Rapid urbanization in coastal areas and its risks Case study: coastal areas, Babolsar Iran

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Abstract

Today, rapid growth of urbanization and non-systematic utilization of natural resources has created a lot of risks. So it seems that in the near future not only socioeconomic conditions in these regions are faced with a crisis, but also cause irreversible losses of lives. Studies show that some of the northern cities of Iran are in this situation, and among them some cities are in a worse condition and one clear example of it, is Babolsar. This study intends to investigate the status of the city using descriptive and analytical method. The required data for the study are gathered from available documents; SPSS field observations and satellite images, and then analyzed and mapped using SPSS and GIS, respectively. The results show that the risks of coastal areas of the Caspian Sea in Babolsarare rapid fluctuations in the Caspian Sea, hydrodynamic force of waves, return flows, the remaining wells of tide and continuous construction in the vicinity of the sea; these are all factors that threaten the city's economic and human life. For this reason, it is recommended that administrators and policy makers take alternative thinking, before the present dangerous conditions to become a human and environmental crisis.

Key words: urbanization, coastal areas, risk, Babolsar, Iran

1. Introduction

Discussions about social and environmental risks associated with extensive production and population pressures existed since the appearance of man on Earth. Displacement of people from one place to another for agriculture and finding new suitable areas has been the first reaction to reducing ecological power of the environment. However, there wasn't any existing principled approach to deal with this issue until less than hundred years ago. Since then, the study about social and environmental risks arising from urbanization and commercial activities began in the Western countries, especially in the academic community. The campaign reached its peak about 60 years ago, when in the 60s and 70s of the twentieth century activity centers and settlements spread to the suburbs, as a result of economic boom. The effects of such an anomalous development threaded many people's lives and property. So, many ideas including Garden City Howard, Le Corbusier and etc. are examples of these reactions which later replaced and filled with the ideas of sustainable development, healthy cities and so on. Recently with the emergence of rapid development effects all over the world have been faced with the issues of uncontrolled expansion of urban and industrial pollution and mining activities. So today, risks of population growth and the greedy use of available natural resources are beyond the usual daily alarms and cause to the struggle between policymakers and profiteering and speculation. The pages of the newspapers and the news media headlines are allocated to considerable economic and environmental consequences, converting pasture forest and agricultural land to the urban areas, coastal villas and bungalows. So that the ordinary people of the streets and the market has shown sensitivity to the warnings and call outs for these problems. Particularly, these conditions are much higher in certain regions which are interested from people and domestic tourists. These areas not only provide their residents with economic production facilities, but also due to their natural beauty and attractions are visited by people from other regions; so any kind of threat to the regions affects other people from other parts of the country. Specific examples of these areas are the cities of northern Iran among which, some cities have especial condition because in addition to the natural attractions of the beach, these cities have other areas to attract residents. Babolsar is one of these cities that the role of its university in recent years has been more important. And thus the attraction of a large student population, more population and economic activities caused environmental problems. Therefore, these issues will be discussed in this study with regard to the opportunities and various bottlenecks.

2. Materials and methods

The analytical method is used to determine the biological and environmental hazards of Babolsar. The city is in central Mazandaran and its geographical coordinates are 36° and 43° minutes north latitude and 52 degrees 39 minutes east (Map 1). The area of Babolsar is less than 15 km^2 and its population is 50,477 people. A population density of about 3,000 persons per square kilometer is estimated (Statistical Center of Iran, 2012). Population of the city has increased unbelievingly, due to the adoption of new roles such as university (Shamaei and Mahmoodi, 2012) and industrial role. To investigate natural and environmental hazards of the city, First data collected from the departments and agencies responsible for coastal protection and agricultural land, and then current conditions, particularly the effects of increase and decrease, recorded and analyzed. Two series of Landsat MSS and TM satellites' images (1988 and 2006) are gathered and changes are determined, which are used to comparing different

historical periods. In some cases, the other images of newer and older periods are also used according to current state, and they are combined using ENVY software. Waterlogging of coastal areas and the calculation of the slope are also investigated based on existing maps. In addition, exploratory interviews have done with experts and authorities in the various organs in order to overcome the lack of statistics and information. Eventually after summarizing, correction and enter the machine, collected data and information using descriptive and inferential statistical software SPSS and spatial models of GIS software analyzed and mapped.



Map No. 1 position on the shores of the Caspian Sea, Babolsar

3. Theoretical bases and literature

Because of the hegemonic thinking of human and his endless efforts to overcome nature, investigating of natural hazards is one of his main concerns and these risks are some kinds of natural retaliations in human's point of view, so that many efforts have been made to eliminate or minimize them. Nature, unlike human who apply poor capabilities with lots of noise and tumult, slowly over the course of its normal process and destroys advanced human achievements. Therefore, the struggle continues and now that man is always busy with innovations and modern technology, there is less attention to natural forces. For this reason, outcomes and disasters which are incorrectly considered as natural are much higher. As a result, human attempts to deal with these events are also increased and several studies have been conducted in this regard (BahramSoltani, 1980). Because of the constant frequency, risks of coastal areasmuch earlier than others were studied. In this context, the issues of ebb and flow of sea more than others flashed (Canter, 1996). Rapid urbanization and environmental threats have been proposed in the

literature, too (Mohammed, 2003, USSR Academy of Sciences, 1994, etc.). Several studies in the case of this study area have been conducted that some of them are introduced in this section. Dadgar (2007) in a research on environmental contaminants and sustainable development problem of Babolsar argues that due to the lack of attention to environmental measures and methods of waste disposal, the city has become a graveyard of wastes and pathogenic microbes. Kordovani et al. (2014) in an article titled geomorphological hazards caused by the fluctuation of the Caspian Sea, Case Study BABOLSAR to Chalus, concluded that the slope of the coastal area BABOLSAR is 12%, and potential risk of waterlogging in the area is more than Sysangan area. Ghanavati and others (2013), have shown in a detailed study that during decades after the revolution Babolsar growth has been scattered, so that quality of life in the new formed neighborhoods is much lower than in previous ones. Other research in this regard include Vaso et al. (2015), Ghadami and others (2014), Goudarzi (2014), Karimi et al. (2015), and so on. As the brief references in this section suggests most studies to date have examined one or two of risksand important aspects such as the hydrodynamic force of the waves, return flows, the remaining wells of sea water intrusion, continuous construction in the vicinity of the sea, etc. have received little attention. This study intends to consider these cases.

4. Discussion and analysis

3.75 m fluctuation of water level of the Caspian Sea (-24.50, the highest level and -28.25 the lowest level) in 95 years (1977-1982 AD) has coursed serious problems for different applications and human societies of confines of the Caspian Sea. Hence the necessity of considering these changes is essential. In fact, revealing fluctuations in the level of the sea and the scope of sea vicinity enable future planning of coastal towns and can considerably reduce possible problems. The importance of planning and forecasting is due to that, if the proper distance to the sea not to be observed, beaches, villas, coastal towns and farmland will be underwater with the flow of sea water. Meanwhile, the city area has risen sharply in recent years. For example, analyzing satellite images of 1988 and 2006 indicated that in 1988 Babolsar was only 8 km², and in 2006 Its area increased by 50%, more than 12 km². A considerable part of it is on the boundary of the sea (Figure 2). Something very important is that a considerable part of the development is placed in the vicinity of the sea (Figure 3). Field survey and comparison of satellite images indicates that new construction has been mainly in the seafloor and its boundary. In fact, almost all constructions and instruments that have been done since 1980 are located in the northern area. The probability of risk of Waterlogging in normal Fluctuations condition that fluctuations are less than 1.5 m is 30%, and in higher volatility of 1.5 m, the risk is 75% and also risk of destruction is 20% probable.



Figure 2. Expansion of Babolsar, 1998 – 2009



Figure 3. A significant part of the recent developments locate in the vicinity of the sea.

Non-essential and non-program construction seems dangerous when we know fluctuations in water level of the Caspian Sea is a severe and unusual. As noted, the level of Caspian sea have fluctuated nearly four meters during the last 176 years. A prominent example of the extreme fluctuations is raising water levels between 1995 and 1997 which is about 2.38 meters. According to these surveys, over 18 years, the average rate of increase in the water level of the Caspian Sea has risen 132 mm (Diagrams 1 and 2). The importance of these changes is evident when considering that Caspian Sea level changes during a year is equivalent to ocean water level rise during a century (Kronenberg. 2000). The more important point is that changes in the level leads to drastic changes in the volume of sea water. For example, every 1 cm displacement of the water level of the Caspian Sea causes about 4 km³ volume changes. This amount makes changes lives of nearly 30 percent of people employed in fishing, boating, tourism-related services and so on.



Diagram no.1 fluctuations in water level of the Caspian Sea during 1837 to 2013.



Diagram2.Water level of the Caspian Sea, level measurement station (1391 & 1392. Noshahr)

One of the most important factors in dangerous conditions of construction inBabolsaris that the slope of this region is very low (about 12%). For this reason, even the smallest rise in sea level may cause considerable flooded parts of the city. For example, during the years 1995 to 1997, approximately 302 km² (Qanqormeh, 1378) of the area of Mazandaran province flooded. Babbolsarhas the highest rate of Waterlogging among cities in West and Central Mazandaran province. Babolsar Field investigations show that the sudden rise of sea level has caused more than 57 residential houses, 30 shops and hundreds of factories, warehouses, etc. be destroyed 10 – 100%. Therefore, according to the approvals of the Supreme Council Any permanent construction in the vicinity of less than 24m (Fig. 4) is prohibited.



Figure 4. The range of -24m and the position of Babolsar

Despite approvals and guidelines issued by the institutions and agencies, illegal construction continued and year after year, the amount is added. The field investigations show that in a 10-year period of 1381-1391 the number of cases about violations in construction have been 7-fold (the Court of Mazandaran province, 1393). Not only the public, but also law enforcement institutions that are in turn responsible for monitoring the field have ignored the low. For example, Seaside Park of Babolsar is constructed in the vicinity of the sea (Fig. 5). So that, during stormy sea levels especially when the wind speed is 4 m/s, the area is threatened and if the wind speed be increased up to 21m/s, the total area will be affected (Fig. 6) and there will be an uncontrollable crisis (Babolsar Station, 1393).



Figure 4. BABOLSAR stormy weather and the Caspian Sea water flow



Figure 5. Babolsar Seaside Park location on the seafloor



Diagram 3. The correlation coefficient between wind speed and the Caspian Sea water level, BABOLSAR station

Construction of urban infrastructure and villas in the vicinity of the sea and seafloor along with removal of sand from the forbidden areas (Fig. 6) has led to intensification of natural hazards. As a result, even in relatively normal conditions, the risks are higher than thought. This condition causes the Babolsar coastal attractions and opportunities to become a threat. Therefore, a survey (Saberifar, 2012) shows that Babolsar has lost much of its tourists and more dangerous exploitation of the sea vicinity and seafloor in order to compensate for the loses causes even more critical situation. Due to the construction and new uses are usually constructed in at risk areas, the amount of damages will be increased (Fig. 7 to 9) and the round is continues.



Figure 6. Removal of sand and dunes and construction in the vicinity of the sea



Figure 7. Some of the damage caused by sea water flow



Figure 8. Babolsar beach in the old days, before construction in the vicinity of the seafloor



Figure 9. Caspian Sea water intrusion and damage to buildings in Babolsar

Removing sand from the seabed in Babolsar, in addition to further penetrate into the seabed and the vicinity of the sea, has caused many of the old places to be considered as the sea bed. The examples can be cited to the wells in the seabed _ specifically, in the parking number 8, Babolsar (Fig. 10).



Figure 10. The remaining wells in the sea caused by fluctuating water level, parking eighth and ninth

Some people have occupied so much of sea vicinity and seafloor, so that almost there is no available area for the public. That's why people who do not want to pay the expensive cost of private villas swim in places that for various reasons are very dangerous and cause death. For example, in recent years, more than 100 cases of drowning have been recorded (Figure 11) caused by "splitting flows" (Kordovani et al, 2015: 124). Such cases have created problems associated with tourism. Although ignoring the boundaries of the sea and seabed apparently only created environmental problems, the process is followed by series of economic, social and cultural problems. Typically, any of the problems related to water intrusion _ in particular, examples of which can lead to major economic losses _ is followed by a series of individual and group protests. Specifically, we can refer to the 2 organized protests about damages from sea water flow, which is recorded in historical memory of the people of the city. Political protests to the performance of political forces, security and police do not refer only to the economic and

financial losses. These protests are also done against drowning of tourists and local residents. Especially, in cases where the number of drowning in one day is more than one or a person or persons drowned corpse not to be found, the protest reaches its climax and leads to range of movements challenging security and political structure of the region. Sometimes the Caspian Sea is stormy due to unfavorable weather conditions and there are turbulent waves. In stormy weather, because of underwater flows approaching to the beach, many tourists who swim in coastal waters are at risk. Every summer, in some northern cities _ Gilan, Mazandaran and Golestan _ Hundreds lose their lives (Figure 12) due to the lack of awareness of the dangers of the sea and the lack of attention to this issue. The number of fatalities that occur on the northern coast of Iran has not been observed in any of the beaches in the world. Of course, the other factors such as Caspian Sea water intrusion and other sunken parts underwater are important in turn. The media and governmental and scientific institutions should further investigate the disaster, and inform the public of the danger of the Caspian Sea (Khaledi,2004).



Figure 11. A splitting flow



Figure 13. How to exit of the splitting flow

5. Conclusions

Babolsar is a touristy and academic city which has grown rapidly over the last few years. It is important that the construction in the coastal area has done without control and regardless of the distance of the sea waves, stormy levels and Fluctuations in sea level. The Caspian Sea levels have fluctuated during different periods; from 1995 to 1997 the water level has risen by about 2.37 meters so that approximately 302 square kilometers of littoral land of Mazandaran is submerged. Seawater intrusion in beaches has led to Geomorphological hazards and these cause erosion and destruction of the foundations of buildings. The evidence of the destruction can be seen in parking7-9,Babolsar. Another danger that threatens tourists is the risk of return or splitter flow which should be informed. Therefore it is essential that any permanent construction in areas with height less than - 24 to be prevented.

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