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REVIEW ARTICLE

Flood and Its Consequences in Iran

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ABSTRACT
When the soil and plants are unable to absorb the rain and the rain cannot flow in the natural river bed, flood occurs. The goal of the present research is to study floods and their hazards in the country of Iran. The method of this study is review (library-documentary). Studies have shown that negligence in frontages of river and dry rivers caused number of floods and their damages to grow exponentially. Restoring jungles, construction of levees, dams, storages, and flood channels are the main policies for flood containment. One of the most effective methods to prevent flood and decrease its damages is by accomplishing watershed management project and programs, as it is done in Iran; but due to lack of protection of river frontages and aquiferouses, it has become necessary to increase these projects and programs by both credit extension and administrative supports. Watershed management includes biological and mechanical operations to strengthen vegetation, protect soil, and to increase the permeability to decrease flood potential in flood prone areas. Aquifer and water spreading studies for effective use of flood flow and damage control, and correction and land-use changing studies and presenting allowed uses especially considering zoning and flood potential in short and long terms. Risk management, flood, and cautionary method studies in advances countries like USA, Australia, Britain, and Japan shows that monitoring methods and flood anticipation models like SSM, 3MR, MH-HAZUS, etc. are the most effective methods against flood, although these methods have been noticed enough in Iran. Studies have shown that construction and improvement of watershed drain pipes, construction of facilities for storing surface water, encouragement of construction buildings with storing and recycling surface water (storing rain), increasing awareness of flood problems, development of cautionary systems, relocating residential areas to somewhere out of the flood range, facilitate flood insurance, and other plans can highly control flood damages.
Keywords: *flood, flood-water, natural disasters*

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INTRODUCTION

Despite the progress of engineering works for flood disaster reduction over the last twenty years, flooding continues to be a major challenge [1] and incidences of floods have been on the rise, responsible for more than half of all disaster-related fatalities and a third of the economic loss from all natural catastrophes [2].

Flood is the most dreadful natural disaster in the world considering fatalities and financial damages. Flood in one the most important natural disaster that causes more damages than drought and famine. [3]. The increasing number of fatalities and damages done by flood in recent decades is concerning [4].

Floods are considered as one of the important and destructive natural phenomena and disasters worldwide. Floods cause damage not only in countryside areas but also in urban areas. Changes in pattern of natural drainage system made by mankind in urban and countryside areas are the main cause for floods and their damages. The increasing number of floods in recent years indicates that other regions of country are susceptible to flood [5].

Natural disasters are part of inevitable reality that generally mankind cannot control their occurrence. Management of natural disasters, especially in the case of flood, is a set of actions that take place before, during and after a disaster to reduce the damage as much as possible.

All studies show that as the urban areas increase and their permeability decreases, surface waters increase. Studies also show that urbanization and constructive activities on the basins area will increase

volume and current of surface runoffs. Some studies in USA have shown that changing rural lands to urban lands will result in a 9 fold increase in floods caused by rain and will increase maximum flood discharge by 500 percent over 50 years [6]. However, in rural region of country flood is considered as an unexpected and destructive phenomenon too [7]. Different studies indicate that negligence in rivers and dry rivers' areas has caused the number of floods and their damages to grow exponentially. Increasing growth rate of flood damages in recent two decades has made us to come to an understanding that we cannot prevent flood occurrence, but we can control its precious and destructive consequences [8].

Areas with the most risk for flood are urban areas. Being unable to completely control flood, learning to live with it and using new policies for land use management and expanding residential regions on river areas to control its destructive effects is necessary.

Destroying aquiferous on upper urban areas due to destroying the vegetation, road construction, and immethodical expansion of urban and industrial lands will decrease permeability and vaporization and will increase surface runoffs. On the other hand, vernal and partly aestival short time cloudbursts are the main precipitation regime of the country that provide little time for the rainwater to be absorbed and as a result a considerable part of it will turn into runoffs. Thus rivers and dry rivers of urban aquiferous have a high degree of flood risk and its damages and as a result achieving sustainable urban development requires designing suitable models for management and protection of rivers and dry rivers of urban aquiferous. Lots of human activities such as destroying jungles and pastures and land-use changes increases number of floods in the region and flood occurrence can be predicted in such regions.

As a general rule, studies that have been done on urban constructions confirm that construction of new cities and towns and expansion of urban areas decrease land permeability, increase urban runoffs and turn them into floods that can be dangerous [9].

Flood risk factors of areas:

It is necessary to mention that there is a relation between number of flood occurrence and technological development and land possession [9]:

1. Expansion of urban areas:
   Lands that are channels for dry rivers and overflowing rivers are suitable and tempting for construction and civic programs and are of burgesses', urban planners', and city managers' interest. But these lands are part of the channels for rivers and dry rivers and even if it has not been a flood or an overflow for several years there is no guarantee that it will not happen again after a repeat interval.
2. Land-use change on countryside:
   Changing the land-use to different kinds of civic uses disturbs natural system of the area, decreases permeability, and increases flood potential.
3. Transferring surface runoffs to dry lands:
   Generally surface waters flow in all of the rivers and dry rivers and in most if the cases, especially in normal conditions, rains don't cause a flood. But when constructions are done on these lands and an impermeable connecting network is made, permeability decreases by 70 percent and so the rain water cannot be absorbed by soil and will be guided to rivers and dry rivers through a network by a natural on unnatural gradient, and as a result rivers will be loaded with 70 percent more water.

The article is an important historical piece that draws on unique oral history regarding flooding and its impact. Furthermore, it is a story about power, politics and colonial dynamics and forced relocation using flooding as a pretext. The article indicates how colonial authorities made use of this benevolent excuse of a natural disaster to compel people to move permanently to new areas so as to fulfill the colonial administration's political agenda of security and control over the population. The article indicates that flood-prone communities may fear relocating permanently due to cultural, social and economic factors. Thus, the government should not use force to relocate communities but should address communities' fears and provide them with support in relocated areas

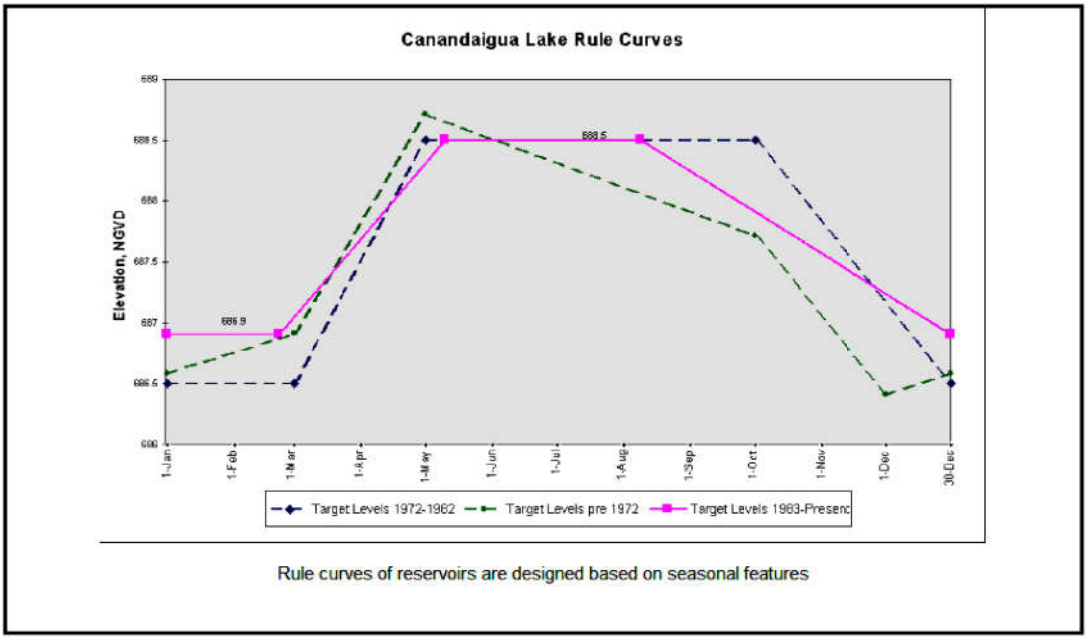
IRAN'S POTENTIAL FOR FLOOD MANAGEMENT

One of the flood precautionary organs is seasonal flood management in dam reservoirs. Seasonal features of Iran's rivers usually have a good condition to reserve floodwater in reservoirs. Rivers in which vernal floods, cause buy melting of snow, flow, the amount of the snow reservation of the area can make a good chance for reservoir to play a rule, and in rivers which are the best potentials for flood in December, the reservoir has a considerable volume for controlling flood due to summer consumption. It is possible that a huge flood comes after the flood that has already filled the reservoir before there is time for it to get

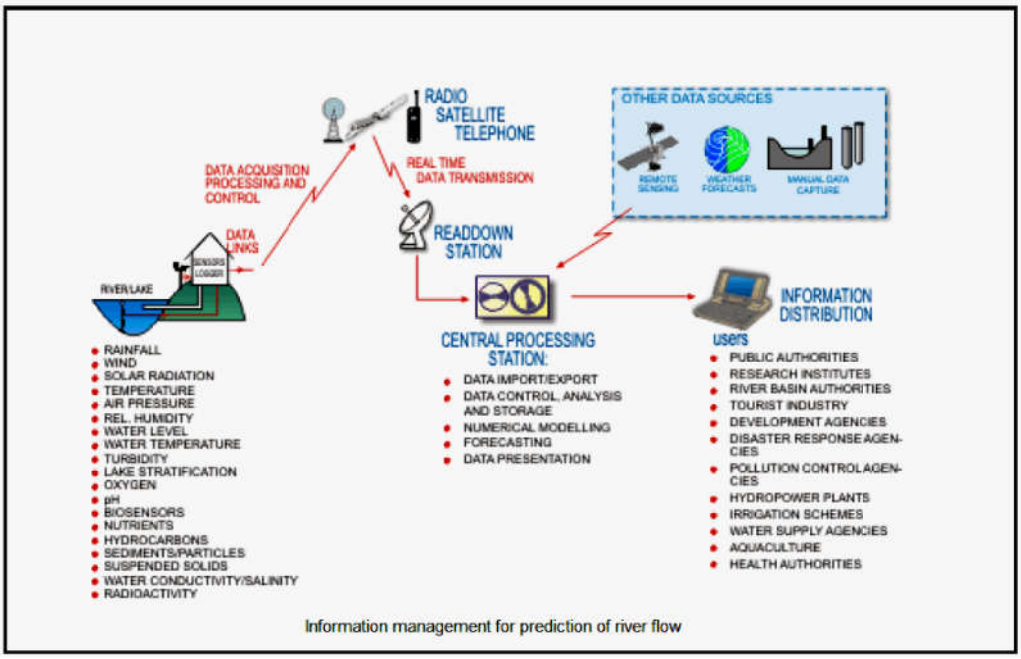
empty. In such condition reservoir doesn't do any good in flood control and to prevent destruction of the dam, spillways are constructed.

In reservoirs with controlable valves existing volume can be used in a better way to restore floodwater

The possibility of economic harness is the most when there is seasonal floods in the river. Panning for reservoir filling and getting empty can be done in a way that the reservoir be filled most likely in the end of the flood season and not sober than that. With proper cognition and appropriate management of seasonal floods potentials, reservoirs constructed for watering, hydroelectricity, etc. can be used to control flood. Boston's American Society of Civil Engineering's (ASCE) report obviously shows reservoirs constructed in that area to provide water for urban uses and generating electricity, played an effective role in controlling floods occurred in March 1936 and September 1938. Reservoirs were empty due to huge amount of snow on mountains and summer uses in March 1936 and September 1938 respectively.



Rule curves of reservoirs are designed based on seasonal features



Information management for prediction of river flow

Seasonal features and hydraulic and meteorology predictions have provided the optimum use of multipurpose reservoirs. In most cases hydraulic prediction of reservoirs are more accurate than hydraulic prediction of rivers and levees. Reservoir volume required for restoring water in most dams in the country is far more than required volume for controlling flood and as a result utilizing dams constructed for restoring water to control is possible only by active management using hydraulic and meteorology predictions, seasonal features, and the latest technologies like internet, satellites, and storm radars. Frequency of flood occurrence in our country is lower than that in countries such as Bangladesh, Japan, and even developed countries like US, but still damages done by flood is considerable related to these countries. In this regard, south areas of the country are affected by flash floods with short continuity and high discharge peak due to dry climate and monsoon rains and south west and north west areas are affected by floods caused by Mediterranean climate, thus flood potential of south areas of the country are similar to countries such as Bangladesh but with lower intensity, and controlling floods in these areas using structural methods would be very difficult and in some areas can be impossible. Examples are catchment areas of Pishin and Minab. Floods occur in these areas have such volume and discharge peak that existing dams even being completely empty cannot do much to balance the flood discharge peak. In mountainous catchment area like Dez, Karun, and Karkheh it is possible to construct huge storage dams and to control input floods. Thus flood prediction should be done in south areas of the country to warn and evacuate areas subjected to flood and in mountainous areas to increase efficiency of flood controlling reservoirs and to aware residents and beneficiaries of dams. In this regard main problem of flood occurrence in areas with flash floods is numerous causalities of floods, and in mountainous areas it is utilization and controlling existing flood dams and flood designing of developing designs. In spite of knowing this fact, flood prediction in catchment areas even in its simplest form has been done rarely and experiences of developing countries in this field haven't been used.

DISCUSSION AND CONCLUSION

Flood is on the harmful atmospheric phenomenon that occurs in most of the world. The country of Iran has witnessed this phenomenon for years too, and there has been countless damages done by it. When the soil and plants are unable to absorb the rain and the rain cannot flow in the natural river bed, flood occurs. Restoring jungles, construction of levees, dams, storages, and flood channels are the main policies for flood containment. Levees can be constructed with or without a design. In designed levees professional consideration on foundation soil, type of soil used in the levee, proper density of the levee, protection of the upper areas of the levee against scour, and other parameters are considered. One of the most effective methods to prevent flood and decrease its damages is by accomplishing watershed management project and programs, as it is done in Iran; but due to lack of protection of river frontages and aquiferouses, it has become necessary to increase these projects and programs by both credit

extension and administrative supports. Watershed management includes biological and mechanical operations to strengthen vegetation, protect soil, and to increase the permeability to decrease flood potential in flood prone areas. Aquifer and water spreading studies for effective use of flood flow and damage control, and correction and land-use changing studies and presenting allowed uses especially considering zoning and flood potential in short and long terms. Risk management, flood, and cautionary method studies in advances countries like USA, Australia, Britain, and Japan shows that monitoring methods and flood anticipation models like SSM, 3MR, MH-HAZUS, etc. are the most effective methods against flood, although these methods have been noticed enough in Iran. Studies have shown that construction and improvement of watershed drain pipes, construction of facilities for storing surface water, encouragement of construction buildings with storing and recycling surface water (storing rain), increasing awareness of flood problems, development of cautionary systems, relocating residential areas to somewhere out of the flood range, facilitate flood insurance, and other plans can highly control flood damages [10]. There is no reliable method to predict next flood and its extent. Studying past floods and using statistics, engineers estimate the probability of floods with different extents. Probability of flood occurrence in every area depends on conditions in that area. In practical cases, the acceptable risk depends on situation. Flood susceptibility of most areas in the country, extension of the water sources developmental plans in areas, and develop of computer technology have made it necessary to manage flood by modeling and software. Especially that the cost of management methods using computers are so low compare to non-managemental and structural methods, and combining managemental and structural methods to lower the costs, increase system efficiency, and decrease damages done by flood is necessary. In most catchment areas of the country flood management and developing softwares are considered to be less valuable than water sources developmental plans, and this fact has caused the field of using related technologies to progress less than it should, compare to developed and developing countries. As a result, identifying key points and using simple and practical management methods especially to predict flood can be considered as the first step of developing complicated flood management systems. Hopefully with attention of authorities for making preparations and facilities needed for development and improvement of catchment areas management, this first step will be achieved soon. The fact about methods used for controlling flood damages and the way to encounter the flood, is the perspective changing from containment and controlling the flood to flood management. It is obvious that protection and organization of rivers, improvement of urban dry rivers, optimum use of urban runoffs, and creating an integrated management in urban flood management utilizing modeling and computer simulation will aid sustainable development of cities against flood. According to hydraulic studies, obstruction of bridges and nonconformity of river areas can increase flood risk and it is necessary to take actions for improving river hydraulic condition before and during the flood. Management of upper and lower aquiferous areas to decrease flood potential damages, studying flood monitoring in cities and creating a flood damage zoning map, and considering flood risks for use locating and urban residency management are fields that should be considered more than before. In lots of urban areas utilizing non-structural approaches is the only choice for comprehensive management of floods. Considering low cost and set up time of flood predicting and cautionary systems in urban areas, it is recommended to prioritize these systems. In the field of flood management, identifying locations with highest amount of runoffs and flood potential is necessary, because planning on the upper part of the area will lead to flood management in the lower human parts. With Identifying areas with high flood potential and taking required actions surface runoffs can be reduced. One of these actions is watershed management. Using drops will decrease water velocity, increase permeability, and as a result decrease runoffs. Changing land-use and destruction of pastures will increase runoffs volume and must be prevented; thus, strengthening of the vegetation and pastures are effective methods. These methods can decrease flood potential of the area. In flood management, especially in urban areas, in addition to hydraulic and engineering aspects, other aspects of the flood such as spatial, ecologic, politic, and social-economic aspects are taken into the account too. To achieve a comprehensive, stable and effective flood management a combination of urban, technical, and organizational planning is needed. Also flood risk must be prioritizing in the field of urban development planning and rules and regulations of construction and land-use. In order to provide and complete data needs such as meteorology-hydrologic and flood hydraulic simulation data, investment of concerned organizations is needed. Flood zoning maps, flood risk maps, and instructions for before, during and after flood must be publicized for different audience. Obstacles for cooperation of concerned organizations like overlap and interference of related responsibility must be removed. Utilizing fast cautionary systems, to generate on time information about flood and to inform people in danger, must increase. Public medias such as internet, social networks, formations, and groups can be used to increase public awareness.

Whereas preventing proceedings and measures cost less than reactive actions, preventing proceedings must be considered more than before.
Solutions for damage control:

1. Identifying potential risks in domains using zoning;
2. Avoiding expansion in areas with moderate and high risk;
3. Making proper preparations to release flood-prone areas;
4. Using engineering solutions;
5. Urban specific management in vulnerable areas;
6. Changing high-risk land-uses to allowed uses (greenbelt and sports);
7. Propagation of the idea of protecting natural views like mountains and rivers by public institutions;
8. Preventing of construction on dry river areas;
9. Creating passage network with high width in areas with high vulnerability;
10. Constructing new structures with desirable and persistent materials;
11. Creating open spaces in order to relief in case of occurrence on a natural disaster;
12. Decreasing building and population density in vulnerable areas;
13. Decreasing building stories in dry river areas;
14. Locating a proper position for relief centers in order to control flood consequences.

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