather than just the damages to life, limb, and property.

Cochrane (1975:111), in evaluating the current distributive effects of natural hazards, found that "the federal government under a wide variety of relief programs seems to bear a substantial proportion of the loss to property However, this percentage tends to decline as the severity of the event [increases]." At the same time, the current composition of federal programs favors middle and upper income groups since the poor may not qualify for government loans. Tax deductions are also worth more to those in higher tax brackets, and forgiven loans disproportionately benefit those with the most wealth at stake.

"ECONOMIC TOOLS CAN...BE TAILOR-MADE TO MINIMIZE IMPACTS ON THOSE WHO CAN BEAR THEM THE LEAST."

If a disproportionate percent of the poor live in areas subject to the most frequent and severe catastrophic flood events, they also bear a larger share of injuries and deaths, and it is likely that they will be in those locations due to lower land prices and rents.

Federal aid may be useful in cases where a flood-prone locality is in a financially depressed region that is unable to impose a



Structural techniques of flood control are meeting increasing public opposition.

greater tax burden on residents or fund subsidies. The Corps of Engineers is empowered to acquire land and relocate buildings and utilities off the floodplain; that may be cheaper than building a giant impoundment even if the locality by itself cannot afford the relocation costs.

FEASIBILITY OF THE ECONOMIC APPROACH

Taxation of floodplain use will encounter political hostility, but less than that generated by other tools such as floodplain zoning. Unless the taxing jurisdiction coincides with the flood-risk areas, other groups will also gain from imposition of the tax. General taxpayers will not have to bear the burden of taxes for rescue, relief, and rehabilitation if the tax is set at the proper level and funds set aside for these purposes. If inefficient development is pushed out of the floodplain, the total tax burden should go down. Unfortunately, people may fail to perceive this logic and this could have very real political repercussions.

A tax system is more flexible to administer because the rates can be adjusted up or down more easily and faster than other regulatory mechanisms. Since floodplain locations shift, taxes can be adjusted to fit changing natural conditions or account for the cumulative effects of small developments. Taxes are also more flexible as they are not bound by grandfather clauses.

Taxes or subsidies with rates set according to explicit legislative criteria are probably less prone to charges of political bias and favoritism in administration than is direct regulation. Tax payments are a matter of public record and fewer avenues for variances

exist with taxes than with zoning. It should be a simple matter to determine whether the tax on a parcel has been paid or not. Administrative costs would be low if the tax were tied into the existing property tax base.

Property taxes do have some intrinsic problems that result from disparities in services, differences in size of assessment jurisdictions, the manner in which competent assessment personnel are employed and trained, the types and numbers of properties to be valued, and the state-local governmental relations and responsibilities (Back, in Lynn, 1976:62).

Due to administrative costs and political realities, recapture of social costs or payment of relocation subsidies should be above a minimum threshold size. At what point should the tax be collected or subsidy paid out? There are many possibilities:

1. At the point when public action causes the event (difficult to determine in practice unless the event is a very specific one such as relocation out of the floodplain);
2. Upon sale or transfer of property (harsh if private losses are incurred before that time);
3. Upon gift by owner (can lead to loopholes);
4. Upon death of owner (a proxy for sale, but does not impair real estate transactions, although it also does nothing about the land use before that time unless combined with regulations. Corporations persist.);
5. Upon attempted bona fide sale at a lower price if caused by a wipeout or a higher price if due to a windfall (less harsh, but prone to abuse);
6. On beginning or completing development (this option makes a great deal of sense for a floodplain tax or subsidy system aimed at reducing development in critical areas);
7. On granting or refusing development permission (even better than option six);
8. Each year or at some stated arbitrary length of time (this scheme also makes sense for a floodplain tax or subsidy program. Taxes would be assessed several times a year as a reminder of flood hazard). (Hagman and Mischynski, 1978:35-40)

In designing the taxation system, the sources of political opposition and support should be identified and the information used to advantage by the planner. Floodplain residents or landowners are the most obvious sources of opposition. Farmers, land holders, and speculators favor a positive (subsidy) program with fewest sanctions for conversion of undeveloped land. Conservationists favor a

positive program with stiff sanctions for conversion, or a negative (tax) program with differentially high taxes for new and existing development. In general, subsidy programs are politically popular and may be difficult to uproot once enacted; subsidies and preferential tax assessments are also relatively invisible and not usually subject to annual budget scrutiny, which can be a problem.

James believes that property taxes will not be used as a major environmental protection device because:

1. the environment has traditionally been a common-property resource;
 2. divergence of private versus social costs creates entrenched political interests;
 3. subsidies and grants are more popular;
 4. "the tax structure already suffers from too much social engineering";
 5. activities of various levels of government would not be affected.
- (Lynn, 1976:183)

On the same subject, Haar states that "among the lessons taught by the American system [of land use control], perhaps the most valuable one is that incentives often produce better results than legislative edicts" (Baker and McPhee, 1975:57).

TYPES OF LAND USE TAXES

A wide variety of economic disincentives can be used to guide land use: charges, fees, assessments, and other instruments lumped together under the term taxes (although their legal status varies with the precise type of system). Disincentives may be defined as "a monetary charge levied by government on conduct which is not illegal but which does impose social costs, for the principal purpose of discouraging the conduct" (EPA, 1974:6). Taxes may be used to guide future development away from the floodplain or discourage inefficient uses from staying in. According to Delogu (1968:673), the system can be set up in more complex ways to fine-tune the effects if there is a "hierarchy of undesirable land use situations and countervailing public actions could be construed by the legislature and appropriate tax rates imposed." Taxes also provide a source of revenues which can be used to counteract adverse impacts of the taxed activities.

Land use taxes can be structured in various ways. Some examples are:

1. flat rate per acre;
2. variable rate with type of use;
3. variable rate with type of use and quality of structure;
4. rate dependent on actuarial risk to make people aware of true costs;

5. rates set to cover the extra costs of public services and contingency costs;
6. rate based on population density of residential use as a proxy for quantification of generated externalities;
7. rates adjusted until the amount of desired change in land use patterns is achieved.

Some other types of specific disincentives include special assessments, exactions on development permission, impact taxes, sale of development permission, and transfer taxes.

Special assessments penalize incompatible uses in a natural hazard area. Although special assessments are just the reverse of the well-accepted preferential assessment tool, penalty assessments are much more controversial. Special assessments to finance particular flood control projects or to set aside a fund for flood relief are generally viewed as legal and equitable. Special assessments can be compared to cost-sharing by the beneficiaries of flood control works or relief programs. When special assessments are used, closer scrutiny over the exact benefits and costs of a proposal can be expected. It is easier to base assessments on cost allocations because benefits are uncertain as they are dependent on when a flood occurs.

Exactions on development permission are charges imposed with subdivision requests, rezonings, conditional use permits, variances, or building permits. The legality of exactions varies with state and local law, but the trend is toward acceptance of exactions when the amount paid is less than the gains from development (Hagman and Mischynski, 1978: xxvii).

Impact taxes are applied later in the development sequence than exactions and are meant to pay for needed public facilities and services. In some cases, the cost of servicing floodplains will be greater than flood-free areas; for example, stronger water pipes must

"RELOCATING EXISTING LAND USE IS ESPECIALLY DESIRABLE WHEN THE RISK OF FLOODS OR COST OF CONTROL WORKS IS VERY HIGH."

be used. According to Hagman and Mischynski (1978:xxvii), "Impact taxes do not enjoy the same legal acceptance as exactions [but] may be more appropriate as general windfall recapture devices than exactions are."

Sale of development permission is related to contract zoning. Regulatory permits are issued in exchange for certain monetary or other considerations. In the extreme, this may be construed as sale of a license to violate a

land use regulation, which is illegal. Although the theoretical price would equal the net social loss from granting development permission, this method may have some loopholes. Hagman and Mischynski (1968:xxxviii) point out that speculators might buy up development permissions and officials might end up "playing a real game of monopoly rather than...administering a public trust," and further that "no court has ever approved a sale of the right to regulate. Therefore a permission would be subject to subsequent regulation even by the contracting government."

Transfer taxes are sales taxes paid upon sale or gift of land. They may be ad valorem taxes based on a percent of the value with fixed or sliding rates or may be levied on increases in land value. If high enough, these taxes will affect a buyer's decision to locate in the floodplain. However, transfer taxes also have the dual effect of discouraging current residents from moving out. Unscrupulous businessmen may even evade the law by setting up dummy corporations and claim that no sale or gift has taken place.

TYPES OF SUBSIDIES

The purpose of land use subsidies for the floodplain are to preserve compatible uses and encourage elimination of incompatible uses. Subsidies may be outright grants, low interest loans, special tax benefits, or other compensatory schemes such as transfer of development rights.

Relocating existing land use is especially desirable when the risk of floods or cost of control works is very high. Although relocation subsidies have been seriously proposed for Prairie du Chien, Wisconsin, they have not been extensively used (Kusler, 1976:118). If a subsidy program is voluntary, people will only accept the subsidies when they perceive it to be their interest to do so. Alternatively, relief programs could be designed to reward people who move out of an area after a flood hits.

Governments should also investigate the use of direct payments, loans, or tax credits for floodproofing. Tax credits are more equitable than deductions, which are less valuable to lower income groups.

Easement purchase or differential tax assessments can be used by governments to reduce development pressure on floodplain land in agricultural or open space areas. Easements and differential assessments are well accepted tools in almost all states. Differential assessment increases the profitability of farm use and reduces carrying costs on open space. For this reason, differential assessment must

be combined with land use regulation or economic disincentives on development to prevent sprawl caused by market postponement of conversion aided by tax shelters.

There are three types of differential assessment programs. The first, *preferential assessment*, bases the value for tax purposes on current use and not the "best and highest possible use." Because there is no penalty for later conversion to other uses, this tool can only modify the *rate* of development of the floodplain.

Deferred taxation is similar to preferential assessment, but back taxes must be paid if the agricultural or open space is developed. Clearly, unless the penalty is severe, back taxes are such a small part of development costs that delays in conversion are only temporary.

Restrictive agreements are voluntary contracts between land owners and governments to keep land in a particular use for stated periods of time in return for lower tax assessments. Generally, the tax differential plus interest and a penalty must be paid if the agreement is broken. Sometimes, long advance notice is also required before development is allowed. Restrictive agreements are more complex to administer than deferred taxation because contracts are individually negotiated. They can, however, be applied more selectively.

Another incentive/disincentive technique for development control is that of zoning by special assessment financed by eminent domain. Landowners in restrictive zones are compensated by receipts from special assessments on landowners outside the floodplain whose property increases in value due to supply restriction. This is an old technique which has been upheld in the courts, but is now infrequently used.

THE LEGALITY OF NON-UNIFORM TAXATION

The Fourteenth Amendment of the U.S. Constitution requires equal protection and due process of law for all citizens of a state. Equal protection does not imply equal treatment of all individuals. It does mean that governments must weigh public and private interests and make decisions on a reasonable basis. Non-uniform taxes based on location inside versus outside the floodplain do not violate the Fourteenth Amendment. If the entire local jurisdiction is inside the floodplain, the locality is not confronted with accusations of discriminatory taxing unless it sets multiple rates for different segments of the floodplain according to specific hazard potential. Unfortunately, a locality entirely within the floodplain would be risking a competitive disadvantage compared to its neighbors in and out



In severe floods, structures can end up as debris and add to erosive scouring.

of the floodplain. Thus, the locality is not likely to undertake a taxation policy on its own, unless it has already reached its desired total level of growth or cooperates with all localities within a region on a floodplain management program.

There are precedents, however, for using taxes to discourage undesirable behavior. State and federal taxes are already being used to provide economic disincentives against behavior which is harmful to individuals and the environment. Sumptuary taxes on drugs, firearms, gambling, and alcohol, for example, are widespread, and are not considered violations of equal protection requirements.

Most state constitutions prohibit use of public funds for direct private gifts. A subsidy tied to a desired action is *not* a gift. However, if just the poor received relocation subsidies and the rest of the inhabitants have to pay floodplain occupancy taxes, there may be accusations of unequal treatment. If "similarly situated" is interpreted the same way it is for the progressive income tax, there would be no problem.

The exact wording of state constitutions and the implied connotations have a good deal of bearing on court acceptance of tax classifications. Most states have some kind of constitutional clause relating to uniformity of the property tax structure. These clauses can be divided into ten groups:

1. "Property shall be taxed according to its value." (Arkansas, Maine, and Tennessee)
2. "Property shall be taxed in proportion to its value." (Alabama, California, Illinois, and Nebraska)
3. "The legislature may impose proportional and reasonable assessments, rates, and taxes upon all persons and estates." (Massachusetts, New Hampshire)

4. "There shall be a uniform rule of taxation." (Michigan, New Jersey, Ohio, and Wisconsin)
5. "Taxation shall be equal and uniform." (Mississippi, Texas, West Virginia, and Wyoming)
6. "The legislature shall provide by law for a uniform and equal rate of assessment and taxation." (Florida, Indiana, Kansas, Nevada, South Carolina, and Vermont)
7. "Taxes shall be uniform upon the same class of subjects." (Colorado, Delaware, Georgia, Idaho, Louisiana, Minnesota, Missouri, Montana, New Mexico, Oklahoma, Oregon, Pennsylvania, and Virginia)
8. "Taxes shall be uniform upon the same class of property." (Arizona Maryland, North Carolina, North Dakota, South Dakota, and Washington)
9. "There shall be a fair distribution of the expense of government." (Rhode Island and Vermont)
10. No uniformity clause directly pertaining to taxation. (Connecticut, Iowa, and New York) (Newhouse, 1959:9-16)

In general, there is more flexibility in tax classifications than first meets the eye. Uniform rules imply classifications are acceptable. Often, careful creation of tax districts can circumvent possible problems. The most restrictive situation occurs in categories five and six, which outlaw taxation that is not equal and uniform.

In North Carolina, the General Assembly may classify real property for different tax rates. Presumably, it could place floodplain land in a separate category. However, this power cannot be delegated to cities and counties to set up their own classifications themselves (Brower et al., 1974:80).

Another possibility is designation of urban and rural service districts. A tax break could be given on land in the floodplain if the governmental unit refuses to extend services there. This tax subsidy may backfire and encourage development if the service boundary is not taken seriously by developers and the government; it is best used in conjunction with regulations.

A MIXED STRATEGY

Now that the case has been made for an economic approach, it can also be mentioned that economic incentives, direct regulation, and structural control are not mutually exclusive tools. They can be integrated to provide effective floodplain management. Additionally, a mixed strategy is safer if there are doubts about the legality of a particular element of the overall plan.

A minimum level of effectiveness can be ensured by overlaying the various approaches. If taxes and subsidies are set too low, zoning and building codes can guarantee some desired level of land use control. Further, zoning, by itself, may be useless for modifying existing uses rapidly, while taxes and subsidies alone may not be able to change locational preferences quickly. Land use locational decisions are a long time in the making and involve habitual behavior; we do not know the relative elasticities of responses to taxes and subsidies.

An integrated approach might also be useful in a rapid growth situation. Since they can be set into action quickly, taxes are well suited for use in an interim control program until a comprehensive plan or regulatory guidance system can be prepared or expanded.

"...ECONOMIC INCENTIVES, DIRECT REGULATION, AND STRUCTURAL CONTROL ARE NOT MUTUALLY EXCLUSIVE TOOLS."

With moderately high taxes and subsidies, in combination with land use controls, the efficiency and equity advantages of the economic approach can be substantially preserved. A mixed strategy is, therefore, not as inconsistent as it may seem at first, and is probably the best strategy for practical experiments with innovative policies.

CONCLUSION

Flood losses are increasing, despite expensive structural flood control works because of exogenous development pressures undampened by effective land use guidance. Direct regulation of land use has been largely ineffective and is hindered by special treatment of existing uses and by proliferation of variances. It is time to experiment with a different approach depending most heavily on economic incentives and disincentives, in addition to regulation and structural control if necessary.

It does not make economic sense to prohibit all use of the floodplain. Taxes and subsidies can be set up, at least in theory, to encourage the socially desirable level and types of activities appropriate for the floodplain. It is economically efficient to bear some risk and provide a certain degree of floodproofing, including structural controls. Aside from being more efficient, the economic approach is also more equitable. Disincentives and incentives do not force anyone to avoid or leave the floodplain. Instead, floodplain residents must

pay the full costs of their locational decision, including spillover costs and environmental damage. Often, people are unaware of the true dangers facing them and society can bring the risks to their attention with the periodic reminder of a tax bill.

Still, political opposition to any strong floodplain land use guidance system can be expected because of the power of special interest groups, even though society as a whole would be better off. Legality depends on specific requirements of states and localities and the program design. Regulatory taxes based on reasonable criteria are likely to be upheld.

There are many varieties of taxes and subsidies which can be investigated. Each form has its own particular intended and unintended consequences. The best floodplain program may be a combination of taxes, subsidies, regulations, and structural control.

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It is true that because the use of taxes and subsidies is innovative, we have little real world data on their effectiveness in controlling land use. The lack of experience is an advantage as well as a problem. These tools are riskier to attempt, but give the planner more room to experiment. At any rate, previous flood control policies can be safely judged a failure. Planners have little to lose in advocating that the floodplain taxes and subsidies reach the public agenda as a serious alternative.

REFERENCES

- Baker, Earl and Joe McPhee. 1975. *Land Use Management and Regulating Hazardous Areas: A Research Assessment*. Boulder: University of Colorado.
- Brower, David et al. 1974. *Growth Management Tools, Techniques, Systems*. Chapel Hill: Center for Urban and Regional Studies.
- Cochrane, Harold. 1975. *Natural Hazards and Their Distributive Effects*. Boulder: University of Colorado.
- Delogu, Orlando. 1968. "The Taxing Power as a Land Use Control Device." *Denver Law Journal* 45(2). Spring.
- Environmental Protection Agency. 1974. *Economic Disincentives for Pollution Control: Legislative, Political, and Administrative Dimensions*. Washington, DC: Government Printing Office.
- Hagman, Donald, and Dean Mischynski, editors. 1977. *Windfalls for Wipeouts*. Chicago: ASPO Press.
- James, L. Douglas. 1968. *Economic Analysis of Alternate Flood Control Measures*. Lexington: University of Kentucky Water Research Institute.
- Kusler, Jon. 1976. *Perspectives on Floodplain Regulations for Floodplain Management*. Department of the Army, Office of the Chief Engineer.
- Lynn, Arthur, Jr. 1976. *Property Taxation, Land Use and Public Policy*. Madison: University of Wisconsin Press.
- Maddock, T. 1977. "A Primer on Floodplain Dynamics." *Journal of Soil and Water Conservation* 31(2).
- Newhouse, Wade, Jr. 1959. *Constitutional Uniformity and Equality in State Taxation*. Ann Arbor: University of Michigan Law School.
- Oates, Wallace and William Baumol. 1975. "The Instruments for Environmental Policy," in Edwin Mills, *Economic Analysis of Environmental Problems*. New York: National Bureau of Economic Research.
- United States General Accounting Office. 1975. *National Attempts to Reduce Losses From Floods by Planning For and Controlling the Uses of Flood-Prone Lands*. Washington, DC: Government Printing Office.
- United States Water Resources Council. 1973. "Water and Related Land Resources: Establishment of Principles and Standards for Planning." *Federal Register* 38(174).
- White, Gilbert et al. 1975. *Flood Hazard in the United States: A Research Assessment*. Boulder: University of Colorado.