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INTEGRATED FLOOD MANAGEMENT

CASE STUDY

TURKEY: *RECENT FLOOD DISASTERS IN NORTHWESTERN BLACK SEA REGION*

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TURKEY: *RECENT FLOOD DISASTERS IN NORTHWESTERN BLACK SEA REGION*

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Summary:

Due to geographical location, geology, and topography, Turkey undergoes mainly three different types of natural disasters related to gravity flows; floods, landslides, and snow avalanches. Flooding is second important natural hazard after earthquakes with 18 flood events causing 23 deaths per year, on average.

Especially in recent years, a number of devastating flood events have occurred in various river basins of Turkey. In many cases, floods caused deaths, suffering and extensive damages to both public and private properties. Almost after each flood, the government has paid a large proportion of the damage in addition to losing significant revenues due to the consequences of economic disruption. The experiences gained from flood events in Turkey in the last decade have shown that, almost all essential infrastructure might be at the risk of costly damage. On the other hand, unplanned urbanization on both banks of rivers and upper reaches of the basins have a major role in the rising cost of floods, besides the meteorological and hydrological magnitudes of the occurrences.

The last decade's flood events with their costly results have brought Turkey to a new approach to tackle with the reduction and control the susceptibility to the flood damages, namely the "Integrated Flood Management" concept. It is nowadays well known that, owing to the complex nature of the Hazard Mitigation, specific measures for the flood hazards cannot be implemented or evaluated independently. In this regard, it can be concluded that building a flood control structure is neither the best solution nor the only solution to a flood problem. Structural flood protection projects may be considered as one of the basic strategies that can reduce flood damages, and in this context Integrated Flood Management including flood protection planning should be considered.

With this study, some ongoing efforts in Turkey within the content of Integrated Flood Management based on the central authority at Ankara, local municipalities and the people living the flood hit area are presented. Within the framework of comprehensive flood hazard mitigation concept, referring to the former studies on Flood Inventory of Turkey, a case study from Western Black Sea region of Turkey is presented. Both structural and non structural solutions for the sustainable and effective use of the flood prone areas are given for the case study area. During the last five years, with the loans and credits provided by World Bank, a series of flood protection structures were designed and built for the rehabilitation of the region. Besides the construction of new reservoirs, longitudinal and transverse structures for river training, flood forecasting by using the real-time data collected along the river courses, satellite data use, and GIS and, non-structural flood protection studies such as flood proofing, early warning, land use modification, building public awareness of the floods, keeping flood danger in agenda at flood zones, the change in urban planning concept to keep the settlements as far as possible from the flood plains, obligatory natural disaster (including floods) insurance, to discourage the ongoing trend to settle at flood plains in narrow valleys, higher tax for those settlements at flood prone areas, education of the young generation. So a work programme has been drafted in this framework to develop flood management and to reduce and when possible to eliminate long-term risk and damage to people and their property from natural hazards and their effects.

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Also, for the case study area; Western Black sea region, which covers about 30 000 Km^2, with four rivers and 12 towns, the factors causing the flood disaster are given. A series of flood events in the region, which took place in the years of 1972, 1975, 1983, 1988, 1989, 1991, 1992, 1994, 1995 and 1998, and their effects on households are analyzed. Also the lessons learned after the flood disasters are presented.

Key Words: Flood disaster, Integrated Flood Management, structural and non-structural flood protection, Western Black Sea region, Turkey

1. Introduction

A number of devastating flood events have occurred in the various river basins of Turkey in the last decade. In many cases, floods caused deaths, suffering and extensive damages to both public and private properties. After each flood, the government had to most of the damage in addition to losing significant revenues due to the consequences of costly social and economic disruption.

Last decade's floods with their costly results have brought Turkey to a new view-point in reducing the susceptibility to the flood damages, namely "Integrated Flood Management". Owing to the interrelation between land and water resources of a country and the complex nature of the hazard mitigation, specific measures for the flooding hazards can not be implemented or evaluated independently. Integrated Flood Management (IFM) is to be carried out within the context of Integrated Water Resources Management (IWRM). IWRM integrates land and water resources development in a river basin, within the context of maximizing the efficient use of floodplains and minimizing loss to life. In this regard, it can be concluded that building a flood control structure is not enough. Structural flood protection projects may be considered as one of the basic strategies that can reduce flood damages, and in this context flood protection planning should consider the full range of the hazard mitigation activities. Socio-economic activities, land-use patterns, hydro-morphological processes, etc., need to be recognized as constituent parts of these systems. The entire hydrological cycle is considered rather than differentiating between droughts and floods while planning water resources development of the river basin as a whole.

2. Flood Inventory of Turkey

A flood inventory of 776 cases was prepared using a simple computer program for PC use for easy access to 68 different parameters encompassing the geographical, topographical, hydrological, meteorological, and synoptic characteristics of each flood. By categorization of the available data in hand, spatial and time distributions of past flood events were determined For this purpose, floods during the period from 1945 to 1995 from economic and social perspectives by creating a database that has 68 different parameters (see Appendix I) to define a single flood event and it was being updated till 2003 [1,2,3,4,5,6,7,8]. To access the flood data compiled from the archives of General Directorate of Natural Disasters, Turkish State Hydraulics Works, State Meteorological Office and Turkish Newspapers, a simple program named "TASKIN.PRG" was written using Dbase III Plus [4, 7]. Based on this information Figure 1 was prepared to show the areal distribution of the floods. Accordingly, on the average 18 flood events occur in a year and they take about 23 lives.

3. Location of the case study area

3.1. Co-ordinates

Turkey extends between 36° - 42 North latitudes, and 26°- 45° East longitudes. The area selected for the case study is located at 40°29' - 41°36' North and 31°11' - 33°42' East, and encompasses 4 river basins: Filyos, Devrek, Bartin, and part of Melen (Figure2).

3.2. Physical features of the flood prone region

Most of the drainage areas of the rivers in the project area are featured by short main courses, their steep slopes and rather dissected with deep valleys and the tributaries have river bed slope bigger than % 2 at upper reaches. During the flood, due to high sediment, the river flow is muddy and viscous has high velocy. The forest cover has been damaged by man and the water retaining capacity of drainage basin was decreased, therefore erosive energy is very high. The large amount of erosion and debris materails dragged by the flowing water and deposited in the flatter low lying areas. Sudden floods especially at the short main courses are common and these produce widely devastating so-called "flash floods" in the the project area and in the country, which usually occur more frequently May, June and July [5,6].

3.3. Land and water use patterns in the region

Due to topography, local people use the flood planes of rivers located in narrow valleys, both for settlement at urban areas, and agriculture at rural areas. In order to control the floods, local municipalities asked the central government to help them to build the longitudinal protection walls on both banks of the river section crossing the urban areas. Since the fertile land is very limited to the narrow valleys, it is very dear and utilized under any risky conditions.

The main use of the water in the region is for irrigation. If the topography is suitable energy is also produced at multi-purpose reservoirs. At certain locations, domestic and industrial water can be supplied from the rivers. At the outlet of the rivers to the Black Sea, there is limited navigational use.

3.4 Existing flood measures in Turkey

The existing flood related measures carried out in the framework of flood management can be summarized as:

- Structural Projects: Structural projects keep flood waters away from an area with a levee or reservoir, or other measure that controls the flow of water.
- Hydrometric and Meteorologic Observation Works: In an attempt to determine riverine flood hazard by catchment area characteristics, such as rainfall and stream flows.
- Survey Reports on Past Floods: DSI has been preparing survey reports soon after flood events to establish actual flood damage information and area of inundation. These reports also include date, time, duration, place, meteorology, hydrology and hydraulic of each flood event. The study method is based on field interviews, questionnaries, observations and flood records. The survey reports of each year are formed as flood yearly book by DSI.
- Surveys Relating to Land Use Plans: As all settlement and construction areas are subject to land use planning pemission, DSI carries out flood surveys, which are conveyed to municipalities or governmental organisations and institutions for use as data at the planning stage.
- Regional Riverine Flood Plans: DSI prepares regional flood plans that have the basin-wide coverage to be integrated to basin disaster plan for using in the emergency management of the future disasters in the basin.
- Stream bed modification by setting up new diversion structures, dykes and groins.
- Reforestation, land improvement.
- Education and information

However, the methods listed above are available and applied at many places, that does not mean that they are effective everywhere. And the last item `education` is relatively short-lived. If no practical proof of the theoretical information is given, the knowledge and awareness of the risk will be lost within a few years, even if it was there at the beginning.

4. Description of floods

4.1 Type of the floods

Floods are due to heavy rainfall on the coastal areas of the western and southern parts of Turkey or to a sudden increase in air temperature, resulting in snow melt in the eastern, mountainous part of southeastern Turkey. In the northern and central parts of the country both factors may occur depending on the time of the year.

In Turkey the precipitation types are frontal, orographic, or convective. During occluded fronts, long lasting, intense rainfall may produce flooding depending on the season of the year. Most of the coastal precipitation in the Black Sea region where the range of mountains run parallel the shore sea, is the orographic type. Convective precipitation mostly occurs during the transition seasons of spring and autumn and affects central Anatolia.

The snow accumulated in the upper reaches of the drainage basins of Anatolian rivers melts, starting from the beginning of February or March, and can cause flooding in downstream areas of the rivers.

4.2. Flood disasters encountered in the region

The flood disaster in north western Anatolia (inner Black Sea Region) affected 4 cities, 10 towns, 110 villages, and 25 000 ha agricultural land. Kastamonu; Bartın, Zonguldak, Bolu cities were effected from the floods which occurred during 19-21 May 1998 along the Devrek and Yenice tributaries of Filyos river, Bartın and the tributaries of Bartın river and Kozcağız. Another area susceptible to major floods is the western part of the catchment's of Melen River (Figure 2).

During this flood mainly the residential areas along the rivers, the infrastructures of all the cities and towns, agricultural plains and existing river training structures were heavily affected. Especially the city of centers of Bartın, Karabük, Devrek, Eskipazar and Alaplı suffered most from the floodwaters.

In general, the upper reaches of the drainage basins are dissected with deep valleys and the tributaries have riverbed slope bigger than % 2. During the flood due to high sediment, the river flow is muddy and viscous. Man has damaged the forest cover and the water retaining capacity of drainage basin was decreased, therefore erosive energy is very high.

The most intensive rainfall was observed between Zonguldak and Bartın. The maximum precipitation during 21 May 1998 is given as 130,3 mm Kozcağız, 115,4 mm at Bakacak, 106,4 at Alaplı, 100,4 at Yenice [3] (Figure 3).

Filyos basin

Filyos is the largest river in the catchment with the notable flood prone regions being Devrek, Caycuma, Yenice, Gokcebey and Karabuk. There are many smaller flood hit sections along the river and its tributaries (Figure 2).

The Filyos River flows through a narrow valley at Saltukova location and this creates some kind of impoundment effect on the river. Therefore there is a large flooded surface at upstream of this location

The drainage area of Filyos is 13 300 km^2, it has been observed since 1963 and the maximum recorded discharge 2780 m^3/sec at 01.05.1975 and annual mean value of discaharge for 29 years is 102,1 m^3/sec.

Devrek has the most restriction to flow due to the narrowing of the natural channel by installation of longitudinal concrete protection walls. Floods breaking out of this channel are destructive due to the high velocity through adjacent low-lying areas. Flood problems will be alleviated somewhat by the proposed construction of two dams upstream

Bartın basin
Flood discharge in the Bartin River (Figure 2), where the slope is very low (0,0002) and river is navigable for an inward distance of 12 km from Black Sea, was close a 100-year flood. This event caused the biggest flood loss in Turkey in the past 100 years. Loss estimation go as high as US$ 2 billion. During the flood, 30 people died and 2200 houses either had to be replaced because they were destroyed or badly damaged by the flood and landslides.

On May 21st, 1998 Kozcağız tributary of Bartın river flowed with 800 m^3/sec discharge and it corresponds to 350 year-return period. The other tributary; Bartın creek flowed with 150 year return period. The total drainage area of Bartın River is about 2100 km^2 with a long term mean annual precipitation total of 1034 mm.

Bartin city, on the Bartin River, is another area susceptible to major flooding. These floods are considered as flash floods due to the small catchment. The hillslopes are very steep with very short time of concentration. As with the Devrek River, there are planned dams upstream of Bartin. The Kirazlikopru Dam also being used for flood protection

It is interesting to note that the flood which occurred 19-21 May 1998 in the case study area is not very big in magnitude compared to the floods formerly occurred in this region. The magnitude of a flood of a return period of T_r=100 yr occurred in this region is almost equal to 19-21 May 1998 [3] (DSİ, 1988). This leads to an important question of why such a big disaster happened. The area covered by flood water was estimated to be around 35 000 m^2 and the recession of the flood waters to river beds took more than 24 hours. Another observation of the local people is the simultaneous and sudden rise of all the rivers and tributaries in the region.

5. Flood management measures

5.1. Flood management measures existing in the basin
At present there are mainly structural protection measures against flood control in the case study area. They are multi-purpose reservoirs, dikes, and levees, and channel improvements. As non-structural measures, the infrastructure of real time data collection and flood warning systems are completed but the operation has not yet started. The existing and planned structural units are given in Table 1.

5.2. The use of floodplain and floodwaters along the rivers
In the western Black Sea region, at urban area, flood plains along the rivers crossing cities and towns are used for car parking, recreational purpose and for sporting activities, but at rural areas, the flood plains are used for agricultural purpose. The farmers cultivate at their own plots as before the land acquisition, but if the flood occurs, with the help of local legal people, sue the state for repayment. But usually they get nothing from the state.
The floodwaters are not used under any circumstances; the local people and authorities try to get rid of the water as quickly as possible.

Table 1. Existing and Proposed Flood control Structures in the Case Study Area

Water Structures	Type of the	Province	Main	Aim of the project	Stage

	structure		basin		
Flood protection structures	32 structures	Zonguldak	Bartin	Flood protection	In operation
Flood protection structures	21 structures	Bartin	Bartin	Flood protection	In operation
Çay Dam	Dam	Bartin	Filyos	Domestic water supply, hydropower, flood control	Planning
Andıraz Dam	Dam	Bartin	Filyos		Planning
Aktaş Dam	Dam	Bartin	Filyos	Hydro-power, flood control	Planning
Araç Dam	Dam	Kastamonu	Filyos	Irrigation, flood control	Planning
Kirazlıköprü Dam	Dam	Bartin	Bartın	Flood control	Planning
Kozcagiz Dam	Dam	Bartin	Bartın	Flood control	Planning
Kisla	Flood trap	Bartin	Bartın	Flood control	Planning
Filyos downstream flood protection project	River bed enhancement	Bartin	Filyos	Flood control	Planning

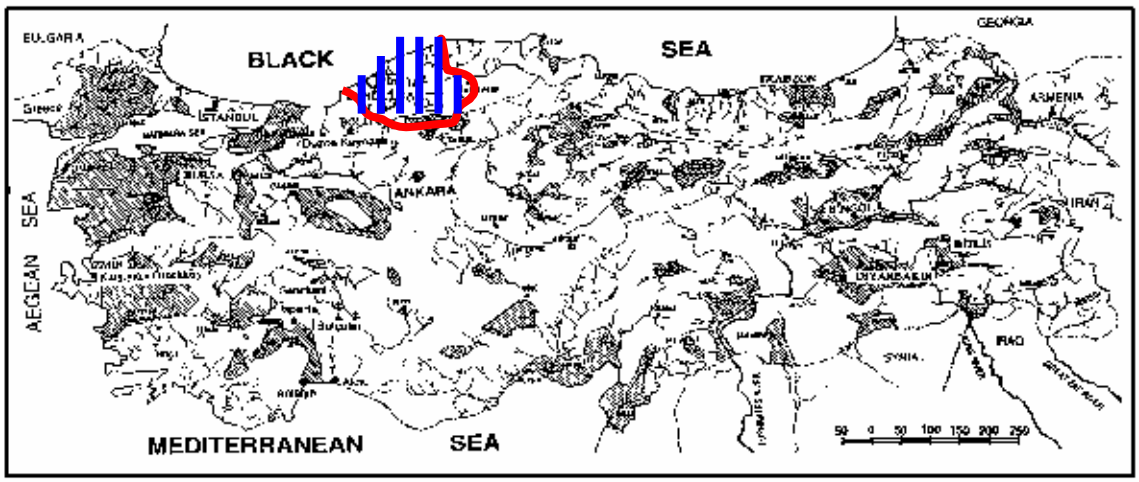

Figure 1: Areal distribution of flood events in Turkey [6]

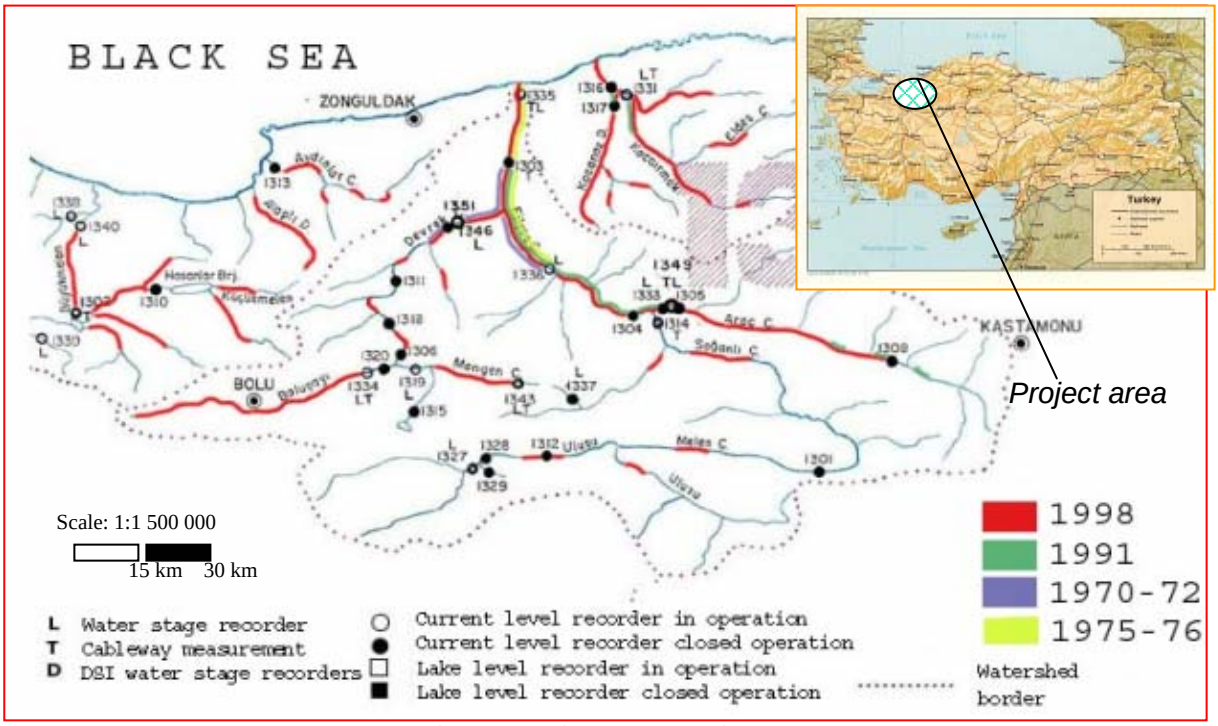

Figure 2: The case study area

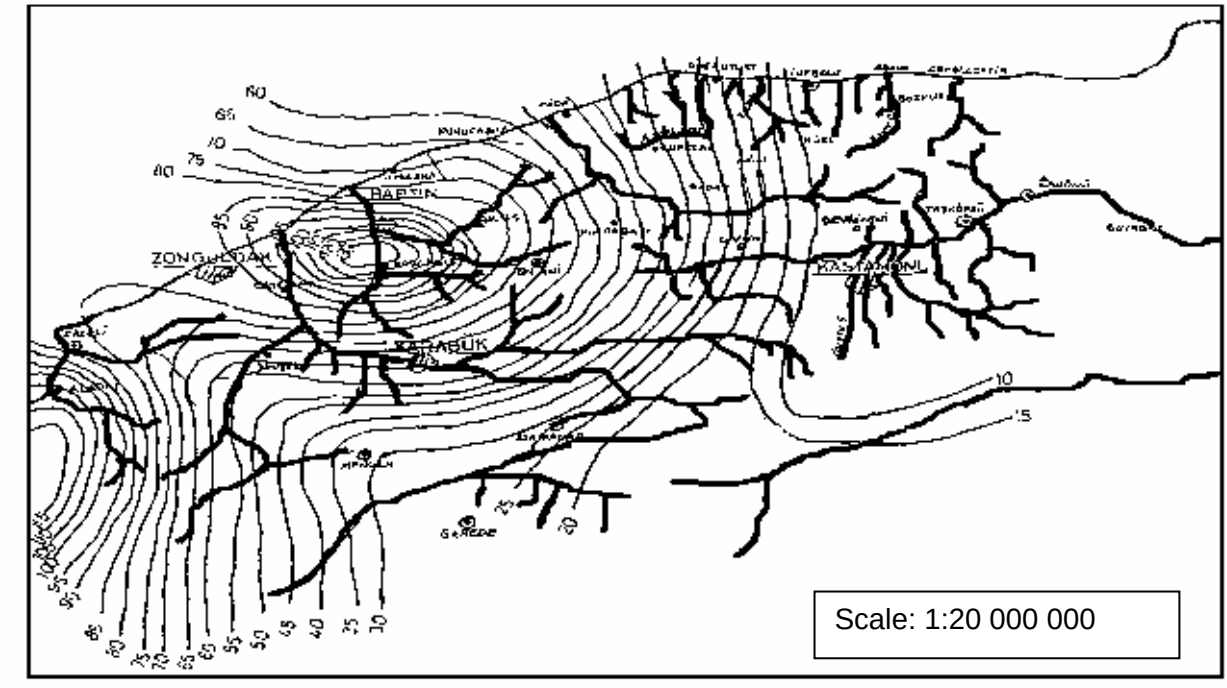

Figure 3: The flood disaster area and the isohytes of 21 May 1998[3].

5.3 Critical examination of the efficiency of the mechanism

Experiences gained from the floods of last decade show that structural measures implemented in the basin-wide are effective but too costly in reducing the risk of flood damages. So, it has been considered that more importance should be given to non-structural measures, particularly modification of traditional land use and updating building code guidelines and design standards, early flood warning system, creation of public awareness, insurance and timely and effective emergency management, in order to be more effective for integrated flood management in the project area and in the whole country. Due to economic limitations, nonstructural measures imposed by the local municipalities are not always successful. Because the local municipality authorities had to receive the money from central government for the realization of the infrastructures, for example their budget can not cover the land use modification projects.

Briefly, the existing non-structural measures are not always successful because of two main reasons:

- In the present situation, the non-structural measures are mostly dealt with by the local administrations including municipalities, mayors, “muhtars”. However, due to the present economic conditions, the implementations of the needed activities by these bodies are limited.
- The local units do not have enough educated and trained personnel to implement the non-structural measures.
- In Turkey, local NGO‘s are themselves at developing stage.

The other point is that the development stage of local non-governmental organizations (NGO) is not yet satisfactory in dealing with flood disasters**.**

5.4. Flood Mitigation

5.4.1 Structural Measures

In the case study area, there are 53 flood control structures completed and in operation, and 23 more are at planning stage. All the project activities, as the structural measures, regarding to the flood protection and hazard mitigation are being operated by General Directorate of State Hydraulic Works (DSI).

5.4.2 Non-structural measures

From the experiences gained during the latest flooding events, it can be concluded that building a flood control structure is neither the best solution nor the only solution to a flood problem. Non-structural flood protection measures such as early flood warning system which was set up and ready for operation, and the modification of land use in the region were already initiated in the case study area. The main characterisation of the land-use in the area is type of agriculture. However, recreational use of the riversides is common also.

Regarding to the continuous agricultural development, in Turkey, specifically in the project area, because of high population rate and continuously dividing of agricultural properties, depending on Inheritance Law, some problems have recently been seen to get the utmost benefits from the agricultural projects. In order to solve these problems, the land expropriation is being considered as primary issue.

Among the major benefits of land expropriation are the application of modern technics in land use, the construction of network for irrigation and transportation in the agricultural areas, the lowering of loss regarding to the employment, and the prevention of over dividing of land areas. In addition to this, with the consideration of inheritance law and others establishments, there are also some other social and cultural benefits with respect to the land expropriation.

5.5. Recent modification in flood mitigation understanding

Within the framework of flood management, with the increase of structural measures, it is true that the occurrences of floods and their damages become less in Turkey. However, in the recent

years, the more importance is given to the non-structural measures, in a given comprehensive plan, including the arrangement of the human activities, the education of the people and the informing of the stakeholders. From the last experiences, it is understood that the most of the damages is directly related to the fact that the irregular and uncontrolled urbanisation at the high-risk areas in the flood plains. In this regard, this approach gives the more responsibility to the local governments and municipalities. There are also some mitigation activities done during the flooding events. These are mostly related to rescue works and emergency studies.

6. Flood and water management instruments

6.1. Existing laws related to integrated flood mitigation concept

The basic legislation in water sector is the Turkish Constitution, which states that water resources are natural wealth of the country, and under the authority of the State, to be used for the benefit of public. In this direction, the Turkish Civil Code covers water both common waters and private waters. The red crescent does the first aid, and the General Directorate of Disaster Affairs (AFET) does the flood mitigation work. With existing laws, the following State organizations deal with the integrated flood management.

a. Law of Turkish State Hydraulics Works (DSI) states that DSI is to prevent the disaster effects of both surface and groundwater; and to build protective structures against the floods, and get benefits from its beneficiary uses
b. Turkish State Meteorological Organization (DMI) Law states that DMI is to supply the meteorological support to the sectors of agriculture, forestry, tourism, transportation, energy, health, environment, military; so all kinds of climatic data are collected by DMI during floods.
c. The law of General Directorate of Rural Affairs (KHGM**)** states that To prepare and apply some service and investment programs for the requirements of farmers in the rural areas in order to protect, develop and effective use of water and land resources in compliance with the politics and principals determined in the development plan and program. To reclaim the unsuitable land areas for agriculture, which are belong to the state or private; to prepare the needed reclamation projects for these areas. To establish co-operations for the activities of soil conservation, land reclamation and irrigation.
d. Laws of Bank of Provinces (IB) and Municipalities also states the responsibility of local organizations to fight against the all natural disasters faced at the region under consideration, IB provides the funds and Municipalities spend it properly.

6.2. Enforcement of the Laws

The enforcement is realized by the close cooperation of the central government at capital; Ankara and her top level representative at the provinces; where the flood disaster is encountered. The basic steps are the first aid, evacuation, safety, shelter, normalization of the daily routines, rebuilding and recovery of local economy.

When a natural disaster like flood is encountered in a city, then the governor is top decision maker. The experts from various state organizations and mayor and army representatives help the governor to shape up the final decision. This expert group forms ”the crises table” and includes deputy governors, mayor, local army commander, the local representatives of State Meteorological Organization (DMI), State Hydraulics Works (DSI), State Highway Department (TCK), General Directorate of Rural Affairs (KHGM), civil defense, red crescent, fire brigade and other local non-governmental organizations, like farmers union, trade union, chamber of commerce etc. In case of flood disasters, DSI and DMI local representatives play the most important role in decision-making. If the local infrastructure, including available equipment and supply will not be sufficient, the central government helps and even international aid is in the picture

7. Institutions Responsible For Flood Management

7.1. Central Authority and Institutes

A number of governmental and non-governmental organizations have direct and indirect responsibility in integrated disaster management of floods in Turkey. They are General Directorate of Disaster Affairs (AFET), General Directorate of Civil Defense, Army, Local Administrations and Municipalities. Institutional framework has three levels; namely, decision making, executive and users level (Figure 4). In decision-making level, prime ministry, state planning organization and ministries take place. Governmental organizations under the ministries are at the executive level. There are both governmental and non-governmental organizations at the water users level to cope with the integrated flood management. General Directorate of State Hydraulic Works (DSI) is authorized to plan and manage all aspects and issues of flood management especially after the flood event.

In the long run, all the rehabilitation works are planned and realized by the state, but during the planning stage, all the local interest groups express their views freely. At this stage, local parliamentarians and administrations play the most effective role on deciding the priorities.

7.2. Cooperation among the institutes

When a flood disaster is encountered at a province, according to the existing laws, written rules and regulations defining the responsibilities of each organization in emergency case, legislation, administrative principles, hierarchy and the local traditions, the group called ”provincial crises table” is formed.

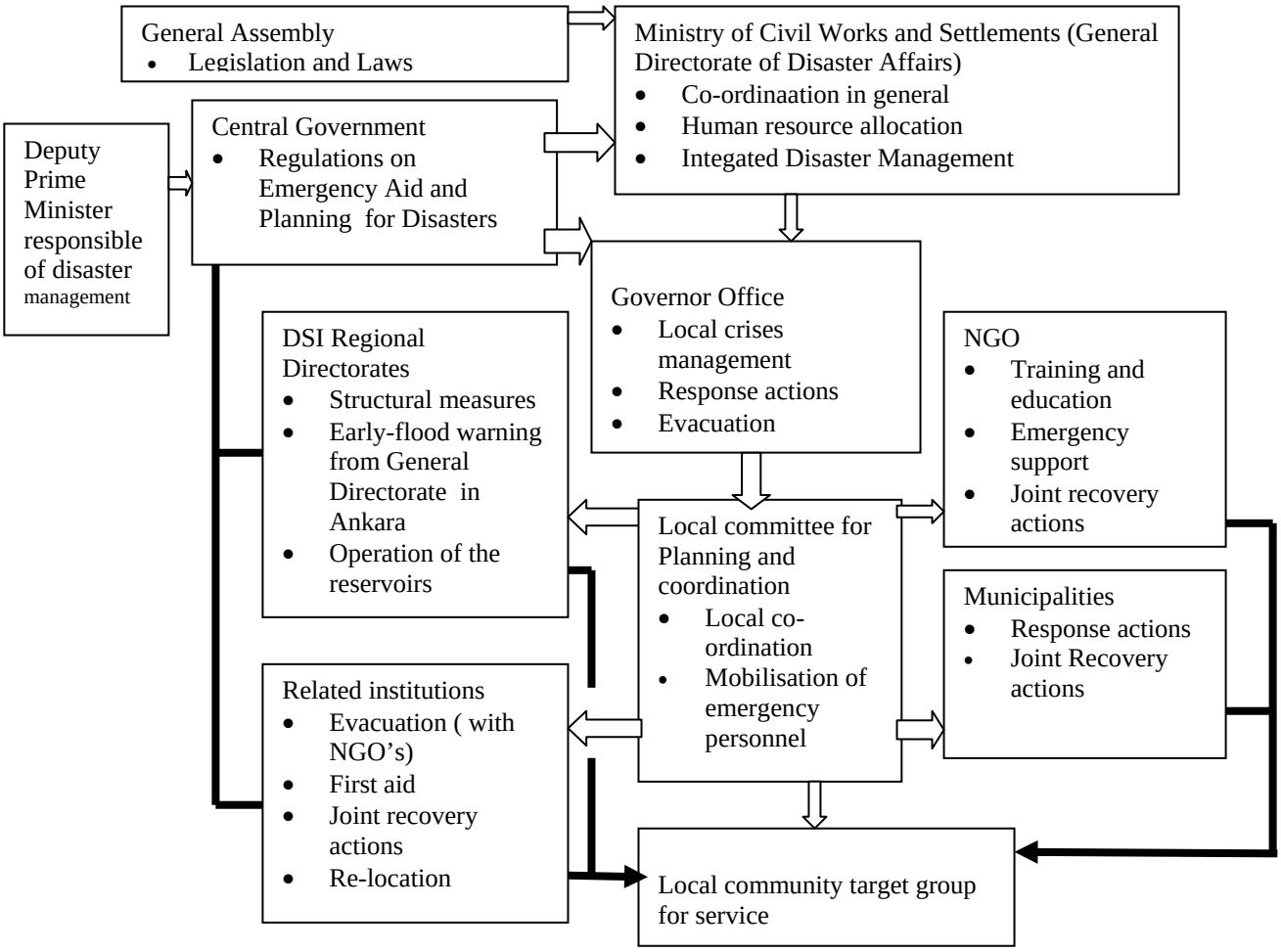

Figure 4. The Flow chart in Turkish Disaster Management system according the present legislation. administrative principles, hierarchy and the responsibilities of the state administrative offices.

The regulations set up in September 1968 as "Emergency Aid Organizations and Programs Related to Disaster Management" initiated the following points:

- Pre-disaster planning
- Set up 12 service units in cities for disaster management
- Set up other special service units and related details

In 1982, "Increased law enforcement due to natural disasters ", and on 8 May 1988,"Regulations on Emergency Aid and Planning for Disasters" were set up and Ministry of Civil Works and Settlement was appointed as coordinator for Integrated Disaster Management. The responsible person in enforcement is Governor in city and local governor in town.

In case of big disasters, the Central Planning and Coordination Council set in Ankara; capital, regulates the fast, effective and coordinated services to optimize the available resources and time for integrated disaster management. It is set up from the representatives of ministers in the government and the under secretary of Ministry of Civil Works and Settlement is the chairperson in the council meetings. The representatives of Red Crescent, Turkish Army joins the meetings when needed. The council enforces the directives of Premier, evaluates the information

gathered from the governors of the disaster region, make proposal to the Premier, coordinates the internal and international aids, and reports the developments to the Premier.

The similar type of structure of the Central Planning and Coordination Committee is set up in cities from the representatives of the local organizations and state offices under the leadership of governor. The "Provincial Crises Table" includes governor, deputy governors, mayor, local army commander, the local representatives of State Meteorological Organization (DMI), State Hydraulics Works (DSI), State Highway Department (TCK), General Directorate of Rural Affairs (KHGM), Civil defense, red crescent, fire brigade and other local non-governmental organizations, like farmers union, trade union, chamber of commerce etc. In dealing with flood disasters, AFET, Civil Defense, DSI and DMI local representatives play the most important role in decision-making. Mobilization of the emergency personnel, damage assessment, restoration of essential public services, recovery planning, resolution of conflicts over the goals, anticipation of the possible impacts of the disaster are organized by this committee. More specifically such as providing communication, regulating traffic, and transportation, rescue of buried and injured ones, medical first aid, providing accommodation and shelter, debris removal, repair of the infrastructure, setting up quarantine and all the other services which will be required for the quick restoration of essential public services during pre-, trans-, and post disaster time are carried out by the people appointed by this organization. The names of responsible people are known before the disaster.

All the disaster mitigation decisions are shaped by the members of local crises table, under the leadership of the governor. An imminent cooperation among all the local state organizations is realized. Generally, there are written rules and regulations defining the responsibilities of each organization in emergency case, but due to human factor, just after the disaster, there may be always chaos, but soon it is over and the system starts to work properly. If the local infrastructure, including available equipment and supply will not be sufficient, the central government helps and even international aid is in the picture.

7.3. Local Interest groups

According to the present laws and regulations on dealing with the natural disasters, the state is the main healer of the disaster hit area both economically and psychologically. There are nongovernmental organizations; the unions of farmers, merchants, businessmen, chamber of commerce, muhtar, elected representatives of the local people, mayor, in helping to shape up the local public mind to deal with the similar type of floods in future. There may be economic help from the banks, rich local people, some nationwide campaigns to help the disaster hit area but usually these types of helps come afterwards and not sure. There are no written rules to define the type of the service the NGOs are expected to give, but their service is voluntary. So the state is the main healer and organizer of the helps.

8. National Policy in Integrated Flood Management

8.1 The new initiative for flood management:

Until 1998, Turkey carried out the flood related activities, generally as structural measures in the river basins so as to reduce or eliminate long-term risk in the sensitive areas to the floods and water erosion. DSI has built dams, reservoirs, dykes, drop structures, weirs and channel improvements to minimize the adverse affects of floods on people.

The experiences gained from the floods of last decade show that structural measures implemented in the basin-wide are effective but too costly in reducing the risk of flood damages. Therefore, within the framework of Integrated Flood Management concept, after 1998 floods, more importance was given to non-structural measures, including flood proofing, early warning system, land use control especially at floodplains, flood disaster awareness creation, initiation of

the concept of flood insurance, and timely and effective emergency management to be more effective for flood hazard management in the country

In response to 1998 floods at western Black Sea region, the Government of Turkey with the assistance from the World Bank has identified an Integrated Flood Management programme, named TEFER (Turkey Earthquake and Flood Emergency Recovery) Project to develop flood management and to reduce or eliminate long-term risk and damage to people and their property from natural hazards. With TEFER, the urgent need in the flood prone area; which has been presented as case study from Turkey; the establishment of all kinds of structural and non-structural measures as flood control alternatives are being realized.

The project provides technical assistance to perform hydrometric network review and design and automated weather and hydrometric system design. By the technical assistance, it is meant that, having participated to the regional projects such as MED-HYCOS, Black Sea-HYCOS and WOISYDES, DSI has gained lots of technical knowledge about the sophisticated methods and technologies used for the flood warning**.** Some concrete technical support has been available by the contracts realized by the finance of World Bank-supported TEFER Project. Regarding to the duration of the TEFER, the first phase of the project is about to finish. The implementation of the second phase depends on the financial source allocated by the Government.

TEFER project supported the re installation of 14 automatic real-time hydrometric, 10 automatic real-time meteorological in the project area and 1 Doppler radar stations so that real-time data be available in order to run the operational flood forecasting models (Figure 5). Data integration is one of the highest concerns. The integration of the rainfall-runoff routing model to incorporate hydrometric and automatic weather data, and real-time quantitative radar data, in real time, is required.

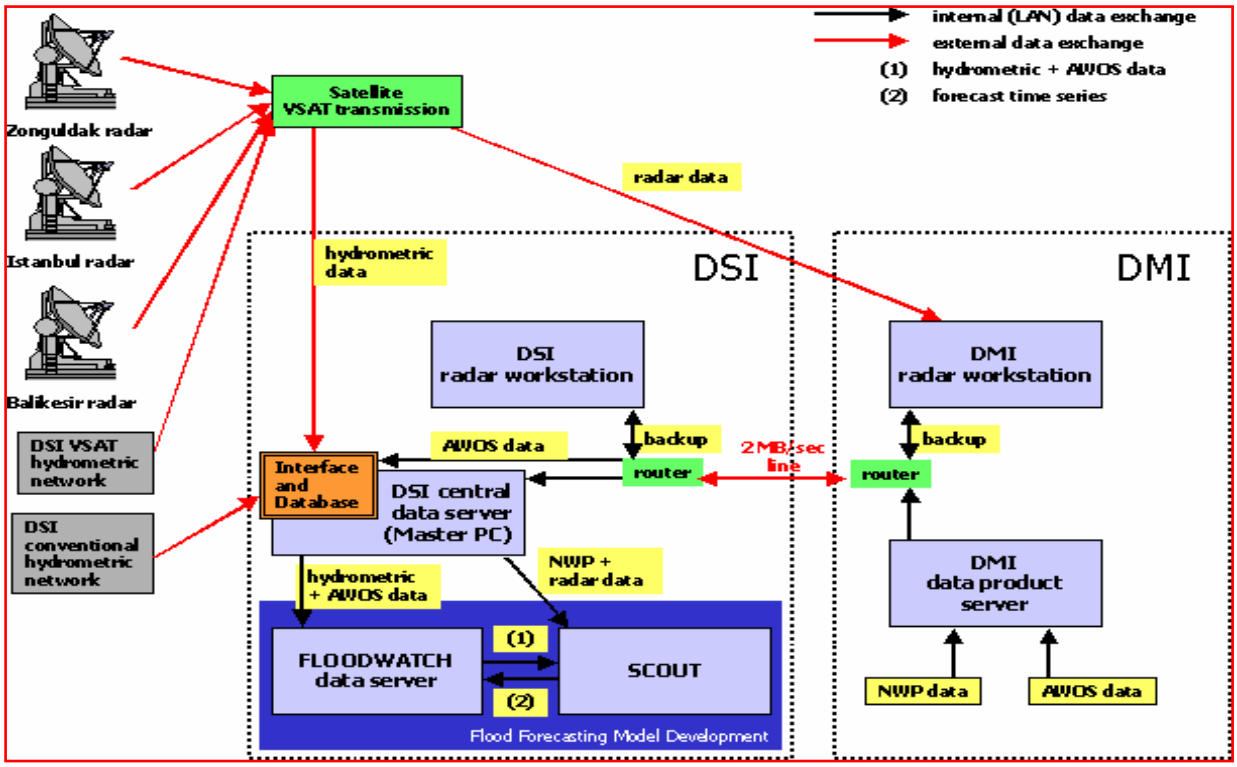

Figure 5. TEFER Project Western Turkey Pilot area

8.2 The participation of stakeholders to the flood management

In shaping up the integrated flood management policy in Turkey, the participation of stakeholders is observed at forming the policy and decision making. Accordingly, the local municipalities and governors are in the position directly to influence on the flood projects both at the planning and implementation level.

Village elders and the elected members of the rural communities initiates the idea to solve any problem related to their small community and they pass it local administration by written note; petition and to central government through their representatives in the parliament. Local media and NGO follow up the developments and inform the community.

Besides the elected members of the community, women also affect the decision. The family structure in rural area is so that the woman acts at the back stage and she expresses her view on all communal subjects. But, since the speaker of the family is the husband, therefore when the villagers meet at the village coffee-house to make the final decision, it is the decision of the community including women. It should be considered that the role of women in educating the children is of high importance in Turkish society.

Regarding to the local community, with the help of media; TV and Newspapers and local unions, people living in the flood areas can request from the governmental bodies to conduct some enhancement works against the flooding events. In this regard, during the planning process of the water structures, the local communities and interest groups are partly involved in the framework of the environmental impact assessment studies realized for the related project.

8.3 Changes in the flood management policy

The floods of the last decade, with their costly results have brought Turkey to a new view-point to reduce and control the susceptibility to the flood damages, namely the "Integrated Flood Management". In this context, a sound underwriting for land use control, flood insurance and early warning system are being considered.

Years of experiences gained showed structural measures such as dams, levees and dykes, diversions, channel improvements, implemented in the basin-wide were effective with rather high cost, to reduce the risk in flood damage. Therefore non-structural measures are becoming more important in flood hazard management in the country.

9. Lessons learned from past experience in Flood disasters

The dams and other flood control structures played very important role in protecting the human life. However, flood control and management based on structural solutions could be insufficient. Therefore, effective solutions based on land use control, zoning, building ordinance, modifications in building codes, flood information programs by local communities are needed. This required major restructuring of both present legal systems and institutions responsible for management. Local municipalities and NGOs now comment more on the state originating proposals to deal with natural hazards, even criticize heavily and propose alternatives. The flood plain use along the narrow valleys, encouraged by local civil administrations, had to be put under control. Otherwise, future human loss will be greater. This is a known fact by local people. But at urban areas, flood plain along the rivers are opened to sport activities. In rural areas, local farmers put pressure on the decision makers to allow the flood plains to be cultivated by them with their own risk or insurance.

9.1 Need for a flood insurance policy

It is evident that the present situation as regards risk assessment, underwriting, and rating is not yet satisfactory for the insurance industry as a whole. Flood in Turkey is not only the result of climatic conditions but also of uncontrolled urbanization and inefficient infrastructure.

Consequently, floods represent a real risk for both insurance industry and their reinsurersand to the state. It is very important that the risk engineering departments of insurance companies be equipped with the knowledge necessary to deal with the insurability of high to flood in terms of geographical areas and for individual risks. Flood insurance must not be subject to un-technical competition, and a return to sound underwriting must be achieved.

9.2 Lessons gained from the last decade events

In Turkey, during the floods in 1998, in reducing the adverse effects of the disasters such as loss of life, both central and local flood management mechanisms were rated as succesful, but at the same time, some lacks of present management system were also noticed by the government. The fact that, the need to modernize the current disaster management system and increase its capability had been recognized in Turkey in the past, but their solutions had been deferred because of the budget constraints. Whereas at present, government has been conducting some studies by giving much more importance to the non-structural measures included in integrated flood management concept to reduce or eliminate long-term risk to people and their property from floods and their effects.

Since the structural measures cost more, non-structural measures are encouraged. Recently proposed new legislation will give more power to local administrations and, they will have their own budgets. It is expected that floods will be managed at local level.

In this respect, some ongoing efforts which are already under the progress could be mentioned herewith:

- The Government has been preparing a new national Disaster Mitigation Strategy Report to develop and to adopt a national mitigation strategy, in addition to establising and improving mechanism for coordination and communication among the agencies concerned with disaster mitigation.
- Some regulations related to land use and design standards, and building codes have being modified.
- Studies on building a flood insurance system have been going on.
- Studies on establishing a disaster information system have been going on.
- Designing and implementing of an automated real-time weather and hydrometric system in the pilot hydrologic basin is going on.

The relevant ongoing efforts regarding to the non-structural measures are expected to be completed at least in coming 5 years, in parallel to the implementation of the TEFER Project.

9.3 Needs for institutional and legal changes

First of all, prior to and during a flood, all the state organizations should cooperate. In this respect, General Directorate of State Hydraulic Works (DSI), General Directorate of Electric Power Resources Survey and Administration (EIE) and State Meteorological Institute (DMI) should be able to work together to collect and use the most up-to-date hydro-meteorological data in Turkey. The may lead to institutional and legal changes.

Although new radar technologies and computer visualization techniques hold significant promise for improving the timeliness and accuracy of river forecasts and flood warnings, ground-based verification will still be needed even after such technologies are in place.

The hydrometric stations must be far enough upstream to give a delay of between four and six hours before a flood peak reaches the risk site, but not so far that measured flow is unrepresentative.

9.4 Some suggestion for the other developing countries

Considering the above mentioned experiences, disaster mitigation measures proposed for developing countries would be as follows:

- To install or to improve early warning system
- To prepare hazard mitigation plans and strategies in the light of lessons from the extreme events, considering the economic and cultural differences between the countries
- To supply scientific and technical information needed for lowering the life and property losses; to support research activities in this area
- To disseminate the existing experiences and new techniques among the related people
- To supply technical support systems and to develop application programs which are effective in vulnerable areas

On the other hand, it is considered that dams and other water structures play very important role in protecting the human life. However, from the flooding events, which are seen also in the last decades in Turkey, it is suggested that flood control and management focused on structural solutions using embankments and reservoirs could be insufficient.

Therefore, effective solutions must go beyond structural measures and require major restructuring of both legal systems and institutions responsible for management.

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Appendix 1. List of the parameters used in defining a flood event.

1.The number assigned to the flood

Location of the flood

2. Name of the region
3. Name of the city
4. Name of the town
5. Name of the village
6. Local name if any
7. Name of the river
8. Name of the tributary

Geographical co-ordinates

9. Latitude of the flood location
10. Longitude of the flood defined

Type of certainty of the event

11. Flood occurred for sure
12. Flood probably may occur

Definition of the sure case

13.Date of the event
14 If the flood was a single, an independent event (Y/N)
15.If the flood was concurrent with an avalanche
16.If the flood was concurrent land slides
17.If the flood was concurrent rock-falls
19.If the flood was concurrent an earthquake

Magnitude of the effect of the flood

20.Number of people lost in the flood
21.Number of injured lost in the flood

22.Property loss, domestic animals,
23. Property loss cultivated and productive farm lands,
24.Total population in the disaster area
25.Total number of residences in the flood-prone area
26.Number of houses damaged in the flood
27.Ratio of the damaged to total number of houses
28.Number of houses partially affected
29.Ratio of the affected to total number of houses

Post-event investigations

30.Preliminary investigation
31.Overall detailed investigation
32.Date of field investigation
33.Type of report prepared
34.Date of report

35.Type of solution if proposed any
36.Type of road available to reach the area
37.If the solution proposed was realized

Geomorphologic definition of the flood

38.Number of flow channels (as in braided rivers)
39.Slope of the channel
40.Exposure of the channel
41.Drainage area of the river flooded
42.Maximum discharge if measured
43.Maximum water level if measured

Meteorological Data

44.Day time temperature
45.Night time temperature
46.Wind velocity at H = 2 m.
47.Wind velocity at H = 10 m.
48.Percent of cloudiness
49.Relative humidity
50.Duration of sunshine
51.Total radiation

52.Total amount of rainfall
53.Duration of Rainfall
54.Date of occurrence

55.Total amount of snowfall
56.Depth of snow pack
57.Density of the snow
58.Water equivalent of the snow pack

Synoptic situation of the event

59.If the 500 Mb map is available
60.If the 800 Mb map is available

The vegetative cover of the disaster area

61.If the land surface is barren
62. If the land surface covered by pasture
63. If the land surface shrub
64. If the land surface forest

Regional geology

65.If the area is sedimentary in origin
66. If the area is metamorphic in origin
67. If the area is volcanic in origin

In the event of an earthquake

68. Intensity of the earthquake Content of the study

OPTIONAL
The following part; is the list of content of the paper and it is optional

Summary

Figures