Economic instruments

Impact and betterment fees

Environmental impact fees or betterment fees are one-time payments that developers, builders, or industry must make at the time of development approval. They are calculated to be proportionate to the cost of providing the physical infrastructure and environmental services needed to increase the carrying capacity of the land sufficiently to accommodate the new development, yet still protect the environment. For example, environmental impact fees could be used to finance flood protection, parks and recreation, water supply and sanitation, environmental monitoring and auditing, and hazardous waste cleanup (Mekvichai 1990). According to Dowall and Clark (1991), special assessments to finance new infrastructure can also be applied to owners of vacant land. These assessments not only will ensure that the costs of the infrastructure are paid for by recipient properties, but may also provide an incentive for developing the land.

Low-interest loans and grants

Low-interest loans and grants are two types of incentives that can be used for managing occupation of hazard-prone areas. For example, if commercial banks establish a low-interest loan program in conjunction with the government agency responsible for enabling low-income residents to upgrade their properties, these people will be able to withstand certain environmental threats. Also, subsidized credit can be provided for industries either to relocate their factories or invest in pollution control.

In Turkey, the government provides subsidized credit for relocating industries. For example, leather tanneries relocating to the Maltepe Industrial Zone north of Izmir are entitled to subsidized interest rates of 35 percent for general loans and 22 percent for construction and infrastructure investment. This is a clear incentive because interest costs in 1988 and 1989 accounted for 20 percent of total investment expenditures. The federal government also offers a 40 percent tax deduction on investment for the tanneries relocating to other industrial zones during the first two years of estate construction, and a 7 percent reimbursement on investment for small- and medium-sized tanneries (Kosmo 1989).

Flood insurance

National flood insurance programs can provide a powerful incentive for local communities to enact floodplain zoning and control construction within river and coastal floodplains. In the United States, for example, the National Flood Insurance Act of 1968, as amended by the Flood Disaster Protection Act of 1973, provides federally subsidized flood insurance for property in mapped flood-prone areas. In return, local and state governments must enact and enforce comprehensive floodplain management measures designed to reduce exposure to flood damage, which include land use controls and building standards. This program created flood insurance maps, which delineate flood-prone areas, After a locality enters the program and complies with federal regulations, the local government must require all development within the designated floodplain to be designed and built to withstand a 100-year storm (that is, the storm with a 1 percent chance of occurring in any given year). Generally, this means that new development, including substantial improvements to existing structures, within the 100-year floodplain must be elevated above the flood level (Mantell et al. 1990).

Another approach is to design nontraditional insurance schemes for low-income households. For example, low-income families can join community savings plans, which include insurance schemes. Their plans can be organized and managed by local organizations such as community groups, thrift societies, or savings and loans. Under such a system, each household pledges to put a small amount into an interest-bearing savings account for a specified period (for example, ten years). The organization managing the plan converts the money into hard currency and invests it abroad. Any interest earned on the

account is distributed among the various depositors. If a disaster occurs during the ten-year period, the depositors are reimbursed for the amount they pledged to invest. Either they have savings accumulating over ten years or they have the assurance that they will be covered if a disaster strikes (World Bank 1991).

Property rights

Under this approach, the government establishes a system for clarifying land ownership and boundaries, and provides secure tenure to land occupants in illegal settlements, including those in hazard-prone areas. This enables landowners to gain access to formal credit sources so that they can invest in housing construction or improvements that will withstand certain hazards. Establishing such a system, however, normally requires the political will to institute land reforms at the national level as well as available expertise to review existing laws, integrate customary systems of land tenure with modern land titling systems. design simple and efficient procedures for providing secure land tenure to low-income groups, and register titles in legal cadastres. Providing legal land tenure may also involve a system of incentives to encourage low-income landowners to register their properties, as well as measures to ensure that providing tenure does not encourage further invasions of hazard-prone lands.

Land acquisition approaches

Voluntary sale

Direct land acquisition by government is often the only firm guarantee of land availability for public purposes. Governments commonly acquire sites for utilities, schools, hospitals, public housing, and park and recreation space. Although land acquisition can be an important tool for protecting sensitive lands or otherwise controlling their use, there are several disadvantages to this instrument. They include the high costs of acquiring land, the loss of local property tax revenues, and the often high costs of managing and monitoring the public land. In developing countries, however, where additional constraints are imposed by poorly functioning land markets (see the section on Land Management Strategies for Hazard-Prone Areas), land acquisition programs rarely are carried out efficiently.

Expropriation

The concept of expropriation is based on a sovereign's power of eminent domain, which allows the state to take private land for the good of the state. Expropriation is essentially a forced sale; the laws governing expropriation are as diverse as the countries' notions of the importance of private property and social land needs (Kitay 1985). Nonetheless, the permitted purposes generally include transportation; construction of public buildings (some countries include schools, government buildings, markets, factories, and even low-income housing); public utilities, and parks. In some cases, the public purpose encompasses the misuse of property. In Ecuador, for example, the Municipal Regime Law states that it is the prerogative of the municipalities to expropriate land that has not been put to a socially efficient use.

Most developing countries have fairly extensive laws for expropriation. Although they vary a great deal in terms of power and authority, many exist in name only and are rarely used. One theory for their infrequent use is that they may have been imported and enacted alone without the support of a broad scheme of complementary powers of acquisition. In such cases, the expropriation laws have been undermined by private opposition to public land acquisition. According to Kitay (1985), skillful advocates for private sector interests have been able to use the safeguards in expropriation statutes (that is, the public purpose doctrine and just compensation) to frustrate and delay the use of such authority. Kitay therefore recommends a serious exercise to revise land acquisition laws that result in broad-based laws that do not rely unduly on compulsory powers (Kitay 1985).

Expropriation is seldom a complete response to managing vulnerable areas. For example, a land acquisition program for important wetland habitats can be frustrated by poor land use practices in the surrounding watershed, causing excessive siltation in the wetland basin. Beyond the problem of managing adjacent land uses, the acquisition must be supplemented by a vigorous management program. (In the case of hazard-prone areas, for example, this may mean monitoring easements or covenants to guarantee a free, well-signed, public right-of-way). In considering this approach, therefore, the financial, legal, and administrative costs of acquisition should be taken into account.

Easements

An easement is a legally enforceable interest in land created by a transfer. For example, an easement can establish rights to enter and use land, such as the right of access for public services. They also can limit certain uses of land (for example, prohibit residential development). Easements can be acquired from being used by the public over a long period without the owner's consent, yet with the owner's knowledge. The period of time may be statutory, or the use may have existed for so long that the court will declare that rights of the nature of an easement have been acquired by prescriptive use (U.S. Department of the Interior 1982).

Easements can be used most effectively when some, but not all, rights of ownership are needed to achieve specific land management objectives. For example, an easement can be drafted that specifies exactly what uses will be allowed to continue and what uses will be restricted. For hazard-prone areas, these restrictions can specify the type, size, number, and location of structures allowed on a particular parcel, or they can specify that the design and site plan are subject to approval by a managing agency. Easements are most useful when a private owner desires to continue uses that are compatible with public land management objectives.

Land exchange

Public agencies may acquire land or interests in land by trading land or interests already under their jurisdiction. Exchanges may be for equal values, or values can be equalized by payment of cash. They provide an opportunity to consolidate land holdings or acquire needed land interests to control the use of hazard-prone areas. To carry out such exchanges, however, a government must develop a system for establishing the value of its tradable lands. Because of the difficulties in determining such values, land exchanges may not be expedient for compulsory acquisitions, although they can be useful for voluntary transactions.

Land readjustment

Land readjustment (also known as land consolidation and land pooling) is a method by which a public authority assembles inefficiently configured unserviced urban, suburban, or rural land; reconfigures the plots; installs all public services; and returns a portion of the land to the original owner in proportion to their original contribution. Of the remaining land, the government uses some for the roads and infrastructure and sells the rest to finance the cost of the redevelopment scheme. Essentially, a land readjustment scheme recovers for the public a part of the land developer's profit by making the public body the principal developer. The process is carried out by manipulating the title of the land itself, with only small exchanges of cash.

By consolidating small property holdings and improving access and infrastructure, land readjustment can help remove constraints related to the development of otherwise inaccessible parcels of urban and suburban land. By helping to bring this land to the market for more efficient use and development, pressures are reduced on agricultural land in the urban fringe, and more efficient use is made of existing urban services. Land readjustment has been effective in Taiwan, Korea, Japan, and Germany.

Advance land acquisition

Advance land acquisition is the strategic acquisition of limited amounts of land so as to control its use or pattern of growth, particularly when accompanied by targeted budgeting of capital resources. For example, advance acquisition can be used for acquiring the best sites for planned public facilities at a time when such sites are within the financial reach of the government or for acquiring land along growth corridors (Kitay 1985). In practice, however, few successful applications exist in cities in developing countries due largely to the tendency of public agencies to become monopolistic. Nonetheless, advance acquisition can be considered more appropriate for restricting development in vulnerable areas (Kitay 1985).

Government provision of infrastructure

Targeting resources for infrastructure provision (for example, roads, sewers, water, electricity) can be the single most powerful tool, except for government acquisition and construction of housing and industrial facilities, to control land use. Government investment in physical measures, such as appropriate drainage, waste collection, and disposal systems, can also reduce damages from future floods and provide for routine maintenance and environmental protection in hazard-prone lands. To carry out effective programs to provide infrastructure in developing countries, however, institutional capacity must be strengthened and the availability of public funds and ability to mobilize financial resources for these measures must be increased.

Information and educational approaches

Geographic information system

As tools to collect, organize, analyze, and present data, geographic information systems (GISs) can play a critical role in mitigating natural hazards through development planning. A GIS is a systematic means of combining various data about a geographic area. It can contain mapped information that reveals spatial relationships between various attributes, such as hazardous events, natural resources, and socioeconomic conditions, and therefore can support planners in assessing the impact of natural events on existing and proposed development activities (OAS 1990). The information to be assembled in a GIS for managing hazards is determined by the level of government and purpose of application.

At the national level, for example, planners can use a GIS to categorize land with regard to natural hazards and to determine whether and to what extent natural phenomena pose a significant danger. At the regional level, a GIS can be applied to more detailed studies to identify the potential for development and hazard-related constraints of selected areas. At the local level, planners can use a GIS to formulate projects at the prefeasibility and feasibility levels to locate vulnerable lifeline network elements—for example, ports and airports, hospitals, health centers, police stations, fire stations, schools, energy infrastructure, road network, emergency management facilities, and telecommunications (OAS 1990).

Although a GIS has many potential applications, it may not be applicable in all situations and it may not be self-financing. Moreover, for personal computer-based GIS, there are many possible combinations of hardware and software. The system should be chosen on the basis of simplicity and affordability. Sophisticated systems require more technically skilled staff to run them, and they may be more difficult to maintain and repair locally. Especially for map analysis for managing hazards, their capabilities may not be worth the additional cost (OAS 1990).

Remote sensing

Remote sensing refers to the process of recording information from sensors mounted either on aircraft or on satellites. The technique is applicable to natural hazards management because nearly all geologic, hydrologic, and atmospheric phenomena are recurring events or processes that leave evidence of their previous occurrence. Remote sensing can play a critical role in all facets of

disaster management, especially in the areas of risk management, disaster preparedness, and general development planning. Remote sensing reveals the location of previous occurrences; distinguishing the conditions under which they are likely to occur makes it possible to identify areas of potential exposure to natural hazards so that measures to reduce the social and economic impact of potential disasters can be introduced into the planning process. The technology can be especially useful for obtaining accurate and timely information about the nature of a hazard, or for gathering rapid, low-cost reconnaissance information over large, often isolated areas where data collection may otherwise be cumbersome. Remote sensing also is useful for disaster monitoring and post-disaster assessment (Morgan 1989).

Since 1986, SPOT I—a satellite financed by France, Belgium, and Sweden—has been sending images with eight times the spatial resolution of LANDSAT and other civilian satellites. In a continuous regular orbit, SPOT I provides up-to-date images of urban centers throughout the world. Changes in the urban environment and in urban land use can be monitored by purchasing images at regular intervals. These changes help in estimating population growth and in evaluating the need for new infrastructure (Bertaud 1989).

Land information system

A parcel-based land information system (LIS)—often referred to as a multipurpose cadastre—is a tool for making legal, administrative, and economic decisions, and is an aid for planning and development. It consists of a data base containing spatially referenced land-related data for a defined area as well as procedures and techniques for systematically collecting, updating, processing, and distributing the data. The base of an LIS is a uniform spatial referencing system that links the data within the system with other land-related data. It includes data on land ownership, location, values, and other attributes, such as land use or infrastructure.[2]

A properly functioning, parcel-based LIS can provide many benefits to local governments and private landowners. For local governments, it facilitates urban planning, land administration, land management, provision of infrastructure, and environmental assessment. For individuals and private enterprises, the LIS facilitates real estate transactions by reducing transfer costs and eliminating delays when boundaries and ownership must be established before a transfer. The LIS also reduces litigation and associated costs; provides greater accessibility of information about land, thus allowing a geographically larger and more competitive land market; and increases the availability of credit and mortgages for all types of development by providing credit institutions with reliable records of the extent and security of ownership.

Although improving land information provides many benefits, governments in developing countries are not always eager to launch programs to upgrade existing cadastres or establish new systems for several reasons. Establishing a new land information system is costly and may not yield immediate tangible and quantifiable benefits. Some countries may be faced with direct opposition to a modern land information system. Tribal or ethnic groups may be fearful that customary law will be violated, or powerful landowners may resist such systems because the extent of their holdings may be publicized. Other constraints to establishing effective land information systems include political resistance to introducing or improving property tax systems, as well as possible security restrictions. Establishing an LIS, however, is not only a matter of political will and available funds. It requires the technical capacity to design systems that are low-cost, easily administered, easily understood by local landowners, and properly maintained and updated by locally available experts.

Coastal atlases and data banks

A coastal atlas and data bank are a systematic compilation, interpretation, and display of information linked to a specific set of coastal issues and organized for an entire state or nation. Through this approach, programs can be established that will permit

use of natural resources and maintenance of environmental quality by adjusting use according to resource capacity. Besides being issue-oriented, the information in a coastal atlas should be collected consistently for the same parameters, preferably at the same scale on a national or statewide basis. Such information should also be compiled and synthesized in meaningful ways, using consistent weighing and scaling techniques, and should be easily retrieved. The atlas should include a set of maps prepared on a common scale. In some cases, the map may represent the final output of the data base. In other cases, a series of descriptive and interpretive maps may be part of the analytical effort (Sorensen and McCreary 1990).

Coastal zone atlases and data bases can play a central role in facilitating a more integrated and better informed approach to coastal resource management. Data drawn together on different aspects of the coastal environment (for example, mangrove location, land use designations, and hazards) can be used as tool for identifying problems, especially those that need immediate attention.

The usefulness of coastal atlases and data banks depends on several factors. First, these tools must be linked to a process of interpretation, policy setting, and appropriate intervention. Second, the value of a coastal data base or atlas is clearly dependent on the quality and quantity of raw data. In most developing countries, the available data is often uneven with regard to accuracy and consistency of coverage. Third, the methods by which data is compiled, scaled, and aggregated have an equal impact on the utility of the data base or atlas. This is especially evident in considering the map scales at which data are obtained and reproduced. For example. maps compiled at scales of 1:120,000 or 1:125,000 are useful for large-scale regional planning, but much finer grain is needed (perhaps 1:24,000) for preparing land use plans. Even more detailed maps are needed for site plans of particular projects. Fourth, atlases and data bases can quickly become obsolete, so there must a commitment to their timely use and continual updating. Lastly, building an atlas or data base is costly in terms of money and staff time spent. It should not be undertaken without a clear realization of both start-up and maintenance costs (Sorensen and McCreary 1990).

Mapping natural hazards

Multiple hazard mapping. The multiple hazard map (MHM) is a tool for analyzing vulnerability risk, especially when MHM is combined with the mapping of critical facilities (see below). The advantages of an MHM are that the characteristics of the natural phenomena and their possible effects can be synthesized from different sources on a single map. An MHM can flag hazards that may trigger other effects or exacerbate them, and it can obtain a more precise view of the effects of natural phenomena on a particular area. An MHM can also identify sub-areas that require more information, additional assessment, or specific hazard-reduction techniques. It can allow land use decisions to be based simultaneously on all hazard considerations. The MHM can also support emergency preparedness planning (OAS 1990).

Critical facilities mapping. The main purpose of a critical facilities map (CFM) is to convey clearly and accurately to planners and decision-makers the location, capacity, and service area of critical facilities (that is, all manmade structures or other improvements whose function, size, service area, or uniqueness gives them the potential to cause serious bodily harm, extensive property damage, or disruption of vital socioeconomic activities if they are destroyed or damaged or if their services are repeatedly interrupted). When combined with an MHM, a CFM can show which areas require more information, which ones require different hazard reduction techniques, and which ones need immediate attention when a hazardous event occurs (OAS 1990).

Environmental impact assessment

An environmental impact assessment is a tool by which the potential environmental effects of a proposed project and its alternatives can be

analyzed prior to implementation so as to ensure that the proposed project or action is environmentally sound and that any environmental consequences can be recognized early and taken into account during the project design. Environmental impact assessments may cover baseline environmental conditions; potential environmental impacts (both direct and indirect); comparison of the environmental impacts of alternative investments, sites, technologies, and designs; preventive, mitigatory, and compensatory measures; environmental management and training; and provisions for monitoring the effects on a project.

In the case of industrial development, the environmental impact assessment should address specific concerns related to pollution, risk of accidents, and proximity to surrounding settlements. In the case of natural hazards, however, the environmental impact assessment should address whether or not a proposed project will be affected by natural hazards, and if so, what measures will be taken to mitigate the effects. The environmental impact assessment should also serve as a vehicle for analyzing the effects of development alternatives on disaster vulnerability and for identifying disaster prevention and loss reduction measures. According to the Environmental Sourcebook (World Bank 1991), following are some of the considerations that should be addressed in carrying out an environmental assessment of natural hazard risk:

- identify specific natural hazards, including their characteristics, distribution, intensities, qualities, and historical records to review the frequency, probability of occurrence, and regional and local characteristics;
- identify the critical sectors in the economy and natural resources that may be affected by the identified hazards, analyze the constraints and conflicts that may be imposed by the natural hazards on each relevant sector and on natural resources, and examine the possible structural and nonstructural actions required to mitigate risks;
- for each sector or area at risk, examine standards, design criteria, and maintenance practices that may foster vulnerability, and make appropriate changes to help reduce it;
- examine the institutional capabilities for preventing and mitigating disasters at the national, regional, and local levels, highlighting mechanisms for interinstitutional coordination and areas that may require strengthening;
- identify the specific capabilities of local nongovernmental organizations (NGOs) to participate in activities to reduce vulnerability, particularly concerning community involvement, education, and training; and
- examine the existence of or need for policies to prevent and mitigate disasters and for regulations at both the local and national levels.

As part of the assessment, the capacity of existing institutions to develop policy on natural hazards and to implement that policy through regulatory, economic, and other instruments should be evaluated. Similarly, the institutional capacity to develop and implement education and training programs should be assessed (World Bank 1991).

Land market assessment

A land market assessment (LMA) is a tool that provides an accurate and up-to-date data base on the operation of the urban land market. It assesses the current condition of the land market (for example, which land uses are growing the fastest, where urban land conversion is taking place, where urban land conversion is outstripping the supply of serviced land, whether greenbelts or agricultural land preservation is limiting development, and whether planning standards and building codes are pushing up housing prices). An LMA can be used to estimate future urban land requirements for residential, commercial, and industrial uses. LMAs can be used to support four broad activities: (a) providing information for government planning

and decision-making; (b) evaluating government policies and actions; (c) serving as a foundation for structuring land-based taxation systems; and (d) providing information for private sector investment and development decisions. The most significant benefit of the LMA is that it helps improve the quality of land development planning and policymaking by providing public officials with the basic assessment of the state of the land market. It also serves as a base for monitoring land markets so that the effects of various policies can be evaluated (Dowall 1991).

Natural hazard assessments

Natural hazard assessments provide information on the probable location and severity of dangerous natural phenomena and the likelihood of their occurring within a specific period of time in a given area. These studies rely heavily on available scientific information, including geologic, geomorphic, and soil maps; climate and hydrological data; and topographic maps, aerial photographs, and satellite imagery. Historical information (written and oral accounts) from long-term residents also helps characterize potential hazardous events. The natural hazard assessment evaluates the threat of natural hazards, identifies additional data needs for a definitive evaluation, and recommends appropriate means of obtaining the data (OAS 1990).

Vulnerability assessments

Vulnerability studies estimate the degree of loss or damage that would result from the occurrence of a natural phenomenon of given severity. The elements analyzed include human populations; capital facilities and resources such as settlements, lifelines, production facilities, public assembly facilities, and cultural patrimony; and economic activities and the normal functioning of settlements. Vulnerability can be estimated for selected geographic areas (for example, areas with the greatest potential for development and already developed areas in hazardous zones). The techniques include lifeline (or critical facilities) mapping and sectoral vulnerability analyses for sectors such as energy, transport, agriculture, tourism, and housing (OAS 1990).

Public education

Public education should be provided for urban land managers and local populations affected by natural and human-caused hazards. Information is needed on the nature of local hazards, the critical facilities that would be affected, and on hazard mitigation. Local populations also need information on how to build or rebuild their homes or businesses so that they will not be damaged or destroyed in subsequent floods, hurricanes, or earthquakes. To facilitate the public education process, community-based nongovernmental organizations (NGOs) can play a major role in providing technical support and critical information for improved health and environmental conditions in poorly serviced areas.

Conclusion

The occupation of hazard-prone areas is a critical issue confronting urban land managers in developing country cities. Addressing this problem requires a careful analysis of the nature, frequency, and potential negative effects of local hazards and the underlying reasons for occupation of hazard-prone areas; formulation of land management strategies that take into account the costs and benefits of alternative schemes for all relevant populations; and selection of appropriate land management instruments for expanding the supply of urban land, restricting development, or mitigating the impacts of various hazards. Selecting the right instrument or mix of instruments will involve consideration of a range of natural, economic, and sociopolitical conditions, along with government participation at the national and local levels. As in other aspects of urban environmental management, efforts to manage hazard-prone areas will require actions by a variety of actors, public participation in the decision-making process, and local efforts to build broad-based support.

Notes

1. For a more detailed discussion of urban waste management and pollution control, see two other publications by the author in the Urban Management Program Discussion Paper Series: *Alternative Approaches to Pollution Control and Waste Management: Regulatory and Economic Instruments* and *Priorities for Urban Waste Management and Pollution Control.*
2. Parcel-based land information is also contained within legal cadastres (title registers) and fiscal cadastres (tax rolls) that may or may not be computerized.

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