CHAPTER VI

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

In most disaster-prone developing countries, until now, too little attention has been given to natural disasters, either in national economic planning or in the regional and local physical planning process. This situation is due partly to scientific and technical problems and partly to problems of resources. But the main issue is probably lack of awareness of the existence of basic disaster prevention measures which can assure very substantial and permanent benefits and will not necessarily cause governments additional expenditure. The least costly measures consist in making rational decisions to locate new development and capital investments in areas which are not regularly subjected to systematic damage or destruction caused by natural phenomena. As has been pointed out throughout this study, it is mainly a problem of land-use based on vulnerability analysis.

With the exception of Chapter 5 on floods and earthquakes, this monograph has discussed land-use policies and measures which are not exclusive to disaster prevention and mitigation. It has, by and large, described how known land-use measures commonly applied to achieve "conventional" social and economic goals can also be applied for disaster prevention and mitigation purposes. However, the picture changes when a particular land-use measure becomes a specific function of risk reduction for a particular type of hazard. At that point, land-use control can be said to have become a specific technique for disaster prevention and mitigation. But this desirable situation has not yet fully emerged. Except in the case of flood-plain management, and to a limited extent in seismic areas, land-use planning has not yet developed into a recognized and specific tool for the comprehensive mitigation of natural disaster risks.

Perhaps the fundamental reason for this is that a multidisciplinary, comprehensive approach to disaster prevention itself is still in its infancy. It is not always clearly recognized, either by physical planners or by scientists, that they have common ground upon which to combine their efforts to control the impact of extreme natural phenomena on man (in this respect there has been much closer co-operation between scientists and engineers who, together, have concentrated on producing structural solutions aimed at resisting rather than avoiding the impact of natural phenomena). The consequence is that a serious gap currently exists between the study of natural hazards and the application of the results of such study to development planning, and more particularly to physical planning.

The most immediate and basic information usually extracted from scientific data on natural disasters invariably identifies where they have occurred and are likely to occur again. Therefore, the most immediate and obvious area of the application of knowledge on natural hazards, particularly in the poorer countries, would be in the field of physical planning, and, particularly, land-use planning. In this respect, much progress is being made on the application of seismic micro-zoning but within too narrow a focus. In a number of industrialized countries exposed to frequent and violent earthquakes, much importance is now being attached to the development of seismic micro-zoning as a disaster prevention tool. But with the exception of the siting of nuclear power facilities in specific - but not all - instances, seismic micro-zoning has been principally used to determine

para-seismic building codes. Seismic micro-zoning is still largely undeveloped as a land-use planning tool in earthquake-prone regions, particularly in the developing countries, yet the close association between seismic micro-zoning and zoning for land-use would appear not only logical but obvious.

If the spatial implications of natural disasters in long-term development are still not sufficiently recognized, it is also because much remains to be done to broaden the entire field of "vulnerability analysis". Indeed, UNDRO has systematically made the point that the importance of the field of natural hazard analysis generally lies in its determining role in quantifying the risk of disaster for comprehensive planning purposes. Much has been said about the probable frequency and intensity of natural phenomena; too little stress has been placed on the spatial impact of these probabilities, however, except in the most general terms, usually on a macro (or regional scale) which is of little use to the planner concerned with specific new developments in precise locations.

A further gap between vulnerability analysis and land-use planning is that risks are seldom viewed together or compositely. The simplest illustration of this concerns the lack of study of secondary risks associated with earthquakes risks in a particular locality: landslides, mudflows, floods and the changes in the micro-seismicity of artificial water catchment areas can lead to severe local quakes and even dam failures. Other categories of composite risk may occur when natural disaster risks are closely linked to man-made risks, such as fires and contamination caused in the aftermath of earthquakes, and pollution in the wake of flood disasters. The most common type of composite risk, however, is found when a given area is prone to several types of independent natural phenomena, such as floods and earthquakes. A great deal of work in composite vulnerability analysis still needs to be done at the local or micro-regional level where specific human activities are being located.

The problem of applying vulnerability analysis to spatial planning and land-use in particular has been hindered in many instances by the unwillingness of individuals and groups to accept change. Over-reliance has been placed on protective measures to resist the impact of natural phenomena, and, failing these, on the receipt of relief aid. Furthermore, the entire field of natural hazard analysis has been overshadowed by problems of the prediction of the occurrence (the when) of natural phenomena, so much so that the application of risk analysis techniques to hazard locations for land-use planning purposes has lagged. It is important to remember that although it may not be possible at the present stage of scientific knowledge to forecast (except a few hours before-hand in some cases) <u>when</u> they are going to happen, on the other hand, it can often be predicted with a reasonable degree of accuracy, <u>where</u> they are most likely to occur, for example in flood plains, fault zones or avalanche corridors. This is perhaps most evident in earthquake-prone areas, but even in the case of most "erratic" type of natural phenomena, likely to cause disasters, namely tropical cyclones, it is known that about 90 per cent of the casualties and damage are caused by water, and not by the effects of wind.

If the timing of earthquakes, the <u>when</u>, for example, could be more precisely determined than at present, notwithstanding some obvious negative economic and social impacts of accurate earthquake prediction, i.e. loss of planned investments or development projects in disaster-prone areas, these latent risks would become very much more real in the minds of the public and the authorities. In summary, while the <u>when</u> is not fully possible yet, the <u>where</u> is largely a reality.

Therefore, land-use measures to prevent or limit further settlement in vulnerable areas would probably be carefully formulated and vigorously applied, at least in major settlement areas. The reference here is mainly to new development and expansion of existing settlements. Problems posed by earthquake predictability in existing cities (such as Tokyo and San Francisco) are of a different order, in which land-use measures are being applied for progressive land-use readjustments over considerable time spans to reduce damage probability. The present study has attempted, firstly, to emphasize the relevance of locational criteria to disaster prevention and mitigation; secondly, to begin systematizing land-use planning and control as a disaster mitigating tool, and, thirdly, to point out how much remains to be done in this direction.

Recommendations

The following recommendations are based on this study:

(i) At the international level:

(a) In general, planners and decision-makers in disaster-prone developing countries should be made aware of the vital importance of locating new development whenever possible away from hazardous areas, or at least where the probability of damage is reduced. When such siting is not possible, protective measures must be taken, the level of protection being a function of the level of risk accepted. The first line of defence is correct siting and the second line structural protective measures, related to building designs, materials and techniques.

(b) International banks and agencies financing aid for development in disaster-prone developing countries should, as a matter of routine, include in all project evaluations and pre-investment studies, a vulnerability analysis component identifying the level of natural disaster risk in projected areas of development, and, on this basis, undertake cost-benefit or cost effectiveness analyses for alternate locations of lesser risk.

(c) Agencies and bodies of the United Nations system which are concerned directly or indirectly, with aspects of disaster prevention and mitigation (such as UNDRO, UNDP, WMO, UNESCO, CHBP and CNRET), and other international organizations, should promote through their technical assistance services the application of vulnerability analysis techniques to land-use planning for disaster prevention and mitigation. The need for a multisectorial approach should be mentioned also and, in this regard, reference may be made to the joint UNESCO-UNDRO Committee on the Assessment and Mitigation of Earthquake Risk, which is currently being organized.

(d) Research institutions throughout the world concerned with natural hazard studies, on the one hand, and with urban and regional planning studies on the other, should co-operate in the establishment or promotion of multidisciplinary research and education programmes for the purpose of developing and applying vulnerability analysis methodology to physical planning, and especially land-use planning in disaster-prone regions.

(ii) At the national level:

(a) Governments should seek to strengthen their land-use planning and legislation for disaster prevention and mitigation in disaster-prone areas. Even in the absence of a comprehensive body of physical planning legislation, development planners should include in the national planning process provision for evaluating disaster risks (vulnerability analysis) with respect to regional development policies and the location of new settlements.

(b) Close and regular consultations should be carried out between local and national planning officials in order to create the necessary feedback between development planning and specific natural disaster risks at project implementation level. The probable result of this type of consultation would be an early realization of the importance of locational factors, and hence the emergence of well-defined land-use planning and control methods for disaster prevention and mitigation.

(c) National and regional training programmes on vulnerability analysis and land-use planning should be organized at regular intervals for local and national level planning officials, in order to review (a) progress in the feedback between development planning and disaster prevention and (b) methods to develop and improve land-use control measures for disaster prevention at all levels. Such seminars should include representation from other relevant fields as well as from sectors of national development such as rural development, urban planning, housing and the various sectors of economic development.

(d) Governments should create standing national and regional technical advisory groups to advise policy-makers and planners on the technical and administrative means of harmonizing land-use policies and disaster prevention and mitigation measures with development objectives.

(e) Inter-ministerial and inter-sectoral collaboration should be established on natural hazard analysis: meteorological, hydrological and geological services should create common working groups on developing composite and comprehensive risk mapping and risk evaluation techniques. Such technical groups should also include urban and regional planners and should advise governments on the application of such comprehensive risk evaluation techniques to physical planning at the national, regional and local levels.

(f) The above-mentioned advisory and technical groups working on land-use and vulnerability analysis should co-ordinate their activities on a continuing basis.

(g) As the weakest links are usually at the local level, where there are but meagre professional resources to plan, implement and administer land-use measures of all types, the recruitment, education and training of local planning personnel should figure quite substantially in manpower policies and programmes. At the local and regional levels the successful implementation of all planning activities is dependent upon effective

administration. The development, therefore, of a public administration capability is a necessary adjunct of the technical development of land-use planning capabilities.

(h) Lastly, but not least, governments should use land development policies and land-use measures to harmonize environmental, social and economic goals with disaster prevention objectives. The spatial organization of development is perhaps the most permanent and deterministic of components in development planning. Once established it is extremely difficult and costly to alter the physical patterns of growth of a country. Errors in physical planning become permanent obstacles to positive development, and may in this context add to the risk of natural disasters.

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