

In some circumstances (as in Bangladesh), the normal flood regime of a river is used beneficially by farmers. On some rivers 'flood-retreat' agriculture is practiced where the receding waters reveal moist soil primed for planting with food crops. Such a system has emerged on the River Senegal on its route through Mauritania and Senegal in west Africa. Ironically, in an area where floods are welcome and beneficial, human intervention is going to restrict the flood. Livelihoods based on farming and fishing in the ponds which remain as the flood goes down) are likely to be severely undermined. A dam has been constructed at Manantali on the upper Senegal, mainly for the generation of hydro-electric power and to regulate the river's flow to permit year-round barge traffic up to Kayes in Mali. It will also irrigate farmland, but in large-scale projects which will not compensate those who lose out in the valley. One of the costs of this is that the planned regulated river flow will not allow the traditional flood-retreat agriculture to take place (Horowitz 1989).

2.6 The people at risk: floods and vulnerability

Flood hazards impart a variable impact on people according to vulnerability patterns generated by the socio-economic system they live in. Those who are vulnerable to a hazard are unlikely to be able to move against the process which has generated their vulnerability, so that after a hazard's impact they are yet more vulnerable to similar and other hazards. In general terms, the three types of division between peoples generated by social and economic systems are of gender, class and ethnicity. These may act as determinants of vulnerability to flooding, as in other hazards. Studies are needed which identify particular 'risk groups' - such as agricultural labourers, farmers, urban dwellers, fishing people, refugees, people in shanty towns - from which can be teased out the differential types and levels of vulnerability.

Class position is a crucial aspect in explaining several aspects of vulnerability to floods. The dominant factors in this are existing levels of ownership and/or control over means of production (or lack of it), together with the resultant livelihood opportunities (which may be already inadequate to provide basic needs). It is largely responsible for determining income level. From this derive a range of other characteristics, including the command over resources which influence where someone lives (and its proneness to inundation), the structure and type of housing and workplace (and its resistivity to floods), and the daily and yearly pattern of work and other activities which affects the time and place patterns in relation to hazard impacts.

These variables not only relate to risks of death and injury, but also destruction of assets and livelihood opportunities. In turn, income level affects nutritional status, and this factor combined with place and time patterns for work and habitation affect the vulnerability of someone to disease caused by water-borne pathogens or water-related disease vectors. Illness in turn affecting livelihood operations. There is a need to recognise distinctions between different components of vulnerability: physical (death and injury), morbidity (illnesses associated with hygiene or water-borne disease vectors), material (loss of means of production), or livelihood disruption.

In general, those who possess means of production or have control of hard assets which are robust in the face of flooding are likely to be economically much less vulnerable to flood hazards. Some who may have little or no means of production may have a livelihood opportunity (for example fishing) which is not seriously disrupted by flooding, and these too are less economically vulnerable, but may be vulnerable in health terms. Those who have neither means of production, nor assured access to use of some, and lack a livelihood of a secure nature are likely to be most vulnerable both in health and economically.

Class is only one manner in which access to resources and livelihoods is socially differentiated. In many parts of the world there are ethnic divisions which are often superimposed on class patterns or which in some situations become the predominant form of exploitation. This involves differential access to or possession of resources, or of the right to participate in different livelihoods, depending on supposed racial distinctions between peoples. In these respects, it produces vulnerability in ways which may be broadly similar to those of class position. But it also involves a very different component: the subordination of entire ethnically-defined groups of people, often of all classes (where it is possible for the ethnic group to include its own classes of dominant and resource-rich people). This type of factor may have been significant in the Armenian earthquake, in which building construction under the Soviet authorities (dominated by Russians) was of inferior design and material, despite knowledge of the high seismic risks of the area. Was this because of the chauvinistic attitude towards the local ethnic group?

It is also crucial to understand differential vulnerability dependant on gender. Many of the material differences between classes mentioned in the section above are relevant also as factors in the inequitable possession of and access to resources by men and women. In general terms, economic and cultural systems are male-dominated, and allocate power and resources in favour of men. In relation to flood hazards, this may mean that the efforts put into disaster recovery is disproportionately carried by women, who are in most 'normal' situations having to work harder in rural agricultural and domestic activities (though there seems to be little specific empirical evidence to support this view at present).

In addition, there is the possibility that women are likely to be more prone to post-flood disease, largely as a result of their poorer nutritional condition and physical susceptibility. Another aspect which there may be differences in the impact of floods on men and women is in relation to the time and place patterns of daily and seasonal activities (to the extent that young children are more likely to be with women than men, this also affects their relative vulnerability too). Again, there is an apparent lack of data to support these views (concerning nutrition and time/place). In spite of the rapid increase in awareness of gender issues in development and underdevelopment, there seems to have been little investigation of the differences in the impact of flood disasters on women.

2.6 Wider-scale processes and the generation of vulnerability

Vulnerability of people to flood, whether in rural or urban areas, can also be interpreted through a range of wider physical, social and economic processes. These are related to those which generate different levels of vulnerability according to class, gender and

ethnicity, but are of such significance in that they warrant separate treatment. They include socio-economic ones like deforestation, the debt crisis, global warming, and population growth, and natural ones such as geologically-rapid orogenic uplift of mountainous regions (leading to high rates of debris load in rivers and increased soil erosion).

Firstly, in many parts of the Third World, pressure for access to land is pushing people to farm more and more in flood-risk areas. Such pressure can arise through population growth, or because of land being expropriated for cash crops (sometimes a result of pressure to pay external debt). This is often linked to a lack of economic opportunities other than farming and consequent dependence of some sections of the population on balancing the costs of floods and benefits of a livelihood option which is possibly the only one available.

Land-shortage also has the effect in upland areas of increasing the rate of deforestation, as people clear more land for agriculture, or damage it for fuel and fodder. They may be new arrivals, or local people who have to reduce the fallow period in upland swidden (slash and burn) agriculture. As will be discussed shortly, many researchers associate such deforestation with the increase of flooding downstream. In upland areas of many parts of the world, a range of factors produces landslips and soil erosion. These generate local flooding (through stream-damming) and increase the sediment load of rivers, contributing to the rise in level of river-beds downstream and increased flood hazard. There are disputes among scientists about the significance of different factors in this process, especially concerning the Himalaya. One conflict is about whether or not there has been an increased incidence of flooding during recent decades when, it is supposed, rapid deforestation has occurred.

Some argue that the evidence for a strong connection between deforestation and increased flooding is uncertain, and that hydrological data does not demonstrate that good vegetative cover in large river basins is necessarily a factor in preventing rapid run-off of storm water (see Ross 1984 pp.224-5 and his summary of a debate about evidence from the USA). Others suggest that flooding of equivalent severity and frequency is apparent in river basins for centuries, long before recent increases in deforestation. For example, discussing the situation in Sichuan province, Ross (1984) presents arguments by one Chinese engineer that historical records show a high incidence of flooding even before modern increases in population and logging' (p.223). Ives and Messerli (1989) argue likewise for the Himalayas that there is no convincing evidence of an increase in runoff during the last forty years, despite the apparent increased incidence of flood disasters. The rivers of the Ganges-Brahmaputra basin have been contributing immense amounts of sediment to the Ganges plain and Bengal delta for thousands of years, owing to climatic and tectonic factors in the mass wasting of Himalayan slopes, rather than recent human action. Ives and Messerli ascribe the common perception of an increase in flood disasters not to greater amounts of water in the drainage system, but to human systems having put more people in more vulnerable places.

In analysing vulnerability in terms of both social differentiation and these broad socio-economic processes, the approach here is to focus not on the natural hazard so much as the way in which the structure of societies and the conflicts within them and between them determine the manner in which floods will take their toll.

2.7 The policy responses: ~~from~~ precautions to vulnerability reduction

Precautionary measures and policies for dealing with floods are commonly much more related to the hazard factors involved in the triggering of flood disasters rather than with vulnerability and its causes. They include hazard avoidance strategies, different forms of precautionary intervention, mitigation, and impact alleviation. The need is for policies that go beyond this to look at the implications of vulnerability analysis in the development of different ways of disaster avoidance. Methods used in precautionary behaviour (for social-protection) are normally determined by the dominant economic and political systems. Such methods (which are usually top-down in approach) often fail to (or are unable to) take account of vulnerability. This can be shown by examining local peoples' responses to known hazards, state/national policies for dealing with hazards of natural origin or human agency, and some aspects of international interventions. All three of these levels interact, and they are not dealt with individually here.

Local level and indigenous responses include peoples' own strategies for dealing with flood risks (a combination of self-protection and non-state social-protection). These have been developed by people in many places, often over hundreds of years because of the need for increasing the area of land used for agriculture. In some circumstances, even those floods which seem to outsiders to have brought disaster may in many respects be beneficial. This is the situation in Bangladesh, for example, where the usual shortage of water for crop growth in the winter may be resolved by the increased soil moisture following on summer flooding. Also, the increased rainfall over higher ground, even while lower areas are inundated, may increase yields considerably, resulting in a net increase in grain output compared with non-flood years. These two factors resulted in Bangladesh having bumper harvests in both 1987 and 1988, despite these being the worst floods on record (Rogers et al 1989: 37). But it is not simply a matter of population growth in or movement to flood plains. The vulnerability of many people is class-related or arises out of ethnic, internal or external conflicts. All of these, singly or in combination, may render local initiatives much less effective, or for some groups actually impossible. For instance in the Gangetic plain of north India, villages in flood-prone areas (which includes much of the plain) often demonstrate a clear pattern of differential class vulnerability. The more substantially-built houses of the wealthier groups are often near the centre, where the land is usually slightly higher. Poorer classes including lower castes and untouchables are mainly to be found round the edges of the settlement in low-lying sites.

Although there is an advantage for livelihoods in people settling in flood plains, where the people are well aware of the risks, most of the world's worst disasters have involved floods in such areas. But it should not be assumed that because economic pressures have led people to occupy hazardous tracts of land that flood disasters are inevitable, the price to be paid for the advantages gained in non-flood years. Reducing the risk of flood disaster involves reducing the vulnerability of people by removing the factors which

generate them. Without this, precautionary measures are likely to be enjoyed much more by those whose class, gender or ethnic position puts them in a situation where they can afford precautions.

People often deal with flooding by adapting to it, indicating an orderly and not an anarchic response to inundation. This is especially the case in areas affected by regular flooding (such as Bangladesh) where the majority of people have adopted a 'living with floods' strategy. In such situations, floods are not necessarily disastrous, and jeopardize lives and livelihoods only when floods exceed certain levels or velocities.

But there are complex constraints which limit people in their ability to use their knowledge of flood hazards to overcome their vulnerability and avoid disaster. They include the economic necessity of their livelihood, itself determined by their class, gender, and ethnic position. This in turn determines the location of their resources (both livelihood and domestic) and their proximity in place and time to the hazard. In addition, there is the relationship of State interventions (or lack of them) in respect of flooding, and the ways in which these connect with the different livelihood systems, and with people in their various class/gender/ethnic positions. Overlying these are the effects of foreign states and other external agencies which directly influence flood hazards and affect the nature and level of vulnerability of different sections of the people by their actions or inactions.

2.7.1 Preventive measures

One common response to riverine flood hazards is attempts at prevention of their disastrous impact by modifications of the stream flow. These can be classified as controls of either the speed of discharge of run-off water at different points in the river basin, or of the direction and location of the water channels or overflow.

Discharge controls include a narrow range of measures which nearly always involve a high level of technical (and therefore capital) investment. This is largely a result of the dominance of views both in national and international elites which favour a 'technical fix' approach to problems, rather than a mobilization of peoples knowledge and local solutions. Large-scale dams and barrages are sometimes used in this context (though they are normally also used to provide irrigation and hydro-electric power (HEP) as well). In many cases they have been very successful in flood mitigation and prevention, as for example with the dams on the Damodar River in Bihar and West Bengal, which are claimed to have greatly reduced damage in West Bengal in 1978 (Government of India 1978: p.3). On the Yellow River in China, dams in the upland tributaries have been credited with preventing serious flooding in 1981, despite an unprecedented peak discharge.¹⁶

The reservoir capacity must be sufficient to hold and store the run-off upstream of the dam during periods of peak rainfall. This can then be released in non-destructive quantities over subsequent weeks, provided of course that there are no more rainstorms soon afterwards. The problem they present is that such large-scale investments make it possible to believe that everything has been done that can be done. There is little scope for alternative policies which might reduce runoff or the sediment load which is sometimes responsible (as with the Yellow River or the Ganges-Brahmaputra system) for the

downstream impact of flooding. Such alternatives include small-scale check dams in upland gullies (which also have the virtue of reducing sedimentation in the reservoirs of large dams) and reforestation of upland watersheds. Large dams are also unlikely ever to be enough, they are not technically possible on all tributary rivers, even if they could be afforded. One estimate suggested that 'Even if all the possible dams were built in India and Nepal, only about 8 to 10 percent of total flows could be stored.'¹⁷

Another problem of large-scale investment projects is that they can induce a false sense of security. This may be misplaced if the design capacity of the dam is inadequate, or siltation is greater than expected. In such circumstances there may be settlement downstream which is in the path of dam overflows which have to be released when the incoming water reaches capacity. The dam itself may fail (collapse) because of design faults, construction inadequacies, incorrect location on inappropriate rock base, or earthquakes (which may sometimes be locally-induced by the mass of the reservoir water itself). In such circumstances the resultant flood is truly man-made, and may arise in situations where the dam was not originally in place as a flood prevention measure.¹⁸

Channel control methods tend to be less capital intensive, and usually the construction materials used are local and involve much more labour input, often employing thousands of workers along lengthy stretches of river. The most common approach is to constrain river channels within artificial embankments or dikes (river training), or to use dikes to protect particularly vulnerable areas along the riverside. In addition, embankments may be used to encircle areas or places (e.g. ring bunds around towns or cities) which are deemed to need special protection. Such methods have a long history in some parts of the world. In China the channel of the Yellow River has been repeatedly enclosed within dikes for much of its lower course across the North China Plain for thousands of years. In that particular situation, it has not been all that successful, and there have been massive floods in many years as a result of the river breaching the embankments. The main problem in using dikes in this way is that rivers carrying heavy sediment loads continuously build up their river beds in the lower reaches where the gradient is slight. Consequently, the embankments have to be repeatedly raised higher and higher, so that the river is actually flowing at some considerable height above the surrounding countryside. The impact of any flood is therefore likely to be greatly enhanced should there be any breach of the dikes; breaches are likely if the dikes are not well maintained and upgraded.

Such a model of flood control is being contemplated for Bangladesh at the present, promoted largely by the French government with support from the World Bank (Boyce 1990). The difficulty is that once it is begun, it is very difficult to change to any other method, and the country is committed to a policy which is expensive and difficult to maintain and fraught with risks if it is not (Rogers et al 1989; Boyce 1990). This approach also seems to be rooted in a faith in the efficacy of large-scale civil engineering projects, in this case based on foreign expertise that does not suit the economic or social conditions of the country.

Large-scale river training schemes like this can also generate a false sense of security, as with dams. An added factor is the likelihood that many people who lack land and other

resources actually squat and settle on the land left between the channel and the bunds, which is extremely prone to flooding. This is already the case in parts of Bangladesh where river training projects have been used.

There are other channel control methods which are used (often in conjunction with river training) to provide emergency storage for flood water. These may be existing lakes which adjoin the river channel. At crucial moments in the control of the downstream movement of a peak flow, the embankment leading to the lake can be deliberately breached. Water from the peak is then stored to prevent the river reaching danger levels further downstream. Such a system has been in use for centuries on the Yangzi in its lower reaches. This method can also be used to store water on low-lying land if necessary; less productive places can be sacrificed as flood-ponds, in order to protect more densely populated and more productive areas. This can be a valuable adjunct to systems of embankments, especially to protect the bunds downstream, or to reduce inundation should there already be breaches in them.

Knowledge of the flood risk is no guarantee that the state will commit itself to the necessary preventive measures. On the other hand, some state interventions may alter the pattern of the hazard's impact rather than removing it completely. Policies involving dikes and bunds to protect some areas can enhance the impact of floods and create risks in entirely new locations, sometimes many kilometers distant, as with canalization projects which increase downstream risks. Similarly, strategies which displace flood risk, such as the building of ring-bunds around towns and cities, concentrate water onto surrounding lands so that the victims are farming people instead of urban dwellers.

Normal development interventions can also create flood problems. These include roads and rail lines which are elevated on embankments to avoid floods. These then act as barriers to the return of water into river channels. They are considered to be major factors in flooding in a number of reports, in effect a case of 'development' causing floods.¹⁹ Such linear constructions (ironically including flood-protection dikes) can create inundations even when the rivers themselves have not flooded.

2.7.2 Flood avoidance measures

Where there are known river flood hazards, land-zoning measures can be effective in preventing disaster. These are generally operational only in urban areas. Unfortunately, it is common in developing countries for there to be a large number of people who avoid the restrictions on settlement inherent in zoning plans. Squatting on unstable hillslopes which can slip in heavy rain, or in low-lying flood-prone areas, is often the only way for the poor to obtain any land for housing. A rare example of rural flood plain 'zoning' is the state's intervention in Mozambique in the mid-1970s. Part of the peasants' response to independence there was to occupy and farm land in valleys which was abandoned by Portuguese companies and settlers. This increased their vulnerability to floods, which was to some extent resolved during the governments' settlement scheme by transferring villages from flood plains to higher ground (Wisner 1979: p.302). Although this protected people, because of the need to use the land, it did not necessarily protect food production.

In some rural situations, people have needed to rescue themselves from flooding by seeking higher land. These unofficial coping mechanisms have led to more or less permanent squatter settlements on raised embankments and old railway lines by many thousands of Bangladeshis. They have generally lost assets (especially land) in floods, either through damage, distress sales, or the erosion of their land or village by flooded rivers. Elahi (1989) reports on estimates (probably too low) of 70,000 households living on the embankments of the Jamuna river (the present channel of the Brahmaputra) in Bangladesh.

2.7.3 Flood alleviation and preparedness measures

Although very often inundations may damage crops, kill and injure animals, destroy houses and other infrastructure, it is possible to develop alleviation policies which save peoples' lives even though the flood itself cannot be prevented or contained. The most conventional of such preparatory methods is flood warning systems, the effectiveness of which has been shown in a range of countries. The value of warnings depends greatly on their accuracy (this affects their credibility), the lead-time available for preparedness and evacuation, and the effectiveness of the message delivery system.

In valleys prone to flash flooding, the distance from the catchment area to the endangered settlement may make warnings worthless, and there would need to be other preventive measures. But in the slow-onset type of flood which affects many longer stretches of river, there may be hours or even a day or so for cautions to be made effective. The warning systems need a linked network of hydrographic stations at well-chosen points on the hazardous river's catchment area. In some countries, these stations are automated, and relay their information by radio to central control points from which warnings can be issued, in others, they are linked by telegraph or telephone. They may be in less than perfect order, especially in the stormy weather of flood times, and so proper organisation and maintenance is another vital factor in their success.

The delivery and receipt of the warning messages cannot be taken for granted. There have been cases where, as with the Andhra Pradesh (east India) cyclone in 1976, warnings may be issued only for the most vulnerable sections of the rural people to become victims for want of possession of a transistor radio on which to hear the broadcast. In a report of the impact of the exceptional flooding around Alice Springs in central Australia in 1985, it was clear that ethnic bias was responsible for the lack of delivery of warnings to the Aboriginal people, many of whom were living in flimsy accommodation in low-lying land.²⁰ The radio broadcasts that alerted the white people were not on channels which were customarily used by the Aborigines.

2.7.4 New flood precautionary methods

In some regions where temperatures permit year-round farming with more than one harvest, especially parts of Asia where the rainfall is seasonally concentrated in the monsoon months, there is the possibility of both floods and water shortage for agriculture. It has been proposed by some scientists that the dry-season shortage could be resolved by pumping out groundwater in a systematic manner in particular places, and that this be replenished by pumping back the peak flows of the flood season. In this way it is proposed to deal with both the flood hazard and increase agricultural output in the dry

season. This strategy has been proposed especially for Bangladesh and parts of north India (see for instance Chaturvedi 1981; Rogers 1989). It involves considerable investment (though less than major civil engineering proposals), but has benefits of possible increased output in the dry season. In Bangladesh, this method would involve HEP dam development in tributaries, and the sale of electricity across international boundaries to enable the pumping it would require. In all, the proposal seems attractive but restrained by severe political difficulties.

2.7.5 Sustainable livelihoods: a building block for disaster avoidance?

The concept of vulnerability is centred not on particular economic activities (eg farming systems) nor on physical structures (eg vulnerable buildings), nor even on individuals as vulnerable people in themselves. It is concerned with a livelihood as a means for ensuring the continuance of communities which satisfy each person with adequate subsistence without having to damage the environment, thereby reducing the future of the system. A livelihood requires (on the 'consumption' side) a certain minimum set of goods, services and cultural satisfactions to be adequate for basic survival (and the concept is therefore akin to Basic Needs thinking); its participants normally welcome and seek more than this minimum in order to increase their satisfaction. It also requires (on the production side) a particular and irreducible 'bundle' of resources and rights (in the sense of access to those resources) and/or entitlements (such as selling labour to earn money with which to buy consumption needs).

Many natural hazards have a more severe impact because already vulnerable people have to survive by engaging in practices which degrade the environment. If changes can be brought about which remove the need to survive by jeopardising the potential of the communities' livelihood, then the intensity of the impact of some hazards can be reduced. In this way, the creation and support of sustainable livelihoods are a means to reduce vulnerability in two ways, by both reducing the environmental damage which some people are forced to make in order to survive in the short term, and to improve the level of living standards above those of existing levels which leave people vulnerable.

In the sense used here, sustainable livelihoods do not represent very much of a challenge to the existing economic order in the world: they are how things should operate in most countries if governments lived by their professed objectives or were really committed to (and able to achieve) already stated reforms. Such reforms are difficult to achieve in many countries – whether for practical 'resource' limitations or the political constraints of entrenched class or other interests.

Our response to this enormous set of restrictions on the construction of sustainable livelihoods is partly to point to governmental self-interest: whether to protect class interests represented in government, or to facilitate continued rule without increased civil strife, sustainable livelihoods must be created and supported. There are a number of examples of governments which have been toppled as a result largely or in part because of their mishandling of disasters (eg Ethiopia 1974, Nicaragua 1979, partly influenced by the impact of the 1972 Managua earthquake).

Beyond this, it is rare that any government is monolithic, or that it is run entirely by civil servants who are willing to accept the exercise of power to the detriment of the interests of ordinary people. So there is space for using our arguments by those who can mediate in disputes on the side of the vulnerable, those who can press for the effective implementation of a paper policy which will result in better hazard preparedness, and those who can promote the self-help by communities and groups which can work for the reduction of vulnerability often without the need of large-scale capital expenditure (see Maskrey 1989).

Today, many people are aware of the view that disasters are not natural, and may be willing to accept it without much knowledge of the arguments and evidence for such a viewpoint. The purpose of this paper is to take that view forward, support it with evidence and thus not only provide an explanation of why disasters are not natural, but to show what can be done about preventing or mitigating disasters by use of the analysis of the human factors which operate to cause them.

The key instrument proposed for this understanding of human disaster causation is the use of vulnerability analysis. This is underused, even by those who may accept that disasters are not natural, because it relates to issues of power and inequality in gender, class and ethnic relations. All of these make it difficult to operationalise vulnerability analysis because the factors which tend to generate unequal vulnerability also act in the normal sphere of political constraints on the reduction of those inequalities. It is this which (consciously or not) has tended to lead people to seek supposedly neutral technical interventions, or to feel that little can be done without massive and wide-ranging (revolutionary?) political change.

While recognising the limitations set by dominant political situations, things do not stand still, and need not be as they are. The (reformist?) implementation of this type of analysis can be both instrumental in improving the lives of people, and is itself potentially part of the arguments and struggles for the deeper changes which are needed. In other words, the suffering which results from disasters can be reduced, and the effect of policies for doing it should be to reduce the conditions in which daily vulnerability is created, and strengthen the basis for changing the systems which create and maintain such vulnerability. It is crucial (see the thinking of writers on disasters like Hewitt, Maskrey) that the type of planning for disasters, and the way that relief and reconstruction is carried out, should not reinforce bureaucracies and existing power structures, but instead aim at empowering the vulnerable people.

3 Conclusion

In understanding disasters and their inequitable impact, it has been suggested that vulnerability analysis is not equivalent to simply discussing who is rich and who is poor, even though this might seem a crude approximation of hazard-proneness. In the context of different hazards, different groups of people possessing or having access to varying 'bundles' of resources or entitlements, may be vulnerable to one type of hazard more than another. It is such a focus which makes this approach different, and which means that the new emphasis in disaster analysis need not be the particular type of hazard itself. Many

existing precautions used in the mitigation of flood risk operate within the existing systems of differential vulnerability generated through class, ethnic and gender factors. It seems essential to go beyond this situation if there is to be more success in flood disaster avoidance

Better awareness about what causes disasters is insufficient for reducing them unless translated into policies and changes in the way economic systems are run. This is a major difficulty: if one of the obstacles to disaster reduction is self-interest of some groups, then how useful is it to develop this knowledge? Is a cynical response inevitable, to the effect that change is unlikely, since such causes seem intractable? Does this approach involve irreconcilable conflicts, since we have to live with governments and systems (national and international) which maintain the economic inequity which arguably are causes of vulnerability, but yet we argue that vulnerability must be reduced and politically opposed?

This is no argument for ignoring a better ways of understanding disasters. A combined effort by academics, civil servants, political activists, NGOs, aid workers and others to promote some new thinking about disasters is part of the way in which dominant interest groups can be changed. There is usually scope for something to be done within existing situations to promote disaster mitigation. It is rare for governments to explicitly support the processes by which some people become more vulnerable than others; there are 'spaces' in most societies where the political shift which necessarily accompanies the shift in disaster analysis can be inserted. In particular I would argue for the need to support and promote organisations of civil society which can provide the monitoring of hazards, the measurement and analysis of vulnerability, outside of the control of the state. Such institutions and the struggle to make vulnerability analysis available to the people who are both potential victims and those who would help them avoid disasters would become part of the process by which society is changed to avoid and reduce vulnerability being generated

Notes

1. It is also important to recognise that the impact of hazards themselves, on people who may already be differentiated in levels of vulnerability, may reproduce and enhance the differences between hazard strikes. In other words, the society may already be structured economically according to the manner in which its people have experienced past hazards: those who are relatively less successful in the recovery process are likely to be more vulnerable to the next hazard strike.

2. In developed industrialised countries, the preparedness levels may be high, and in general livelihoods are more secure and insurance makes them more resilient. This has given rise in the literature to a perception of disasters as having little impact in terms of deaths in industrialised countries but much material damage (in physical and value terms), while in the Third World the situation is seen as the opposite. This is based on a crude and ill-informed understanding of the value of a great deal of property in Third World countries for the actual users

3. This dominance of floods as an environmental hazard would be overridden by a factor of ten if epidemic disease were included. See the table of Curson (1989 p.6), for example. Curson includes war and famine in his list, which also dominate floods in mortality. We do not share his definition of disaster to include war: war is a factor in creating disasters, and is entirely human in origin. Famine is also not a natural hazard, but a potential outcome of the impact of hazards (as well as human-caused events like war). Although we include disease in this book, perhaps they should not be all lumped together; there are many differences between them, in some ways as much as there are differences between flood and drought.

4. It is sometimes argued that deforestation is a factor in the causation of both. Later there will be some discussion of the increasing contention around the way that deforestation has been seen as a major cause of flooding in some parts of the world.

5. A lot of what is discussed in this paper concerning patterns of vulnerability to floods may also be relevant to cyclone-prone areas. But the more detailed discussion of tropical cyclones will be left out, despite the fact that they are often a proximate cause of major flooding. This is mainly because there are other distinct forms of wind damage involved, and also the precautionary measures needed to reduce risks are different.

6. It is also important to recognise that a disaster is often only recognised when defined by outsiders as such. Much of the content of what is called a disaster may affect smaller numbers of people and occur in relatively small floods, and are no less disastrous for those who suffer them than the larger recognised events.

7. This statement would incorporate the mortality involved in all types of flooding, including that from tropical cyclones.

8. From China in August 1988 there were reports of the worst floods for centuries in the coastal province of Zhejiang, where flash floods took at least 256 lives, with over 300 missing (The Guardian 3 August 1988)

9. The information is taken from the official weekly Beijing Review (28 September 1981). This is probably too soon after the event for the mortality to be completely assessed, but the figure is low given the scale of the event. In the debate about the flood's causes, a lot of stress was put on what was considered a rapid increase in deforestation in the hills and mountains which surround the fertile Sichuan basin, blamed on the commercial outlook on timber-cutting generated by the then recently-introduced economic reforms. Others disagree and argue that there is no evidence for a recent increase in Sichuan flooding; this is referred to later.

10. In 1931, it is estimated that more than 3 million died in a Yellow River flood. For centuries, the river has been artificially embanked for hundreds of kilometres of its journey across the North China Plain (in order to contain it and prevent floods). As a

result, the river is flowing up to ten metres above the level of the surrounding countryside, so when an embankment is breached it is a rapid-onset flood, rather than the slow-onset type normal in flood plains.

11. El Nino is a phenomena of sudden climatic changes (with much increased rainfall) which periodically affects the west coast of South America. Because the event usually occurs in December, people named it El Nino, signifying 'God's child' in relation to Christmas. It is a result of a warm-water current brought against the coast by an end-of-year reversal of the trade winds. This disturbs the normal upwelling of cold-water from deeper levels, which are nutrient-rich and provide the basis for successful fishing. Occasionally, the event can be extreme, particularly when the water temperature may be 10 degrees Centigrade higher. This means that the onshore winds are saturated with water vapour and release torrential rain over the coasts, mountains and deserts of south America.

In 1982-83 El Nino struck badly, principally affecting Peru and Ecuador. In parts of Peru a state of emergency was declared: rainfall in the first six months of 1983 was many times more than the total rainfall of the previous ten years (Gueri et al, 1986). Flash flooding and landslides destroyed many roads, irrigation facilities, dams and bridges. Mortality directly caused by floods does not seem to have been high, but disease and health problems were made much worse, and people's livelihoods suffered enormously as will be seen later.

12. By contrast, malaria was not reported and much of the area had previously been extremely arid.

13. However, the conditions that make this successful are likely to be similar to those which determine the value of government action/inaction in other respects. Certainly, in one town in north Peru, the role of government had not included the guardianship of collective memory. While some inhabitants of the town of Sullana recalled rain of similar severity to the 1983 El Nino some seventy years previously, a dangerous site was built on in the interim. Housing and the market built in an old water course were all destroyed or flooded.

14. 'It is estimated that over 20,000 varieties of rice have been developed by farmers to suit the different cropping conditions in Bangladesh.' Anon. 1989 'The role of Non-Government Agencies in Disaster Mitigation' Oxford: Oxfam

15. Note though that in Bangladesh and other flood areas, there is often a good harvest associated with floods. In non-flooded areas, there is often a coincidence of good rainfall which increases yields; in flooded areas, the soil retains more moisture which can be taken up in plant growth during the dry season. In 1988, after the 'worst' floods ever experienced in Bangladesh, the harvest was a record.

16. Beijing Review, various issues in October and November 1981.

17. K L Rao (1975) *India's Water Wealth* Orient Longman, India; quoted in Chaturvedi (1981) p.2.

18. There is anxiety about the Tehri dam project in the north of Uttar Pradesh (India), on a site which is considered tectonically dangerous by some scientists.
19. See e.g. Rashtriya Barh Ayog (1980) p.132
20. Hazards Panel Newsletter November 1985 p.24.

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