

Flood Risk assessment and management in Iran

For example, Flood hazard and disaster in the I. R. of Iran, is one of the most frequent and damaging types of natural disasters. They have been the most common type of geophysical disaster in the latter half of the twentieth century in Iran, generating an estimated more than 20 percent of all disasters from 1950 to 2003. one of the hazardous floods of Iran occurred in Golestan province on August 2001. The floods were worst in 200 years.

In the regard of risk reduction and application of risk management of natural hazards, there is several operational flood risk management system in the world. early warning system as one of the most important component of the risk management, that includes: Observation system, weather monitoring and forecasting, early warning issue, and response. Then the synoptic and rainfall statistical analysis of Golestan and Khorasan floods, which have been happened in 2001 and 2002, would be described.

Flood risk mitigation measures aim at modifying either the flood-producing processes, or the flood hazards, or exposure and vulnerability to flooding (Penning-Rowsell, 1996). The analysis and response to flood risk needs to be integrated in a systemic manner: that is to say, in a manner that recognizes all the factors present in natural hazard systems and their interactions (Mitchell *et al.*, 1989; Parker, 1996).

Based on study about the causes and impacts of flooding, a preliminary evaluation was undertaken of potential structural and non-structural measures for flood risk mitigation. Guidelines for integrated flood risk management were established, in some countries around the world. These covered land-use regulation; the integration of structural and non-structural measures; the integration of flood risk management plans with related plans; and recommendations on interprovincial cooperation on flood risk management. These guidelines were supported by a set of flood maps and analytic tools developed during the course of the study (Halcrow Group, 1994)

Integrated flood risk management has a number of facets, where arise from the integration of various aspects of risk analysis and management, including the following:

- Integrated analysis of flood risk
- Analysis of flood frequency
- Analysis of flood hazard
- Evaluation of flood damage

A framework for integrated flood risk management must be contained guidance on the following:

- Selection and integration of structural and non-structural measures
- Land-use regulations, planning codes and flood-proofing
- Other non-structural measures
- Structural measures
- Environmental impact assessment
- Development and implementation of flood management plans
- Integration with related plans
- Integration between riparian provinces
- Integration between nations

A flood early warning system can be defined as including the following components (EMA, 1995; 1999)

Prediction: detection of changes in the environment that lead to flooding and the prediction of river levels during the flood;

Interpretation: identifying in advance the impacts of the predicted flood levels on communities at risk;

Message construction: devising the content of the message which will warn people of impending flooding;

Communication: disseminating warning information to people and organization likely to be affected by the flood;

Response: getting the appropriate protective behavior from the threatened community and from the agencies involved; and

Review: examining the various aspects of the system with a view to improving its performance.

Based on the above motioned components, the National Flood Early Warning System in I. R. of Iran (NFEWSI) has been designed and introduced to the government, and, as it will be discuss later, it is on operation in the country.

As the most dangerous type of the natural disaster in I. R. of Iran in general has always been flood the Early Warning System used at the end of 2001 year is demonstrated on this kind of disaster. Flowchart of the national flood early warning system in I. R. of Iran (NFEWST) has been shown on Figure 4. National Forecasting center (NFC) of Irimo is the first and important box of the flowchart. Asitis is seen on Figure 4, 1 NfEWSI Consists from thre main parts: 1. observation, 2. Issue, and 3. Response.

In the observation parts meteorological data collects by MDCC (meteorological data collection and distribution) from synoptic, climatology, upper a is raingage and hydrology stations as well as radar and satellites.

NFC issues early warning for flood using MDCC data, prevlous flood data, and data received from international forecasting centers. Issued flood early warning has been sent to PFC centers (province forecasting center NCDR (National Committee for Disaster Reduction), media, Internet, Leader office, presidential office and national parliament. Sometimes, PFCs can issue the flood early warning by to permission of IRIMO's NFC.

In the part of response, Action plan provides by related organizations such as ministry of transportation, related organizations such as ministry of transportation, road information centers, National committee for flood management, ministry of interior, Red crecent org., health centers, and soon.

1- Introduction

Natural hazards are an unavoidable part of life. Each day, every one of us faces some degree of personal and public risk from natural hazards of one kind or another.

At the close of the twentieth century, natural hazards and disasters are one of the most common forms of disasters around the world, as it is shown by the statistics in Figure 1[1]. Data gathered worldwide over the last three decades show that, while the number of people killed by natural disasters has leveled out at around 80,000 per year, as shown in Figure 2, the number affected by disasters and associated economic losses have both soared [1].

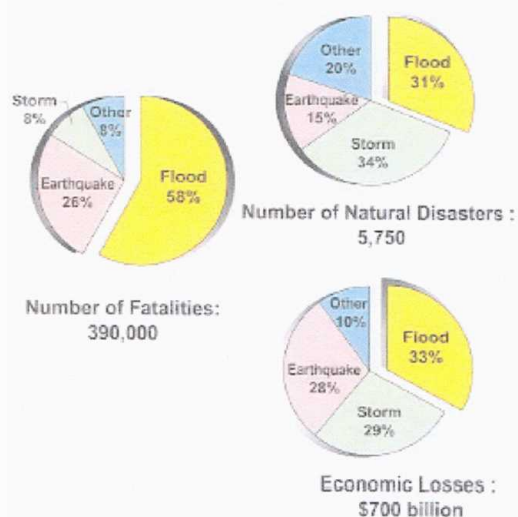


Figure 1: Natural Disasters throughout the World (1988-1997), Source: White, 1999 [1].

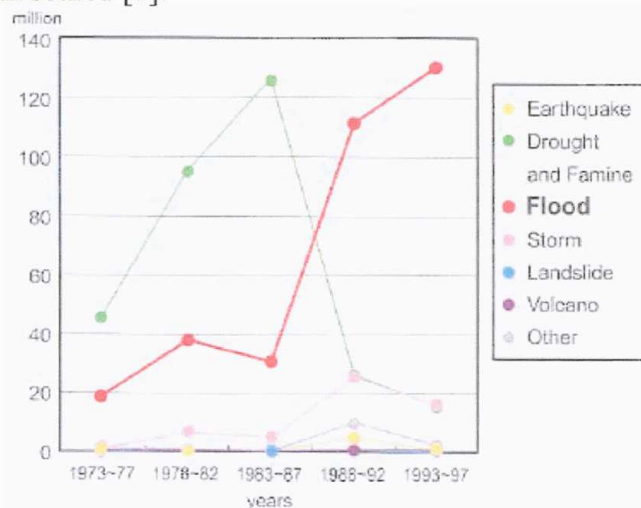


Figure 2: Average Number of Natural Disaster Victims by Type of Disaster and Period (1973-1997), Source: CRED, "World Disaster Report 1999"[1].

Natural disasters cause in significant loss of life and serious economic, environmental and social impacts that greatly retard the development process. In I. R. of Iran, also, different types of natural disasters occur, such as drought, flood, earthquake, sea-level rise, dust storm, hail, freezing and etc, which the percentage of different events has been shown in Figure 3 [1].and flood mapping is shown in Figure 4

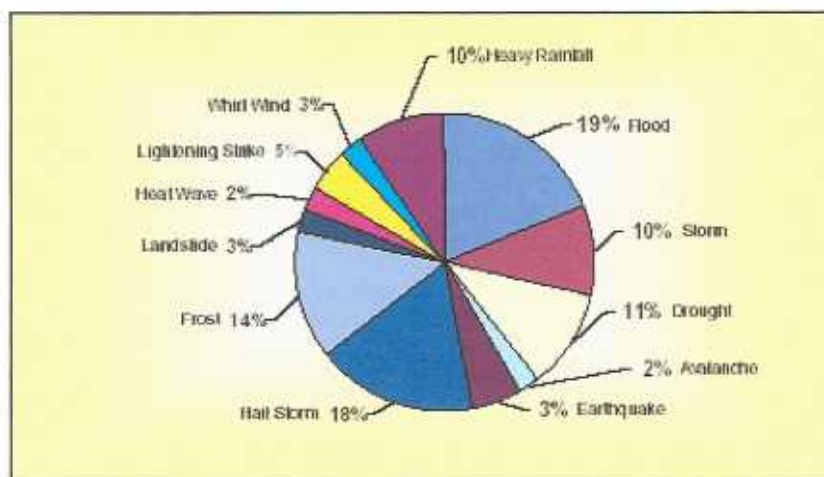


Figure 3: Percentage of Natural Disasters Events in I.R. of Iran (1990-2002), Source: NCNDR, 2002 [1].

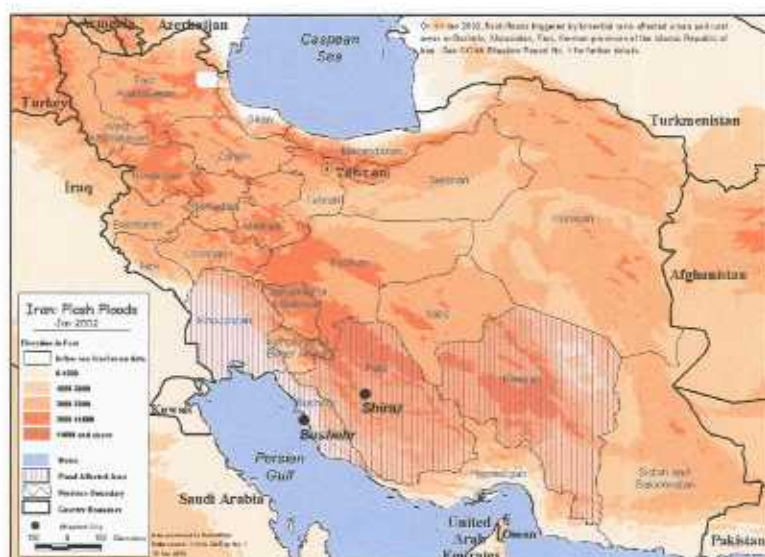


Figure 4: Flood mapping in Iran

Flooding has long been recognized as one of nature's most damaging phenomena. Every year, flood damages many areas in the over the world.

Based on the Statistics flood hazard and disaster is one of the most frequent and damaging types of natural disasters, in Iran.

Iran is naturally a dry country-receiving only one-third world's average rainfall, its climate is extremely variable and devastating floods are a periodic occurrence. Historical data reveals an increase in the number and severity the floods over the past few year, such that in the 1950, there were 195 recorded floods, that number rose to 232 in the 1960 and 1, 351 in 1999s. of the 3,140 flood recorded in the past 50 years, 43.4% had occurred in the past decade.

Heavy torrential rains resulted in devastating flood in the provinces of Golestan, Khorasan and Semnan. For example the flood which occurred on 12 Aug 2002, directly or indirectly affected some 200,000 people, A total of 4,300 ha of agricultural land was heavily damaged, while 80,000 ha of fallow land was also badly damaged.

Considering that these provinces have important role in agriculture and economy of Iran, Indeed flood control and mitigation is increasingly a priority policy issues requiring constant attention and realignment of resources to ensure sustainable development. Types of flood damages and mean annual amount of flood damage in Iran are shown in figure (4) (5), and number of flood events & killed in recent decade is shown in table (1).

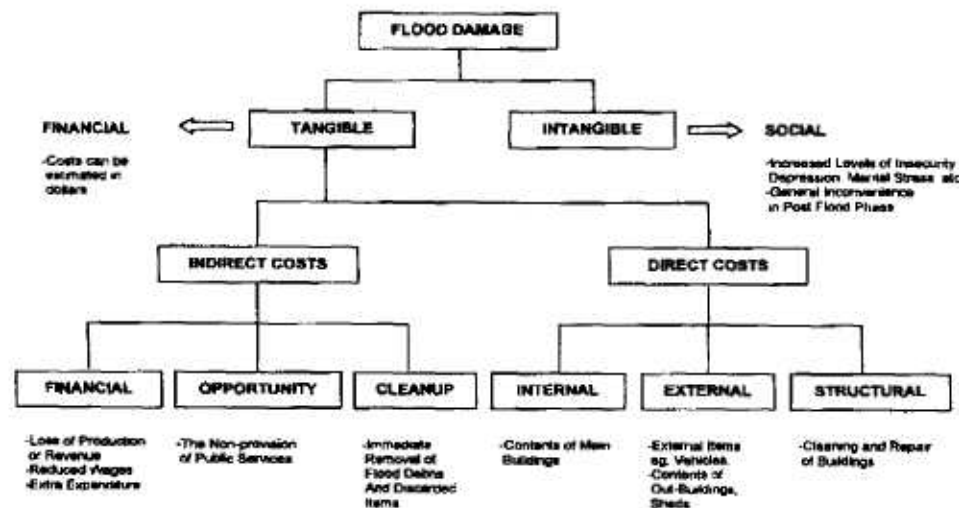


Figure 4. Types of Flood Damages [2]

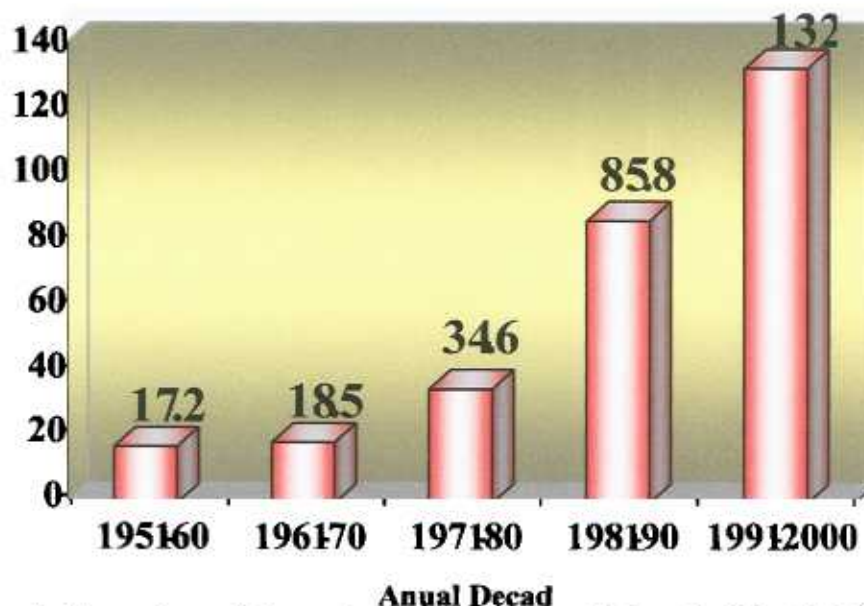


Figure 5. Mean Annual Amount of Flood Damage in Iran (million U.S.\$) [2]

Table 1. Number of flood events & killed in recent decade in Iran [2]

Year	Event	Killed	Year	Event	Killed
1990	37	51	1997	18	56
1991	40	36	1998	15	39
1992	120	979	1999	17	46
1993	66	13	2000	19	40
1994	79	55	2001	23	306
1995	84	57	2002	15	49
1996	21	35	Total	554	1762

In Iran, flood risk, and how we manage it, has become the subjects of increasing research and debate in recent years. Now, we try to describe the flood risk in Iran and the efforts that the government of the republic of Iran has done to control and mitigate the floods.

Type and definition of flood in Iran

Floods are the most common of natural hazards that can affect people, infrastructure, and the natural environment. They can occur in many ways and in many environments. Riverside floods, the most prevalent, are due to heavy, prolonged rainfall, rapid snowmelt in upstream watersheds, or the regular spring thaw. Other floods are caused by extremely heavy rainfall occurring over a short period in relatively flat terrain, the backup of estuaries due to height tides coinciding with storm surges, dam failures, dam overtopping due to landslides into a reservoir, and seiche and wind tide effects in large lakes. Occasionally an eruption on a glacier or snow-covered volcanic peak can cause a flood or a mudflow in which the terrain is radically changed and any agrarian development is totally destroyed, frequently with much loss of life.

In Iran there are some types of flood that occur more than the others. These types of flood depend on causes and specific features of flooding. They are included:

- Flash flooding: (most probable event) e.g. Masouleh and Golestan.
- Mainstream flooding: e.g. Neka, Karoon & Karkhe
- Snow melting: e.g. Hirmanci
- Malfunction of spillway gates and other control works e.g. pishin dam [2].

Many factors affect amount of damages. But the most important ones in Iran are included [2].

- flood plain encroachment (figure 6)
- Deforestation (figure 7)
- Extensive gravel mining (figure 8)
- Improper design of infrastructures in river (figure 9)
- Lack of public education (figure 10)



figure 6. floodplain encroachment [2]



Figure 7. Deforestation [2]



Figure 8. Extensive gravel mining [2]



figure 9.Improper design of infrastructures in river [2].



Figure 10. Lack of public education [2]