19-21 May 2011, EPOKA University, Tirana, ALBANIA.

Risk assessment from floodings in the rivers of Albania

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ABSTRACT

Flooding is a natural phenomenon in Albania. The floods are flashy and flood – waters occupy the floodplain; in the biggest rivers, close to the rivermouth area, these waters inundate the floodplain for several weeks.Attempts have been made to alleviate flood situation in Albania by building protective dykes and creating upstream storage. Although many of these measures have been beneficial, they also served to encourage further encroachment upon river floodplains, thereby raising the potential for flood damage. Actually, more than half of the Albanian population lives very close to the rivermouth areas, where the risk of flooding is higher. The structural solution is only a partial one; the only long-term solution consists of keeping flood-vulnerable development and uses out of the floodplain. In order to evaluate the flood potential, a statistical study in national scale was carried out. The peak discharges for different return periods are computed using statistical method and a map of the flood potential for the country is designed. Those constructions had a relevant protective role during the flooding of the winter 1970-71. Non structural measures consist of measures undertaken for flood warning or flood forecasting or different studies like flood-mapping, estimation of inundation risk and inundation zones and possible damages etc.

1. MAIN ISSUES FROM FLOODINGS IN THE RIVERS OF ALBANIA

Flooding is a natural phenomenon in Albania, resulting from an increase in streamflow beyond the point where the normal stream channel can contain the water. When water overspills riverbanks, it spreads out along the adjoining floodplain. Flood - waters may occupy the floodplain for a matter of hours, as in case of flash floods, or for several weeks, as sometimes occurs during the winter period, when the period of rainfall is longer or during the floods of spring period caused by snowmelt.

. In an effort to provide a co-ordinated, cost –effective approach to the problem, there is a need to established Flood Damage Reduction Program, in order to ensure sustainable development, combining the following activities:

• Mapping of flood – prone areas

• restricting land use activities in the flood zone

• educating the public

• studying flood – prone areas to suggest mitigation, including structure where warranted

• assisting in the implementation of flood forecasting.

2. HYDROLOGICAL CHARACTERISTICS OF ALBANIA

The climate of Albania, in general, is Mediterranean with some degree of continentality in the mountainous regions in the northern, central and southern part of the country. The country combines a coastal plain in the West with fairly high mountains: the highest point reaches 2751 m at the triple border with Yugoslavia and Macedonia, while many ridges exceed 2000 m in the northern, central and southern parts of the country. The rain comes mainly with south-west winds and falls according to the obstacles encountered. This gives a variety of climates and rainfall patterns in the different regions of the country, as show the values extracted for stations with 30 years of continuous observation:
Average annual rainfall is around 1485 mm; the seasonal pattern is very consistent, with July, sometimes August, as the driest month and November, sometimes December, as the wettest one;

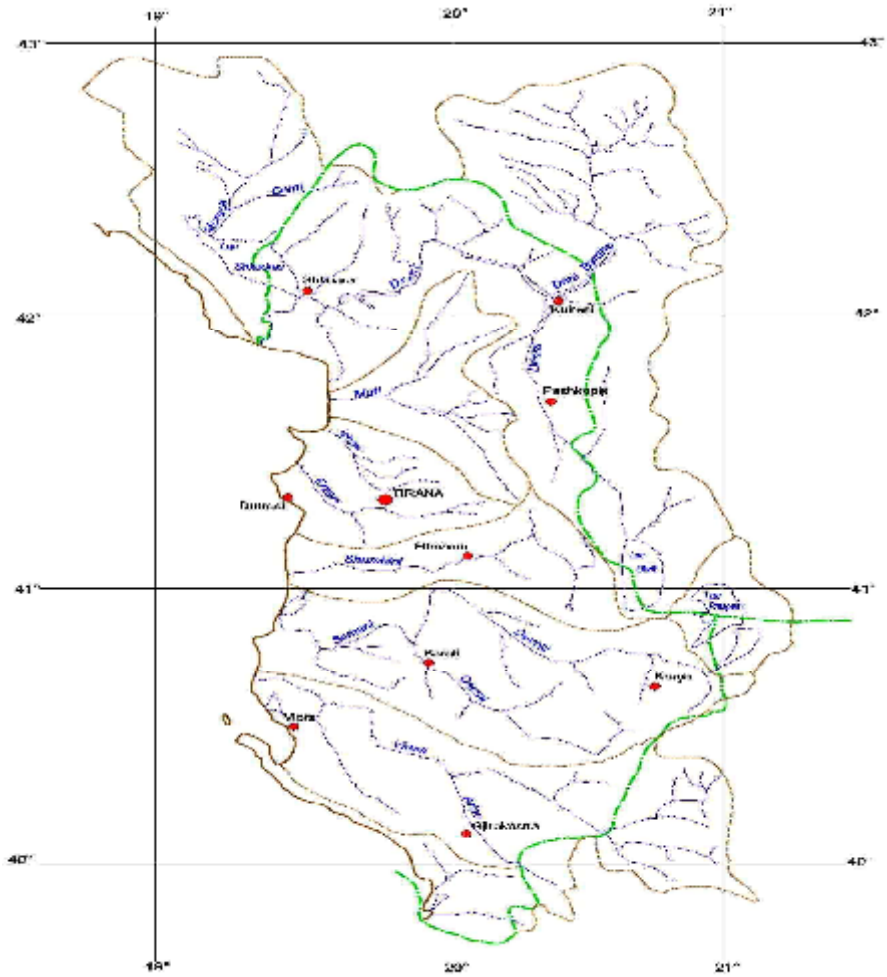

Fig. 1 Hydrographic map of Albania

The wettest area is in the North, in the district of Malesia e Madhe: Boge and Theth receive about 3000 mm per year; other wet areas with annual rainfall above 2000 mm are found in the mountains of the north-centre (districts of Puke and Mirdite) and in the south (districts of Tepelene, Skrapar and Gjirokaster);

The precipitation regime in the low part of Albania is in general Mediterranean, characterised by intensive showers during the winter. The hydrographic basin of the rivers of Albania has a total area of 43,305 km^2 from which only 28,748 km^2 are situated within the state territory of Albania. The rest, which belongs to the catchments of the rivers Drini and Vjosa, is situated in Greece, Macedonia and Yugoslavia (fig.1). The hydrographic catchment of the Drini has a total area of 19.582 km² from which 14.173 km² belong to the Drini itself and 5.187 km² to the Buna. The Drini is formed by two main tributaries: the Drini Zi, with a catchment area of 5.885 km², flowing from Macedonia, and the Drini Bardhe, flowing from Yugoslavia (fig.2).

3. FLOOD POTENTIAL BASED ON HISTORICAL RECORDS

The most important cause of floods is excessive rain. Rain may be seasonal occurring over wide areas, or from localised storms which produce the highest intensity rainfall. Melting snow is another major contributor to floods.The relief of Albania is mountainous with an altitude of 786 m. The precipitation regime is in general Mediterranean, characterised by intensive showers in winter and droughts in summer.In the highest part of the basin the precipitation, in the most part of them come down as snow. During the big floods the water overflow in the Western Plain of Albania, creating almost one river mouth.During the floods, the values of the specific discharge in the main rivers oscillate from 0.5 $m^3/s.km^2$ (Drini river) to 2 - 5 $m^3/s.km^2$ (Ishmi river) and in smaller rivers (A=100-400km^2) from 2 to 10 $m^3/s.km^2$.The floods are flashy and in the main rivers they traverse the hydrographic network in 8-10 hours.Based on the information of historical records peak discharges and the volumes of the floods are computed for different return periods, which are presented for some stations of the low part of river watersheds.ig. 1 Hydrographic map of Albania

4. AN OVERVIEW OF HISTORICAL FLOODINGS IN ALBANIA

4.1 HISTORICAL FLOODING DURING THE PERIOD 1854 -1962

Archival sources and the data collected from the Institute of Hydrometeorology of the Academy of Sciences show that big flooding are observed even in the past. From the first centuries before new era roman historians had given evidences on the flooding of the Buna and Drini Rivers and the movement of their flow direction one time toward the Shkodra and the other time toward Lezha town.
Interesting evidences are given by Turkish chronist M.Sirri on the inundations of Shkodra from the floods of Drini, Buna, Lake of Shkodra and Kiri River during the period 1854-1871 (see State Archives, document Nr.1/5605).
In the watershed of the rivers Buna and Drini other floodings have been observed during the years 1937, 1952, 1960 but always with lower river stages than the floods of the winter 1962-63.

4.2 FLOODING OF THE WINTER 1962-63

Amongst all flooding observed until now in the rivers of Albania the biggest are considered those of 1962-63 in relation to the occupation of the territory, duration and damages caused by them. These events occurred not only in Albania but also in almost all Mediterranean Basin and partly in the Western Europe. More intensifies they have been in southwestern and eastern part of the Balkan Peninsula and Italy. Because of intensive showers, wind storms etc. in coastal lagoons a big quantity of water has been entered, causing high changes in salt, oxygen and sediment regime. In the Lakes of Ohrid, Prespa and Shkodra very high water levels were observed. Water table of groundwaters in the Western Plain was risen up, joining in some places the surface waters, particularly in the fields of Myzeqeja of Lushnjes, in Thumane, Maliq etc.

TABLE 2. FLOOD CHARACTERISTICS OF THE PERIOD NOVEMBER 1962 – FEBRUARY 1963

No	River	Station	Surface of watershed A(km²)	River stage over"0" H (cm)	Discharge (m3/s)	Period
1	Buna	Shkoder	4134	560	2000	13.1.1963
2	Drini	Vau Dejes	11500	673	5180	13.1.1963
3	Drini	Bahçellek	14173	564	*	
4	Drini i Zi	Kukes	4413	531	1080	13.1.1963
5	Drini i Bardhe	Kukes	4314	553	1450	13.1.1963
6	Lana	Tirane	20	302	159	16.11.1962
7	Erzeni	Ndroq	640	584	794	16.11.1962
8	Erzeni	Sallmonaj	719	971	956	16.11.1962
9	Shkumbini	Murrash	1240	542	945	16.11.1962
10	Shkumbini	Paper	1890	631	1430	16.11.1962
11	Semani	Ura Kuçit	5080	714	*	16.11.1962
12	Osumi	Ura Vajgurore	1870	774	1130	16.11.1962
13	Vjosa	Dorze	5420	938	3650	3.2.1963
14	Vjosa	Mifol	6680	652	*	18.2.1963

The discharge is not computed because the waters overflowed the riverbanks

TABLE 3. Inundated zones during the floods of November 1962- February 1963.

No	Zone	Inundated surface in ha	Duration in days
1	Zadrima of Shkodres and Lezha, Bregu Bunes	18575	22
2	Fields between Drini of Lezha and Mati	3122	10
3	Fields between Mati and Ishmi (Thumane etc)	5825	7
4	Fields downward Rogozhina in both river		

	banks of Shkumbini	6896	7
5	Fields in both river banks of Semani	26738	35
6	Fields in both river banks of Vjosa downward Ura of Mifoli	3538	20
7	Total	64694	

5. MEASURES FOR FLOOD MITIGATION IN THE RIVESR OF ALBANIA

The measures undertaken for preventing the lowlands from flooding can be classified in two types: structural and non-structural measures

5.1 STRUCTURAL MEASURES IN THE WESTERN PLAIN OF ALBANIA.

After the catastrophic inundation of the years 1962-63 the Albanian government decided to reconstruct the destroyed embankments and to construct new dykes in other rivers.
As for the structural measures, huge investments are carried out after the inundations of the winter 1962 – 63, for the construction of embankments in the lower part of the rivers Drini, Buna. Mati, Ishmi, Erzeni, Shkumbini, Semani, Vjosa etc.
Those constructions had a relevant role during the flooding of the winter 1970-71.
In addition, the artificial reservoirs in Drini and Mati represent important structural measures, which apart from their use for hydro-energetical purpose, play an important role for the flood regulation.
By taking these measures, the floods with a return period of less than 50 years do not cause the inundations of the lowlands in the Western Plain, on condition that the dykes remain undamaged during these floods and that the pumping stations operate normally.

DYKES ON THE RIVERS BUNA, DRINI AND KIRI

From the village of Zus until the village of Dajc the embankments on the river Buna are constructed on both sides of riverbanks. From the village of Dajci until the rivermouth of Buna the dykes of the left side are situated in the Albanian territory. These dykes, in general, have worked normally, except during the flooding of 1962-63, when the waters overspilled the river banks in the village of Muriqan and inundated the fields.
Embankments are built also along the river Drini, downward Vau Deja, as well as a part of the Kiri River. Nevertheless, during big floods, as those of 1962-63, the waters inundate the city of Shkodra.

DYKES ON MATI RIVER

The dykes in the Mati River are built downward URA e Milotit until the rivermouth. In general, these dykes protect the fields from the inundation, except of a part close to the rivermouth, where river waters recharge the swamp of Potoku.

DYKES ON THE RIVERS OF ISHEM AND ERZEN

The dykes on Ishmi River are built downward the city of Fushkruja until its rivermouth, and they are still in good conditions. The dykes in Erzeni River exist in the lower part of the river and are also in good conditions.

6.2 NON STRUCTURAL MEASURES

Non structural measures consist of measures undertaken for flood warning or flood forecasting or different studies like flood-mapping, estimation of inundation risk and inundation zones and possible damages etc

Two types of maps could be produces under the Flood Damage Reduction Program: public information maps and working maps. Public information maps cover the flood risk area, are usually printed in colour, and serve to provide the public with general knowledge of the areas threatened by flooding. These maps are handed out freely during information sessions and are readily available from appropriate government agencies. Working maps are large-scale, detailed, and generally, monochromatic maps. They are available to that needing comprehensive site information such as engineers, planners, property owners, developers, and government agencies.

7. FLOODPLAIN MAPPING IN THE WESTERN PLAIN OF ALBANIA

The purpose of floodplain mapping is to delineate the area affected by a flood of a specified magnitude. Under the national Flood Damage Reduction Program, the flood hazard area should be subdivided into the floodway and the flood fringe.

The first step in floodplain mapping involves the production of topographic maps for the basin under consideration. The typical production schedule for the maps consist of ground control surveys to establish the vertical and horizontal positions of targets interspersed throughout the basin. Aerial photography is then taken of the area in which the surveyed targets appear in the imagery. In order to avoid in some way these problems, the following procedure was followed. First, the river stages and the corresponding absolute quotas, with different return periods, were computed. Analysing and comparing these quotas with those of the flood of 1962-63, was noted that the highest river stages of this flood actually have a return period of around 100 years. Concerning the minimal scenario, it is presented by inundated zones, inside the space of the dykes, on both sides of the river. For this scenario an indicative map on the scale 1: 100 000 has been elaborated.

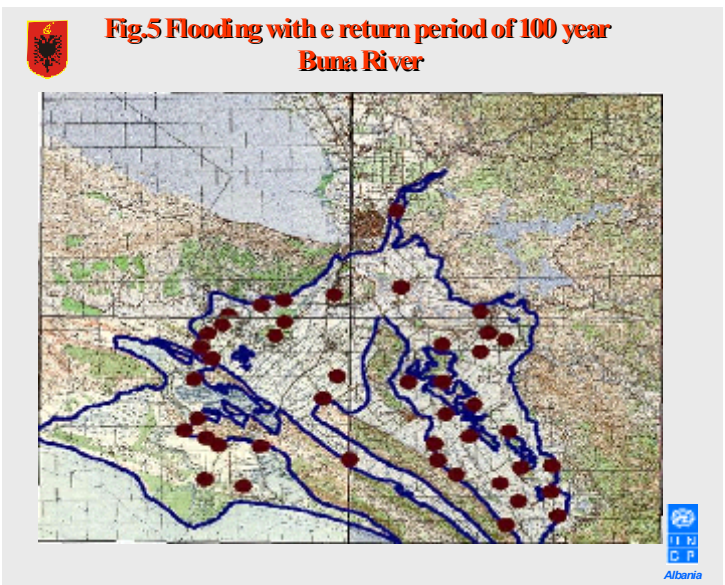

Fig.2 Flooding map for Buna

8. CONCLUSIONS RELATED TO SOME FLOODING MITIGATION MEASURES

As it is mentioned in the above paragraphs, the flood is a natural phenomenon in Albania. In these conditions only flooding mitigation measures could be taken in order to reduce the damages caused by flooding.
These measures can be classified into two types: short-term measures and long-term measures.

SHORT – TERM MEASURES

These measures consist of local works, generally of low cost, that could be undertaken in one season or year. They include maintenance works and organizative measures, aiming to warn as soon as possible the state institutions and population. These measures could be summarized as follows:

- Measures for the improvement of the drainage systems and the channels of high water, especially the work of the pumping stations.
- Organization of the Flood Warning Service in the Institute of Hydrometeorology, which will have the responsibility to warn regularly the emergency institutions and populations on the situation of the rainfall regime and river, stages in rivers.

LONG-TERM MEASURES

The establishment of a National Flood Damage Reduction Program is a priority. This program will be based on the actual Law on Emergencies, which charge the institutions to establish national or regional Flooding Mitigation Planes.
Some measures of technical character are mentioned as follows:
• Identification of the state of dykes and necessary measures for rehabilitation and eventually, building of new structures on both riverbanks (partly in Drini and Buna, Shkumbini, Semani and Vjosa).
• Analyzing the current standards of the hydro-module of drainage of agricultural fields aiming to re-computation of these standards and increasing the pumping station's capacity.
• Rehabilitation of existing dams in small irrigation reservoirs and eventually building of new reservoirs, which could increase the capacity of the flood control.
• Reducing the high erosion rates by means of reforestation, building of small dams in the upper part of mountain torrents etc., especially in the rivers Devolli, Erzeni, Osumi, Drino etc.

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