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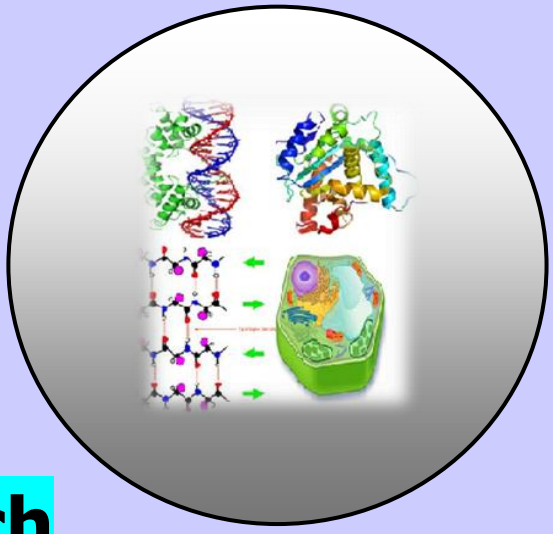

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Assessment Flash Flood Damages and Risks in Wadi Jazan, Saudi Arabia

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ABSTRACT

This paper presents results a survey of the communities and villages opinions undertaken in wadi Jazan, Kingdom of Saudi Arabia. The survey intended to investigate the current situation of damages, risks and causes of flash flood at wadi Jazan. The wadi Jazan contained many villages along the channel that are vulnerable for flash flood. A total 250 questionnaires were distributed between six villages. In terms of the types of damage, the results show property has 76.5% and 23.5% human. The best way to exploit the flash floods is to irrigate farms using clay and concrete bulkheads. The most important causes of flash flood risks in wadi Jazan is sudden heavy rain 27.8 %. Large amount of heavy rain at specific time could be leads to flash flood disasters which vary according to seasons per yearthat affect vulnerable villages along channel of wadi Jazan.
Key words: Flash flood, Risks, Damages, Disasters and Wadi Jazan.

INTRODUCTION

The challenges for the countries that hit by heavy rain or flash floods are an infrastructure and human. The heavy rain and flash flood are affecting large parts of agricultural land, small towns and communities. Government started by building dams in the region e.g. Jazan dam. It is built on 1970 and represents one of the major dams in the area. It located in wadi Jazan about 16 km northeast of Abu Arish in Jazan region of southwest Saudi Arabia. Jazan dam has several purposes to include irrigation and flash flood control Fig. (1). normally, the main channel of wadi remains in dry most of the time. However sometimes, especially during and after heavy rain, wadis became a place for runoff, flood or flash floods, which transport huge amounts of sediment across the area. The water flow generated in wadis varies from year to year (Shi, 2014). Protect human, public and private property are considered important step during flash flood disasters. Jazan region is represented an

important area in Saudi Arabia that may influence by flash flood (Khan, 2013). The area is characterized by many wadis e.g. Jazan, Baish and Damad. Wadi Jazan is characterized by high humidity due to proximity to the sea. Jazan area has two rains seasons one on summer during the August and September and winter season in December and January. The rate of rain on the coastal line 200 mm per year, and this rate are increasing toward the east and mountain to reach 600 mm per year. The Government of Saudi Arabia recognizes the need to develop measures for mitigating the social and economic impact of such floods and designing an emergency preparedness program to protect the inhabitants of flood prone areas. Flash flood disaster is a significant topic in Saudi Arabia and need more adaptation, mitigation and improvement in hazard evaluation. Information on the assessment of flash flood damages and risks is particularly scarce in Jazan. The research intends to investigate the status of flash flood damages and risks around wadi Jazan. The scope of the present study is to survey the current situation of effect flash floods as disasters that often repeated in Jazan region. Hence the importance of the study appears in the highlight being to contribute the assessment the risk of flash flood and its impact on the population and urbanization. The study will enable governmental officer to interact more effectively with the households and communities. It will help the local government to understand the need and requirements of the people in the future.

MATERIAL AND METHODS

Wadi Jazan is located in the southwestern part of the Kingdom of Saudi Arabia within the administrative borders of the region of Jazan, it located on 17.051533 N, 42.969761 E. Wadi Jizan basin stretches from the mountains of Fifa, Al Aredah and Al Ebadl where tributaries converge from the south, east and north towards the west to the Red Sea where the downstream of the Wadi. `Survey of the household's opinion was used questionnaires. The study was conducted including vulnerable villages of wadiJazan. Six villages (Hakemah Abu Arish, Al Mejasas, Al Beed, Al Khadrah, Rah Al Jouthour and Al Okdah) were chosen to distribute questionnaires Fig (1).

Abu Arish governorate represents high population density area in the region 197,112 inhabitant (Census Results, 2010). A total 250 questionnaires were distributed in six villages Table (1).

Table 1. Population's villages in Abu Arish (Census Results, 2010).

Name of the village	Population
Hakemah Abu Arish	21456
Al Mejasas	5679
Al Beed	4534
Al Khadrah	8547
Rah Al Jouthour	11578
Al Okdah	14866
SUM	**66660**

The sample size was determined using Slovin's formula (Sekaran, 2003; Tabachnick, & Fidell, 2007). Different ages randomly were interviewed in autumn 2015.

The main instrument developed for analysis is a structured household questionnaire designed in English and translated into Arabic.The questionnaire has 2 pages and 19 questions as summarized in Table (2).

Table 2.Structure of questionnaire.

Section	Title	Nr. Of questions
1	Personal information	4
2	Direct damage	4
3	Exploit the flash floods	3
4	Flash floods affected	4
5	Causes of flash flood	4

The household questionnaires were processed with MS Excel. The excel file was in Arabic labels to allow facilitating typing. Next step was concerned with filtering Excel data and its conversion to English language. Finally, the data analysis was achieved through the necessary processing (Alhababy, 2014).

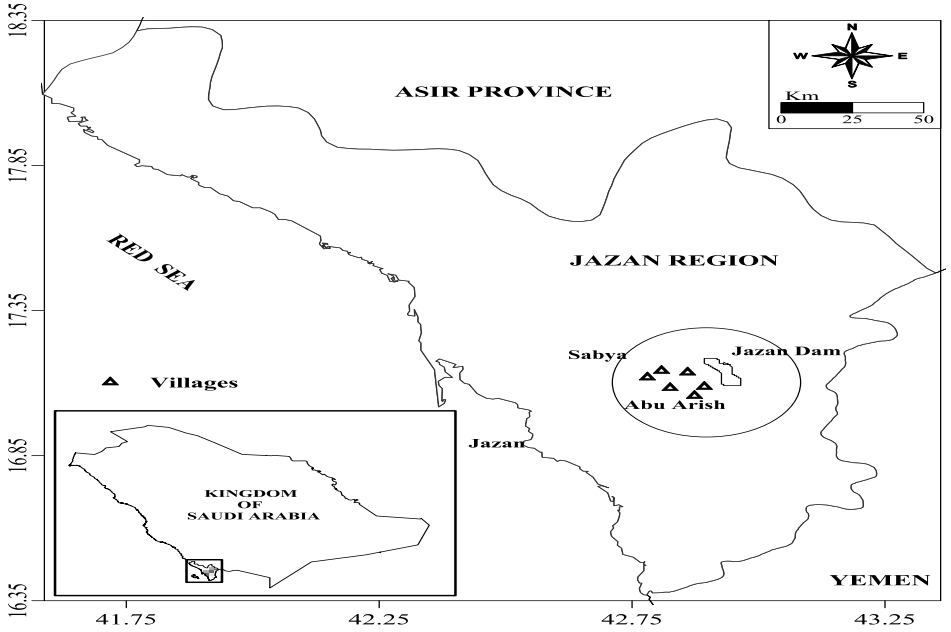

Figure 1.Location of the Jazan region and villages near wadi Jazan (full circle).

RESULTS AND DISCUSSION

The results revealed that more than half of the populations are between 20 and 45 years old and more than 40% has secondary and basic while university degree representing 23.4%.

The results in Table 3 show that 76.5% have direct damage by flash flood on their property and 23.5% affect to human.

Table 3.Type of damage by flash flood.

Type of damage by flash flood	%
Human	23.5
Property	76.5

Table 4 shows that most of the types of damage to property were in farms and infrastructure 37.5% in each of them while it was 25% in homes.

Table 4. Types of damage of property.

Types of damage of property	%
Houses	25
Farms	37.5
Infrastructures	37.5

Table 5 indicates that location of farms were close to the wadi channel or inside it. One third of farms were located far away from the channel 33.3% while two third were inside or on the bank and close to the channel of wadi 16.7%, 16.7% and 33.3% respectively. Most of people prefer to live near to wadi due to easy to access for drinking water or to irrigate their farms. However, flash flood flow is concentrated in the main channel (Wheater, 2002).

Table 5. Location of farms.

Location of farms	%
Inside the wadi	16.7
On the bank	16.7
just 200 m	33.3
Far away	33.3

The households thought the best way to exploit the flash floods is irrigation by establishing the clay bulkheads 50% while 42.8% said the concrete bulkheads Table 6.

Table 6. The best way to exploit the flash floods.

The best way to exploit the flash floods	%
Establishing the Concrete bulkheads	42.8
Establishing the clay bulkheads	50.0
Other	7.2

In terms of percentage causes of flash flood risk, sudden heavy rain is the greatest percent 27.8. The main cause of flash flood in valleys is heavy rain over a short period of time (Chapter 8. Floodplain Definition and Flood Hazard Assessment, 1991).Lack of drainage channels ranks second while no warning devices are the third causes Table 7.

Establishing the clay bulkheads and lack of bridges along the valley are almost close percentage 11.97 and 11.2, respectively.

Table 7. Percentage causes of flash flood risks.

Causes of flash flood risk	%
Lack of bridges along the valley	11.20
Establishing the clay bulkheads	11.97
No warning devices	13.13
Lack of drainage channels	23.94
Sudden heavy rain	27.80

In upstream of wadi Jazan many villages are affecting flash flood for example Hakemah Abu Arish and Al Mejassas.

CONCLUSIONS

A main cause of flash flood is sudden heavy rains and may lead to high damage and risk for property and human. Set up modern irrigation channels and drainage water from the basin or the dam to the farms at wadi Jazan. Warning devices and climate stations should be installed along the wadi Jazan. Need for urban expansion towards safe residential places and modern schemes. Remove random landfill operations carried out by some farmers, whether by throwing waste or establishing new bulkheads and tracks, because that would cause a change in the normal direction of the course of the valley. Stakeholder involvement in management of wadi Jazan is crucial for the successful management and reducing the damages and risks from flash flood in wadi Jazan. Awareness campaigns for households along the wadi Jazan e.g. building around channel, irrigation and establishing bulkheads is important to reduce losses of property and human. Stakeholder opinions and community participation should consider at decision makers to share the influence of flash flood in wadi Jazan. Exchange information on wadi Jazan between different sectors.

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