Prevention of Environmental Disasters by Spatial Planning and Land Management

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Key words:

SUMMARY

Today's society becomes ever more rapidly vulnerable to natural disasters due to the concentration of populations in mega-cities. Additionally, changes in the global environment threaten us with the possibility of severe typhoons, rising sea levels, droughts, among others. Considering these rapid changes of ambient conditions, vulnerability has increased due to growing urban populations, environmental degradation, and a lack of planning, land management and preparedness. Environmental disasters in many cases are effected by human usage of natural resources. They take place especially because of the negative impact of the over-exploitation of natural resources. Spatial planning and land management provide various tools to prevent natural hazards. The prevention of catastrophes in general is a consideration of spatial planning and land management on the regional and local level. Therefore a more active role of planning and land management is necessary. They have to support a sustainable settlement development and a sustainable land use on consideration of the different public and private interests because of there important influences on environmental disasters. Yet, this duty is only being partially recognised, at present especially in flood prevention. Even though spatial planning provides the missing basis for taking precautions against catastrophes. There are several reasons why a more active role of spatial planning and land management in this field have not been taken so far. These reasons comprise e.g. the low frequency of catastrophic events and the difficulty of predicting their spatial occurrence and at least also organisational matters within spatial planning and land management. The analyse of the interrelation between environmental catastrophes and regional development will enable to point out the strategies and instruments of spatial planning and land management to support the prevention hazards.

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1. INTRODUCTION

Today's society becomes ever more rapidly vulnerable to natural disasters due to the concentration of populations in mega-cities. Additionally, changes in the global environment threaten us with the possibility of severe typhoons, rising sea levels, droughts, among others. Considering these rapid changes of ambient conditions, vulnerability has increased due to growing urban populations, environmental degradation, and a lack of planning, land management and preparedness. Environmental disasters in many cases are effected by human usage of natural resources. They take place especially because of the negative impact of the over-exploitation of natural resources. Spatial planning and land management provide various tools to prevent natural hazards. The prevention of catastrophes in general is a consideration of spatial planning and land management on the regional and local level. Therefore a more active role of planning and land management is necessary. They have to support a sustainable settlement development and a sustainable land use on consideration of the different public and private interests because of there important influences on environmental disasters. Yet, this duty is only being partially recognised, at present especially in flood prevention. Even though spatial planning provides the missing basis for taking precautions against catastrophes. There are several reasons why a more active role of spatial planning and land management in this field have not been taken so far. These reasons comprise e.g. the low frequency of catastrophic events and the difficulty of predicting their spatial occurrence and at least also organisational matters within spatial planning and land management. The analyse of the interrelation between environmental catastrophes and regional development will enable to point out the strategies and instruments of spatial planning and land management to support the prevention hazards.

2. REGIONAL AND URBAN DEVELOPMENT, ENVIRONMENTAL IMPACTS AND DISASTERS

First it is necessary to distinguish between natural and environmental hazards that mainly take place in the following fields:

- Geophysical disasters like earthquake and volcanoes
- floods and dam breaks
- landslides related to unstable slopes
- fires in context with drought
- transboundary atmospheric hazards.
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A lot of disasters are the result of meteorological phenomenons such as typhoons, hurricanes, sheet flooding, of coastal and river-based floods. These seems to be related to climatic phenomenon such as the El Niño Southern Oscillation that results in a lower mean sea surface temperature in the east, failure of the monsoon rains in India, and drought in

Indonesia and Australia. Vulnerability to natural hazards has been increased in many coastal areas as a consequence of the loss of habitat such as mangroves and coral reefs that formerly provided natural protection against coastal flooding and also of the loss of natural flood areas. Landslides are very common in the hills and mountainous parts of countries. In addition to the primary cause - the topography - landslides are aggravated by human activities, such as deforestation, cultivation, and construction, which destabilize the already fragile slopes. In Nepal for example as many as 12,000 landslides occur each year as a result of combined actions of natural (mostly heavy rainfall) and human factors.

Environmental degradation and disasters are very closely linked in many region. The countries that suffer most from disasters are the same ones in which environmental degradation is proceeding most rapidly. Similarly, poverty and vulnerability to disasters are closely linked. There is an average of some 3,000 deaths per event in low-income countries, compared with less than 400 per event in middle and high-income countries.

These interactions demonstrate that there is no simple definition of natural and environmental disasters. There seems to be an interdependence between this phenomenons. Considering the increasinbg enviromental disasters espacially the short and the long term impacts of urban and rural settllement on the environment have to be discussed.

Risk assessment and mapping had not been undertaken by most countries. There is a need for comprehensive vulnerability analysis to be undertaken for disaster-prone areas, incorporating information about past disaster events, the socio-economic conditions of the population living in the affected area, and inventories of major structures liable to damage. Risk assessment and hazard mapping would then be used to delineate areas vulnerable to natural hazards and determine the frequency, intensity, impact, return period and other data in relation to each category of hazard.

A lot of countries experienced severe flood problems at comparatively frequent intervals. Their traditional approach to the reduction of flood losses relied upon the use of structural flood mitigation measures such as the construction of dams, levees and channel improvements. Most of the earlier flood mitigation programmes adopted by individual countries had been specific to a city or to a discrete agricultural area and had employed a narrow range of engineering works to provide solutions to the flooding problem. Although some projects were successful, some of them have actually exacerbated flood damage. In recent years, most countries have recognized the inadequacy of programmes based solely on structural measures. Numerous attempts had been made to employ non-structural flood loss prevention measures to assist in minimizing losses, principally through exercising control over development in flood-prone areas. These measures were usually associated with a mix of structural measures and, in some circumstances, provided a comprehensive means of coping with a flood problem. In many cases, however, attempts to formulate programmes which included some non-structural measures had met with limited success, particularly those involving planning controls, acquisition of land and the relocation of people.

3. MODELS AND STRATEGIES OF URBAN AND RURAL DEVELOPMENT TO PREVENT ENVIRONMENTAL DISASTERS

The environmental impacts of the settlement development are on one hand mainly effected by the converse of open spaces to sealed building areas and on the other hand also caused by the specific location of new settlement areas. Therefore the quantity and the quality use of land resources are determined as the central indicator of the guiding principle for sustainable settlement development. In case of expanding settlements the land consumption and land use have to be taken into account carefully. The resource "land" cannot be enlarged, that is why the land use for urban development has to be defined by specific criterion. The structure and the density of the settlements and new building areas have to be optimised, so that the consumption of agricultural land and open spaces and also of energy for traffic purposes is low. The specific land used for settlement and traffic, especially the part of the sealed space, can be used as a general indicator for sustainable development, which also reduces the risks of disasters.

In this context two conflicting concepts of town developments are discussed at present:

- The *"compact town"* is the result of the historic town development with high density, mixed use of land, concentration of settlement and high quality of public spaces.
- The *"network town"* is the result of the present trends in the town and regional development with car-based decentralisation, less density and less mixed land use in most countries. The dispersed structures increase the specific land area used and the individual motorised private transport.

The present situation of the settlement can be described as the transition of the compact to the network town. This development is not sustainable from an economical and ecological point of view. Therefore suitable strategies of regional and town planning are necessary, which attain a concentration of settlement within a poly-centric structure, an optimised building density and density of population, a variety and mix of urban land use, private and public spaces with high ecological and social quality and a transport system compatible with the environment and the town. This kind of settlement structure will support at the same time the prevention of environmental hazards and mitigate the negative effects.

Apart from the statuary framework, the regional and the communal level have a great legal capacity to prevent environmental disasters by the following tools and strategies:

- strengthen the decentralised urban development with poly-centric structure
- assessment framework to choose suitable location and spaces of the future settlement development apart from river valleys, natural retention areas and unstable slopes
- priority of interior urban development (reactivation of brownfield sites, mobilisation of "gap" sites, reuse of urban wasteland and vacant buildings),
- space saving development of new residential areas with mixed use and increased density;
- cooperation between urban and rural areas in the fields of settlement, infrastructure and protection of the environment
- reduction of soil sealing
- safeguarding and efficient realisation of urban concepts,

- integrated planning strategies with social and environmental aspects in addition to town, infrastructure and traffic planning
- enhancement of vegetation and safeguarding the open spaces within the urban areas.

In absence of scientific proofed standards to prevent disasters, there is a great need of research to elaborate suitable guidelines and principles of regional and urban planning and land management in this fields.

5. THE CONTRIBUTION OF REGIONAL AND TOWN PLANNING

It is necessary to use the instruments of spatial planning contributing to the prevention of the risks and mitigating the effects of natural and environmental disasters. In the context of environmental disasters spatial planning and land management have to support the following essential functions:

- *Early warning system*: Spatial planning needs a detailed data base, to get sound information about the spatial development. In practise monitoring systems have to be extended systematically to inform about natural and environmental risks. The efficient data acquisition needs special measurement methods, that have to be investigated and implemented.
- *Risk assessment and mapping***:** Prevention of disasters needs comprehensive information and data about the reasons and effects of hazards. Therefore a systematically framework of the assessment and mapping of disasters is needed. Geological and hydrological information, such as thematic hazard maps, have a very high potential for reducing fatality rates and losses due to natural disasters.
- *Prevention and reduction*: Spatial planning has to analyse the interrelations between the spatial influences and the environmental disasters. On base on that, new models of spatial development have to be discussed, improved and established.
- *Risk Management*: In case of environmental disasters a certain infrastructure (evacuation routes and spaces) and a data base are needed to realise the emergency plan and risk management.
- *Reconstruction*: Spatial planning has to provide innovative models for regional development, which don't limit themselves on the status quo. Not only the damages have to be eliminated but also the future prevention of disasters have to be taken into account with priority.

All this tasks can be met by the specific instruments of planning and land management. They have to be studied in addition to earth science and engineering points of view.

6. CONCLUSIONS

Significant progress has been achieved in disaster preparedness and reduction in the region over the past decade, in terms of improvements in planning, institutional strengthening and use of advance technology including space technology applications. However, the increase in the intensity of natural disasters requires continuing and more intensive efforts at local, national and regional levels.

Cooperation between urban and rural regions for better natural disaster prevention, reduction and management becomes even more important in view of such driving forces as: the rapid urbanization process, increasing rates of economic and social development, and other global factors that would increase the severity of disasters, such as El Nino and potential global climate changes. Within this context, prioritization of regional activities for effective planning, management and development of disaster reduction measures and for applications of space technology to meet the urgent needs, requires wide application of strategic approaches to natural disaster reduction and management. These activities need to be effectively integrated into the national economic and social development process. Such integration and regional cooperation need to be formulated in a well-conceived framework and well-developed regional strategy. Development and updating such a framework and regional strategy is a priority emerging issue for cooperation in the 21st century.

Such a regional strategy may need to address the following priority fields:
- realistic integrated planning for disaster prevention and mitigation;
- enhancement of disaster preparedness including real-time information exchange;
- community participation throughout the natural disaster reduction and management process;
- more effective transfer of disaster reduction and management technology;
- exchange of experiences and information on institutional arrangements for disaster reduction and management.

In order to culminate regional efforts to realistic targets in the development of a regional strategy for better disaster reduction, a realistic reduction of damage, an increased disaster awareness and an improvement of forecasting systems are needed. It may be noted that specific targets of these common objectives depend on the economic and social conditions of the respective countries. Formulation of strategies and programmes towards meeting these objectives is therefore of high priority.

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