

Impact analysis for flooding AREA, In SAUDI ARABIA

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Abstract: In all words the natural hazard can affect the life and the assets and make real bad impact that will put the affected area and human in bad situation .The aim of this study was to explore the analyze the impact of the floods in different cities in Saudi Arabia.

Western Saudi Arabia is one of the arid areas which occasionally subjected to flash flooding effects due to excessive rainfall. The most important and holiest areas in this region are Makkah and El-Madeinah which are of great importance not only to Saudi people, but also for whole Muslims all over the world are also affected by such flooding disasters.

This piece also will present the cases of Jeddah 2009 floods and Riyadh 2010 floods and other events as the most recent disasters in the region. These events were chosen since they are very recent, and have awakened policy makers to shift their emergency preparedness efforts to a more active approach.

The results of this research present and idea about the looses in life and assets in case of the flood happen and give the people the full awareness to try avoiding the danger of the foods which consider one of the very dangerous natural hazard . Data were collected for this qualitative study between 1964 and 2015.

We will support the research with pictures of floods in KSA to deliver clear image to the readers.

I. Introduction

The Kingdom of Saudi Arabia (KSA) has recently hit world news and has become well known for man-made disasters, such as terrorist attacks, and the high rate of motor vehicle accidents. However, natural disasters, such as floods have had much less attention, even though it leads to much more damage than the rest of other disasters or accidents combined.

1.1floods in Saudi Arabia .



Figure .1 indicate the location of Saudi Arabia

1985 flood: on 24 December 1985, heavy rains poured on north-western regions of Saudi Arabia, leading to what has been described as the worst flood in the area in 50 years. Estimates of damage were not recorded, except that there were at least 32 people killed from the flood.

Yanbu flood: heavy rains poured on western Saudi Arabia in January 1997, mainly affecting Yanbu and peripheries of Jeddah. The rain lasted for 24 hours, killing 10 people and causing damage to an area of over 130,000 km² of land.

Asir flood: Asir is a province in the Southwest of Saudi Arabia. On Monday 25 March 1997, heavy rains poured on the region, leading to floods that resulted in 16 fatalities and damaged an area of just below 100,000 km² of land.

Makkah 2002 flood:

heavy rains started falling on Makkah area on 8 April 2002 and lasted for a whole week. This led to flooding of water in some areas, claiming the lives of 19 people; hundreds of Makkah residents were rescued that week.

Makkah 2003 flood: not quite recovered from previous year's rain, Makkah experienced yet another heavy shower described as the worst rains in Makkah in 25 years. Water levels were reported to have reached 6 meters. Twelve people were killed; however, estimates of physical damage are not available.

Jizan 2004 floods: less than four months apart, two floods hit the Jizan region, leading to what has been described as Jizan's worst floods in 45 years. The floods left over 400 people homeless, killed 13 people and devastated many roads and farms.

Medina 2005 flood: very heavy showers fell on Medina region in January 2005. This resulted in a flood that caused the Yatamah dam to fail, killing 29 people. Seventeen people were injured, 50 were left homeless and 43 had to be evacuated.

Riyadh 2005 flood: heavy rains poured on the Riyadh region of Saudi Arabia, as well as on other areas in neighboring countries (i.e. Oman and the United Arab Emirates). The resultant flood claimed the lives of seven people; 700 people had to be evacuated by helicopters and another 700 were left homeless.

Jeddah 2009 flood



at around 6:30 a.m. on Wednesday 25 November 2009, rain started falling heavily in Jeddah, and continued for around 12 hours. The amount of water in this relatively brief downpour (around 90 mm³) doubled the average annual rainfall in Jeddah.

With a sound infrastructure and a proper drainage system lacking, this rain turned into the worst disaster that Jeddah has experienced in 27 years or so. The downpour resulted in the formation of water tides coming from the hills on the east of the city, heading west towards the Red Sea and cutting their way through the city.



Major roads of the city were blocked by meters-high of water waves or by cars that have been washed out. Power and telecommunication services were not spared either. As early as 11 a.m., floods had already resulted in a temporary power outage on the whole western region of Saudi Arabia (i.e. Makkah, Medina and Jeddah). Many people were not even able to call for help as communication with emergency services (e.g. civil defense forces, police or emergency medical services) failed due to the overwhelmed network and power outage. Overall, 161 people lost their lives as a result of the floods, either drowning or from car crashes. This disaster had an estimated cost of around US\$900 million to reconstruct Jeddah and help its victims.

Riyadh 2010 flood: on 3 May 2010, Riyadh city experienced a brief 45-minute water shower, accompanied by light hail and winds gusting up to 24 km/hour. As brief as the downpour was, however, it resulted in floods and car crashes across the city.

The state-run Saudi Press Agency reported earlier today that seasonal storms brought heavy rainfall in central and eastern areas of the country, causing severe flooding in Riyadh and Al-Qassim Regions.

Saudi Arabia civil defense report that 1 person has died in the floods in the province of Rimah, Riyadh Region, which is located about 120 kilometres north-east of the capital Riyadh.

Schools have been closed, roads blocked and in some cases flooding has forced drivers to abandon their vehicles. Saudi Arabia civil defence say they have responded to dozens of emergency calls. The city of Buraidah, Al-Qassim Region, is reported as one of the worst hit.



Hail 12 March, 2014

Two days of heavy rain brought flash flooding to parts of Hail (Ha'yel) Province in north west Saudi Arabia.

Three children are reported to have died after drowning in flood water in the small village of Baida Natheel, Hail Province.

The rain and flooding has been so severe, the Civil Defense and emergency services received nearly 1000 calls. Schools have been closed in the area as a result of flooding.

Riyadh also saw some moderate to heavy rainfall over the last two days, with some flood incidents on several roads reported, causing problems for the city's drivers.



22 November, 2013

According to the Saudi Press Agency, the Saudi Civil Defense department have announced that flooding in the country that first struck over the weekend, have now killed as many as 11 people. Four other people are missing. The deaths occurred in Riyadh, Araar, Al-Gunfuza and Al-Baha. The Civil Defense department has been kept extra busy over the last week, rescuing 448 people caught up in the floods. 309 vehicles were also retrieved by the department.

One of the dead is believed to be a man who fell into a dam in Al-Baha while he was attempting to take photographs of the raging flood waters.

II. Impact analysis

Change impact analysis (IA) is defined by Bohner and Arnold^[1] as "identifying the potential consequences of a change, or estimating what needs to be modified to accomplish a change", and they focus on IA in terms of scoping changes within the details of a design. In contrast, Pfleeger and Atlee^[2] focus on the risks associated with changes and state that IA is: "the evaluation of the many risks associated with the change, including estimates of the effects on resources, effort, and schedule". Both the design details and risks associated with modifications are critical to performing IA within change management processes. A technical colloquial term is also mentioned sometimes in this context, dependency hell.

Bohner and Arnold^[4] identify two classes of IA, traceability and dependency IA. In traceability IA, links between requirements, specifications, design elements, and tests are captured, and these relationships can be analysed to determine the scope of an initiating change.^[5] In dependency IA, linkages between parts, variables, logic, modules etc. are assessed to determine the consequences of an initiating change. Dependency IA occurs at a more detailed level than traceability IA. Within software design, static and dynamic algorithms can be run on code to perform dependency IA.^{[6][7]} Static methods focus on the program structure, while dynamic algorithms gather information about program behaviour at run-time.

Literature and engineering practice also suggest a third type of IA, experiential IA, in that the impact of changes is often determined using expert design knowledge. Review meeting protocols,^[8] informal team discussions, and individual engineering judgement^[9] can all be used to determine the consequences of a modification.

At the below table , we indicate some affected area in Saudi Arabia by floods and the kind of the hazard , total death and number of injured people , the losses after the disaster .

Floods are the most common natural disaster and the leading cause of natural disaster fatalities worldwide. Risk of catastrophic losses due to flooding is significant given deforestation and the increasing proximity of large populations to coastal areas, river basins and lakeshores. The objectives of this review were to describe the impact of flood events on human populations in terms of mortality, injury, and disarticulation and, to the extent possible, identify risk factors associated with these outcomes.

On the below table .1 and table .2 the team try to compare between the flood disaster in some area in the world and Saudi Arabia .

Impact analysis for flooding AREA, In SAUDI ARABIA

year	Country Name	Disaster type	Occurrence	Total death	Affected	Injured	Homeless	Total affected	Total damage (\$)
1964	India	Flood	4	232	770610	---	---	770610	500
1964	Japan	Flood	1	136	---	---	---	---	---
1982	Bangladesh	Flood	1	---	283000	---	25000	308000	---
1982	China	Flood	4	447	601500	4643	210000	816143	---
1985	Nepal	Flood	1	46	60500	57	2000	62557	---
1985	Philippines	Flood	2	79	5444	---	---	5444	---
2000	Cambodia	Flood	1	347	3448000	53	---	3448053	160000
2000	China	Flood	9	422	709000	407	53500	762907	315366
2001	Kazakhstan	Flood	1	---	3668	---	---	3668	---
2001	Korea	Flood	2	124	157500	84	30000	187584	9400
2002	Sri Lanka	Flood	1	2	500000	---	---	500000	---
2002	Tajikistan	Flood	4	32	1248	13	2990	4251	2836
2003	Indonesia	Flood	8	414	438398	30	---	438428	---
2003	Iran	Flood	1	---	---	---	1370	1370	838
2004	Bhutan	Flood	1	---	---	---	---	---	---
2004	Cambodia	Flood	1	---	---	---	---	---	---
2005	Uzbekistan	Flood	1	---	1500	---	---	1500	---
2005	Viet Nam	Flood	5	192	74185	3	18205	92393	54000
2009	Iraq	Flood	1	2	3000	---	---	3000	---
2009	Lao	Flood	1	10	---	---	---	---	---
2010	Korea	Flood	2	---	55785	---	---	55785	---
2010	Nepal	Flood	2	150	8000	---	---	8000	---
2011	Afghanistan	Flood	2	62	3000	110	9700	12810	---
2011	Bangladesh	Flood	1	10	1570559	---	---	1570559	---
2012	Myanmar	Flood	1	2	85000	---	---	85000	---
2012	Nepal	Flood	1	72	---	5	---	5	1000
2013	Georgia	Flood	2	---	25000	---	---	25000	---
2013	India	Flood	5	6453	3415000	4473	---	3419473	1360000
2014	Sri Lanka	Flood	3	95	1204000	29	---	1204029	---
2014	Tajikistan	Flood	2	20	12760	38	425	13223	---
2015	Malaysia	Flood	1	1	6805	---	---	6805	---
2015	Myanmar	Flood	2	110	1114000	---	---	1114000	109000

Table 1 : indicate floods and impact in some area in the world .
Source : EM DAT Web Site

Table 2 summarizes the main natural disasters that occurred in KSA in the last century. It is obvious that floods have been the most frequently encountered natural disaster in the country.

Year	Disaster Type	occurrence	Total deaths	Affected	Injured	Homeless	Total affected	Total damage(\$)
1964	Flood	1	20	1000	---	---	1000	---
1985	Flood	1	32	---	---	5000	5000	450000
2002	Flood	1	19	---	---	---	---	---
2003	Flood	2	12	13000	50	---	13050	---
2004	Flood	1	5	400	30	---	430	---
2005	Flood	2	63	50	17	---	67	---
2009	Flood	1	161	---	---	10000	10000	900000
2010	Flood	2	24	85	---	---	85	---
2011	Flood	1	11	---	---	---	---	300000
2012	Flood	1	19	---	---	---	---	---
2013	Flood	2	39	1021	---	---	1021	---
2015	Flood	2	23	---	---	---	---	---

Table 2 : the floods and the impact in Saudi Arabia
Source : EM DAT web Site

III. Result and discussion

- Number of the floods are increased because of the climate changes.

- Based on the average for the number of death in one year ,we figure out that number of death after 2009 less than number of death average in one year before 2009 flood . this is as result of care of the government to find solution and put programs and centers to manage crisis and disaster .
- The highest year that affected people was in 2003 . the flood of 2009 was more social impact because its result of one flood for that year but on other hand there were 2 floods in 2003and no homeless at all while in 2009 there was 10000 homeless .because of that, 2009 was the point of change for a lot of decision in the government .
- shortage of the residential area lead the people to use the Wadis which increase the rate of hazard and affected person .
- increasing of population growth rate in makkah region more than general rate in Saudi Arabia. Also , the attractive of makkah region for immigration may be affected to increase the number of affected people in 2009 . The amount and the way of the inertial immigration between Saudi region. This study mention The population growth ratein Makkah area more than general The population growth ratein Saudi Arabia .And also the research indicate that Makkah more attractive area for immigration .
- there is no any recorded of flood during hajj season in makkah city but ,base on the given reading in the table .2 we can see increasing number of the floods and short period of time among theme will increase the chance of floods to be happened during hajj season and lead to colossal disaster and crisis .

IV. Analysis figures

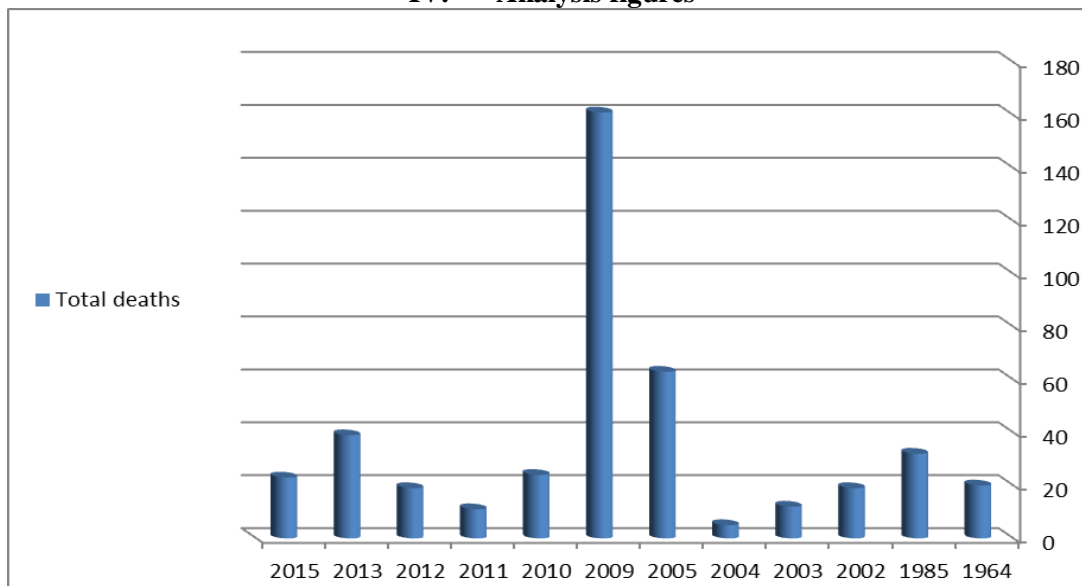


Figure .1 indicate total death of flood in Saudi Arabia .

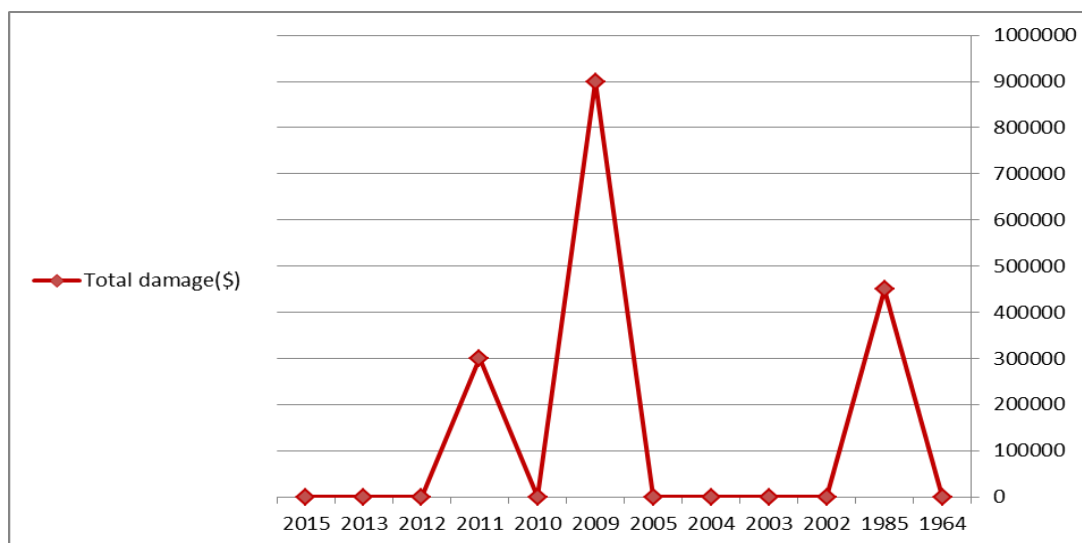


Figure .2 indicate total Damage of flood in Saudi Arabia .

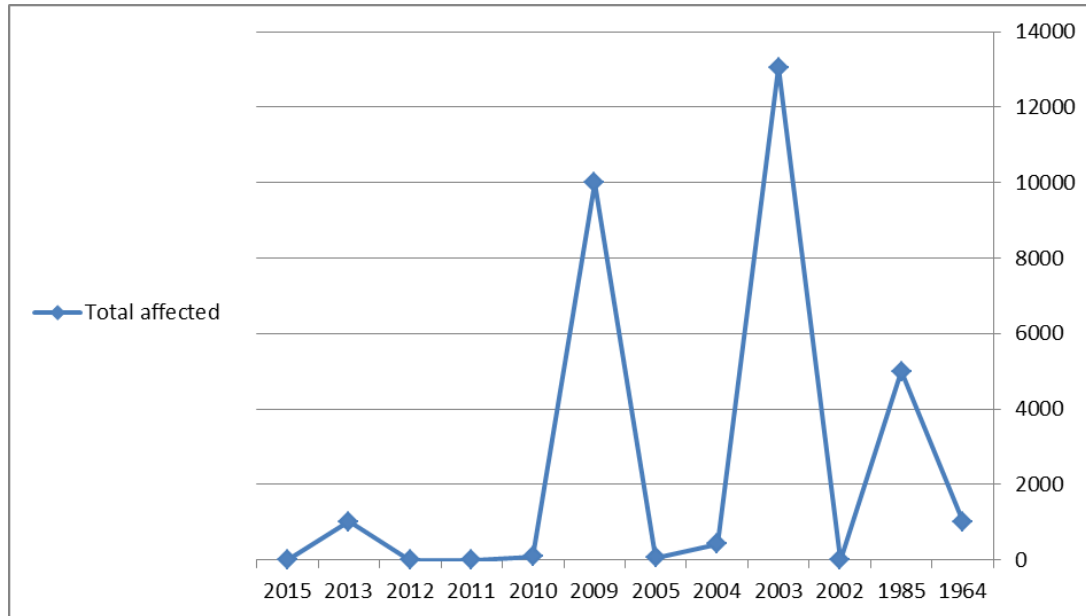


Figure .3 indicate total affect of flood in Saudi Arabia .

V. Conclusion

Arid and semi arid regions are typically prone to flash floods in cases of occasional rainfall events mainly due to the lack of undergrowth and poor infiltration capacity of the surface soils which results in the generation of enormous volumes of surface run off. Manmade structures such as dams are also responsible for causing flash floods in downstream areas when the dam gates are opened to maintain the reservoir entry limit or in instances when there are dam failures.

In recent years flash floods have become an issue of concern in the major urban centers around the world. The reasons are mostly the increasing population pressure which requires more infrastructural development. This has often resulted in the construction of manmade structures in topographically low lying regions which in turn has obstructed the natural rainwater drainage. At the same time the increase in the constructed area has limited the natural land available for access thus resulting in the generation of more surface runoff which at times exceeds the normal water behavior capacity of the urban sewer systems thereby causing floods.

References

- [1.] Bohner and Arnold, 1996, pg.3
- [2.] Pflieger and Atlee, 2006, pg.526
- [3.] Kilpinen, 2008
- [4.] Bohner and Arnold, 1996
- [5.] Eisner, 2002, pg.236-237
- [6.] Rajlich, 2000
- [7.] Ren et al., 2005
- [8.] Endres and Rombach, 2003, pg.17
- [9.] Ambler, 2002, pg.24