An analysis of the effects of human settlements on increasing and strengthening the natural disasters: a case study of Iran

ABSTRACT:
In recent decades, a considerable tendency towards increasing casualties and monetary losses due to natural disasters can be seen all over the world. One of the important and influencing factors for this increment is growing urbanization and most importantly the settlements that are particularly prone to natural disasters. Natural disasters and hazards are the important factors in environmental planning. These disasters would may be intensified by the incorrect human functions and operations in some situations. So, the objective of this research is to study the role and effect of human settlements on occurrence or intensification of natural disasters. In this regard, the effect of human settlements on increasing or strengthening of some natural disasters such as flood, land slide, subsidence, and earthquake were studied. Results showed that, however, man has not the significant role or effect in occurrence of natural events, but has an important role in turning natural phenomenon to natural disasters due to human activities. Indeed, the human activities can increase the frequency and intensity of natural disasters. For example, depletion of green spaces and vegetation cover led to intensification of erosion process or inappropriate changes in land use led to expedition and intensification of land slide. Most disasters such as flood and land slide are related to demolition of environment and depletion of ecological resources. On the other hand, the protective role of natural eco-system has been decreased due to human activities which is led to intensification of disasters.

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INTRODUCTION

In recent decades, a considerable tendency towards increasing casualties and monetary losses due to natural disasters can be seen all over the world. One of the important and affective factors for this increment is growing urbanization and most importantly the settlements that are exclusively exposure to natural and man-made disasters due to the high population and building density and unplanned development (Kraas, 2008). 85 percent of people exposed to earthquakes, cyclones, floods and droughts live in developing countries. The massive cost of disasters poses a significant threat to achieve the development goals. Direct disaster damage costs alone have shot up from US$ 75.5 billion in the 1960s to nearly a trillion dollars in the past ten years (Rodriguez et al., 2009). Even these statistics cannot show the long-range cost to the people and settlements that suffer and endure the impact of disasters, paying with their lives, their livelihoods and their future development perspectives (Ghosh, 2015).

Despite the considerable technological improvements and achievements in this field, extensive damage with inevitable monetary losses has been experienced globally on occasion in the past (Twigg, 2002; Omidvar et al., 2013). In addition, disregard for the potential dangers of an area, poor construction, non-observance of sensitive land use, and inappropriate distances between habitat and fault zones and rivers have resulted in catastrophic disasters (Kelly, 2005; Omidvar et al., 2013). Indeed inappropriate urbanization and excessive population growth, disregarding the safety principles in urban constructions, and non-observance of natural characteristics of the place in planning led to high potential hazard.

Human beings cannot do much, sometimes anything, about the causes of many of the natural disasters. However, they have an important role in turning natural phenomenon into a disaster due to human activities. In other words, man’s interference can increase the frequency and strength of the natural disasters. It can even lead to natural hazards that did not previously exist. Finally, human interference can decrease the protective effects of the natural ecosystems. Destruction of the coral reefs eliminates the first defense line against the ocean hurricanes, which is a clear example of human interference leading to a decrease in the capabilities of an ecosystem in protecting itself. Of course, a better example of the destructive interference is desertification, which is basically a man-made hazard.

The geographical position and climatic diversity of Iran has also increased the likelihood of occurrence of some of the natural disasters in this country. Iran is, in fact, the sixth disaster-prone country in the world; among the Iranian cities, only three percent are located in the low-risk areas. Out of the 40 known types of natural disasters in the world, 31 occur in Iran due to its special geographical conditions. Among the most common disasters are earthquake, flood, drought, and forest fires. During the last 100 years, more than 140,000 people have lost their lives as the result of the natural disasters (EMDAT, 2014). While Iran has only 1% of the world population, about 6% of the fatalities inflicted by the natural disasters occur in this country. During the recent years, the number and intensity of natural disasters have considerably increased. Disasters such as earthquake, flood, landslide, etc. inflict high fatalities and economic losses. Except for earthquakes, disasters such as flood, forest fires, landslides, desertification, and air pollution are all related to damages caused to the environment and destroyed ecological resources. In other words, man has a hand in the occurrence of most disasters. In summary, it can be stated that the majority of the natural disasters happen under the influence of both natural and human elements and, therefore, it is difficult to find really natural disasters.

Natural hazards generally take place in an environmental framework (Figure 1). A distinction is made in this figure between natural events or disasters.
and their interpretation as natural hazards (or resources). On this basis, natural hazards originate from the incompatibility of the processes in the nature with human or, in other words, incompatibility of human and their activities with the natural processes on the Earth. This interpretation gives a central role to human beings in causing disastrous events for two reasons. First, the location and position of human settlements takes on an importance. Second, human understanding becomes also important because when people want to benefit from the Earth, they give importance to personal judgments about the natural processes and consider them as a general evaluation of the environment. In other words, many of the hazardous processes are indicative of two ends of an extreme related to the events in which they are regarded as a resource in one context and as a hazard in another (Smith and Petley, 2008).

Accordingly, based on Figure 1, there is a mutual interaction between the environment and human being and, consequently, between human settlements and natural hazards and disasters. Therefore, considering the importance of and the need for better understanding of this interaction, the present study attempts to investigate the effects of human being, and more particularly, human settlements, specifically, the cities on the occurrence and intensification of some of the disasters including flood, landslide, land subsidence, and earthquake in the world in general and at Iran in particular.

**Flood**

Flood is one of the most destructive natural phenomena that is along with high losses and casualties. Based on the statistics prepared by the UN, flood and hurricane have inflicted the highest casualties and largest damages to the human settlements compared to the other natural disasters; in the decade leading up to 2000, the damages inflicted by flood and hurricane exceeds 21 billion dollars compared to 18 billion dollars in the case of earthquake. From 1988 to 1997, about 390,000 people lost their lives due to natural disasters, 58% of which was caused by flood (Farsani et al., 2011). In this respect, the point of worrying is the increasing rate of fatalities and economic losses of flooding in the world within the last decades. Increased population and properties over the floodplains and the destructive human activities are
among the major reasons for this increase. The increasing trend of the climatic events is shown since 1900 in Figure 2. According to the figure, a considerable increase can be seen in the rate of occurrence of these types of disasters (i.e., flooding) (Cap-Net, 2011).

In Iran also, flood is a disaster leading to heavy losses and damages every year. Based on the statistics related to four decades (1952-1992), 1,890 floods have struck the country, 50% of which has happened in the 1980s (Power Ministry, 2007). Besides, in the 55 years from 1952 to 2007, more than 400 floods have hit the northern provinces in Iran; 70% of which has occurred from 1987 to 2007. This means that in this period, the rate of flood has increased 20 times while no particular change has happened in the rainfall rates within the region except in some rare cases. In other words, this increase is indicative of the effects of human and human activities on the occurrence and intensity of this disaster. Table 1 presents information about some of the floods causing high fatalities and economic losses during the last few years in the country.

During the recent years, the use of land by human being in the urban context led to an increase in the number and strength of floods particularly in the cities. Population growth, urban development, and industrialization leave undesirable effects on catchment and basin hydrology leading to increased downstream pollution, reduction of base flow, and reduced recharge of aquifers (Farsani et al., 2011; Power Ministry, 2007; Jha et al., 2012). Hydrological changes resulting from urbanization and changes in urban lands can be summarized as follows (Toda, 2007; WMO, 2008):

- Change in the volume of run-off and recharge of aquifers from rain,
- Change of the maximum discharge of floods (peak discharge)
- Change in water quality

The most important factors involved in the hydrologic changes include penetrability level and the characteristics of the water flow paths. These two factors show a considerable change in the areas in which there has been or there is urban development (Toda, 2007). Climatic changes may also play a determining role in the occurrence of heavy and destructive rainfalls, but damaged ecosystems are to be blamed for heavy devastating overflows more than anything else. Different factors such as deforestation, unorganized and unplanned

![Table 1. Some of the destructive floods in Iran in the last three decades](image)

<table>
<thead>
<tr>
<th>Flood</th>
<th>Year</th>
<th>Fatalities</th>
<th>Economic losses</th>
<th>Peak discharge (m³/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Golab-Darreh, Tehran</td>
<td>1988</td>
<td>300</td>
<td>189</td>
<td>347</td>
</tr>
<tr>
<td>Masouleh</td>
<td>1999</td>
<td>57</td>
<td>70</td>
<td>23</td>
</tr>
<tr>
<td>Neka</td>
<td>2000</td>
<td>60</td>
<td>4</td>
<td>1283</td>
</tr>
<tr>
<td>Meshkin-Shahr</td>
<td>2002</td>
<td>30</td>
<td>0.12</td>
<td>250</td>
</tr>
<tr>
<td>Golestan</td>
<td>2002</td>
<td>300</td>
<td>95</td>
<td>3017</td>
</tr>
<tr>
<td>Shiraz</td>
<td>2002</td>
<td>-</td>
<td>-</td>
<td>60</td>
</tr>
<tr>
<td>Golestan</td>
<td>2006</td>
<td>72</td>
<td>30</td>
<td>1900</td>
</tr>
<tr>
<td>Qom</td>
<td>2010</td>
<td>7</td>
<td>80</td>
<td>110</td>
</tr>
<tr>
<td>Tehran</td>
<td>2013</td>
<td>-</td>
<td>21</td>
<td>-</td>
</tr>
<tr>
<td>Ilam</td>
<td>2016</td>
<td>4</td>
<td>240</td>
<td>2500</td>
</tr>
</tbody>
</table>

![Figure 2. The increasing trend of the climatic events (ISDR, 2010)](image)
development of the urban areas and overloading and blocking of the natural drainage systems are some of the factors intensifying the disastrous effects of floods. The recent floods in the majority of areas across the country are a clear evidence for this claim. An example of this was the devastating flood in 2002 following the manipulation of the dry river bed in Shiraz leading to heavy damages in this province (Figure 3).

Another example is the flooding of the Qom-Rood river, which caused great losses and damages in 2010 (Figure 4). The main reason for the occurrence of this flooding was the unsystematic and fast development of Qom and change of land use of a major part of the riverbed lands and converting them into streets, buildings, parking lots, and etc.

Therefore, the most important human factors leading to severe floods can be summarized as follows:

- Change of the path of the river or blockage of the river (Golab-Darreh, Shiraz, Qom, and Tehran floods)
- Penetrability and impenetrability (the occurrence of flood in relation to penetrability is dependent upon the percentage of the lands occupied by ceilings, sidewalks and buildings, which are impenetrable, and the areas occupied by wastewater). This leads water into metros and other urban facilities. In majority of the cities, flooding occurs following a little rainfall because of the use of impenetrable materials such as

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Figure 3. Destructive flood in dry Shiraz river in 2002 (IRNA, 2002)

Figure 4. Flooding of Qom-Rood river in 2010 (IRNA, 2010)
cement, asphalt, and mosaic (Golab-Darreh, Meshkin Shahr, Shiraz, Qom, Tehran, and Ilam floods).

- Such factors as deforestation, cutting of the trees for setting up farmlands, destruction of pastures due to excessive grazing, constructions causing vegetation damage (absorption of water by the plants), conversion of watersheds and wetlands into farms, unplanned development of the urban areas, overloading and blocking of the natural drainage systems with an increasing amount of waste and garbage (Masouleh, Meshkin Shahr, Neka, and Golestan floods).

The mentioned factors lead to an increase in the volume of runoff, the water flow rate, and changing the water quality (releasing toxins into the water). Accordingly, flooding in urban areas are primarily caused by using penetrability materials in urban construction. A look at the floods occurring during the recent years including the Golab-Darreh flood at Tehran in 2012, Shiraz flood in 2002, and the one in 2010 at Qom confirms this claim and are indicative of the influence of human on the occurrence and intensification of this disaster. Then, maybe the effects of human activities on natural elements in upstream, and the interactional effects between nature and human settlements contributed in downstream, secondarily, to the occurrence of floods such as the floods in 2002 and 2006 in Golestan.

Figure 4. Flood in the Qom-Rood river in 2010
Landslide refers to the soil, rock, and debris movement on the slopes which can happen in any region under favorable conditions. In this movement, a great volume of soil and rocks move down in the areas with a steep slope. A number of factors and conditions such as slope, length of slope, rainfall, geological features, human factors, deforestation, topographic features and other similar factors normally influence the occurrence of a landslide. This phenomenon can pose great risks such as burial of the villages or cities under tons of soil and rocks.

Overall, landslides are among the phenomena that have caused great damages during the recent years (Jibson et al., 2000; Jibson, 2007). Sometimes the damages are irrecoverable or require spending a lot of time and cost (Carrara et al., 1999). For example in Rio de Janeiro 1988, 277 people were killed, 735 injured and more than 22,000 displaced due to landslide (Kraas, 2008).

In Iran also, landslide, as a natural disaster, is a major cause of high losses every year. Based on a preliminary estimate, annually about 500 million US dollars of damages are inflicted by landslides on Iran (Shirani and Seif, 2012). Due to a mainly mountainous topography, geotectonic activities, being earthquake prone, geographical conditions and diverse geological formations, conditions are potentially favorable for the

Figure 5. Constructions in the areas prone to landslides and the resulting cracks in Tehran
occurrence of landslides so that the biggest landslide in the world happened in Kabir Kouh along the Simareh river in Iran (Akbarimehr et al., 2013). By the year 2000, approximately 2600 landslides, have led to 162 deaths, 176 fully destroyed houses and 170 damaged roads. This phenomenon leads to fatalities, economic losses, destruction of roads, pipelines, energy transmission lines, mining facilities, tunnels, residential urban and rural areas, and natural resources in the country every year. However, among these factors, human being plays a more important role providing the ground for the occurrence of this phenomenon by inappropriate constructions and by disrupting the ecosystem. Figure 5 shows some examples of the constructions in the areas prone to landslides and the resulting cracks in Tehran.

Therefore, landslides are among the hazards that occur if the particular environmental conditions are provided. Accordingly, an examination of the factors affecting the occurrence of landslides seems to be essential. Different researchers have examined these factors. Shojayian and Omidipour (2012) conducted a study on landslide hazard zonation and the factors affecting its occurrence. In their study, five factors including slope, land use, rainfall, penetrability, and ecological features were identified as affecting the occurrence of this phenomenon within the area examined in the study.

In another study, Rajabi et al. (2012) examined the landslide phenomenon. In their study, four factors (i.e., slope, slope angle, height, and distance from the fault) were examined to find the causes of landslide. Direction of the slope controls the concentration of moisture and pore water pressure at the slopes (Ayalew and Yamagishi, 2005). Furthermore, the effect of the slope angle on the occurrence of landslides particularly those caused by earthquakes has been also confirmed by many of the researchers and is normally considered in analyzing landslides. If all the other conditions are the same, the steeper slopes are more susceptible to the occurrence of landslides.

After examining the previous studies and the landslides that have happened, the reasons for the occurrence of landslides can be classified under two general categories: an increase in the driving forces on the slope and decreasing the resistant forces; the most common cause of increase in the driving forces and decrease in the resistant forces on the slopes is the construction of roads (cutting of the foot of the slope and increasing the slope angle) and land subsidence. The human reasons and effects on the occurrence of landslides are summarized in Table 2.

<table>
<thead>
<tr>
<th>Human reasons and effects</th>
<th>Increasing the slope angle (due to constructions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The movement of any buttress elements in the bottom of the slope whether by natural or man-made factors</td>
</tr>
<tr>
<td></td>
<td>Excavation and loading on the slopes (any overload on the slope such as construction or storage of wastes, residential area development and structures along with such as construction of pool and sewage canal)</td>
</tr>
<tr>
<td></td>
<td>Drop of underground water level due to excessive exploitation</td>
</tr>
<tr>
<td></td>
<td>Deforestation</td>
</tr>
<tr>
<td></td>
<td>Irrigation</td>
</tr>
<tr>
<td></td>
<td>Mining and underground tunnels</td>
</tr>
<tr>
<td></td>
<td>Artificial seismic shakes (strokes, shakes, and local shocks which caused by construction machinery or seismic waves)</td>
</tr>
<tr>
<td></td>
<td>Water leaks from installations such as water supply, sewerage, and drainage and runoff</td>
</tr>
<tr>
<td></td>
<td>Improper maintenance of drainage systems</td>
</tr>
</tbody>
</table>

Table 2. Human reasons and effects on the occurrence of landslides
Land subsidence

Land subsidence is a worldwide phenomenon, where there is a sudden sinking or a gradual downward settling of the earth’s surface with little or no horizontal motion (Ghorbanbeigi and Hamodi, 2008), which will have serious economic and environmental consequences if it spreads. In other words, subsidence refers to the vertical or downward movement of the land under the influence of gravity (Ghazban, 2012). It is a disaster that is usually ignored due to the lower human casualties it causes compared to the other disasters such as earthquakes and floods. Subsidence can happen as a result of human activities or natural processes. Among the natural processes is the tectonic movements, erosion of the rocks, and high concentration of sediments. Human activities are included mining, fluid extraction, constructions, loading on the soft lands, and excessive use of the underground water resources. Generally, subsidence is influenced by human activities and geological parameters. In other words, human processes intensify subsidence.

Rapid population growth along with agricultural development during the last decades has contributed to excessive use of water resources. This excessive use and also limited recharge have led to a decrease in the water level in the recent decade. One of the problems occurring as a result of overuse of water resources is land subsidence. This phenomenon does not happen immediately after liquid extraction but takes a longer time. The level of land subsidence varies from 1-50 centimeters for a 10-meter drop in water level. In fact, the range of these changes depends on the thickness and compressibility of the layers, the length of loading time, and the level and type of pressure (Lofgren, 1969).

There have been numerous reports of land subsidence particularly in the areas with low rainfall from all over the world (Bell and de Brugn, 1999; Larson et al., 2001; Stiros, 2001). At the global scale, the risk of subsidence caused by the drop in underground water level between the years 1950-1970 was at its peak, when urbanization and industrialization was growing (Waltham, 1989). Land subsidence has occurred in the past in many parts of the world including Mexico City, China, Thailand, Japan, and United States (Zhou et al., 2003). Land subsidence has been also reported in Iran particularly during the recent years following the drop in the groundwater in a number of aquifers. This can be observed in many areas in Tehran, Kerman, Yazd, and Khorasan where the plains are faced with negative balance of groundwater. In southern Tehran, the drop in the groundwater, and in northern Tehran, the incompatibility of the soil type with the constructions are the main reasons for the occurrence of land subsidence. Figure 6 shows the created fissures in the ground in southern Tehran.

As a result of withdrawing groundwater and evacuation of so much water from underground pore spaces, the conditions are provided for condensation and compaction of the materials up to 300 meters. The higher the load pressure is, the more condensed the materials will become. Therefore, one of the significant problems...
associated with excessive evacuation of water from aquifers is the decline or drop in the water level and condensation of the layers and sediments. This phenomenon causes sudden land subsidence in sand aquifers or gradual subsidence in the case of clay aquifers.

Land subsidence can lead to such problems as creation of deep fissures in the surface of the ground, bending of the pipelines, collapse of the wells wall, destruction of the buildings, change of the rivers and roads slope, destruction of irrigation canals, gradual sinking of the poles and other structures, soil erosion, change of the ground slope, and increased flooding in the region (Ghorbanbeigi and Hamodi, 2008; Ghazban, 2012).

In summary, in areas where land subsidence have occurred, water well casing seems to rise into the air or showing to be sticking out of the land surface (Figure 7), or sometimes produces fissures in the soils and/or showing as sinkhole in carbonated rocks that damage canals, water networks, gas pipelines, oil pipelines and dams.

Therefore it can be stated that one of the most important reasons of land subsidence is the rapid population growth and consequently the excessive exploitation of ground water resources for providing the water needs and demands of this crowd which led to various problems and difficulties that may cause economic losses and sometimes cause fatalities.

Earthquake

Earthquake is considered among the natural disasters happening in most regions and parts of the world. During the years 1900 to 1990, about 1,100 deadly cases in 75 countries were reported and more than 80% of the resulted mortality rates have been reported for six countries. Iran with mortality rate of 120,000 is included in this list with high mortality rates. Furthermore, during 1982-1991, Iran has experienced the highest number of earthquakes.

Based on the UNDP statistics, in the period 1980 to 2000, 158,551 people have lost their lives due to earthquakes across the world. With 47,267 victims, Iran has the highest fatalities caused by earthquakes. After Iran, from the Asian countries, Japan, Indonesia, Turkey, India, Afghanistan and Philippines, from American continent, Mexico, Chile, United States, countries like

Figure 7. Water well installation seems to rise the air due to land subsidence, a: southern Tehran (photo by researcher), b: Teran (Ghorbanbeigi and Hamodi, 2008)
Guam and New Guinea among the small islands, and Nicaragua and Guatemala from Central America are in the list of the most risky countries in terms of the occurrence of earthquakes (Ghazban, 2012).

According to the experts, the main cause of high mortality rates in these countries is the uncontrolled and rapid growth of urban population and the physical and structural changes happening as a result of this growth. These two are the most important factors in the deadly human disasters caused by earthquakes. During the last decade, population growth and concentration in the cities has turned into a big issue in many countries particularly in Africa, Asia, Latin America and the Caribbean.

Over the past decade, destructive earthquakes took place including: 1994 Northridge earthquake, 1995 Kobe earthquake, 2003 Bam earthquake, 2008 Sichuan earthquake, and 2010 Haiti earthquake which they led to deaths of thousand people and heavy damages to infrastructures.

For instance, the 2003 Bam Earthquake in Iran caused more than 20000 deaths and great damages (Figure 8). This earthquake and the ones occurring in the last few years have shown that earthquake does not cause destruction in itself; it is human beings and the built environment that determine the amount of damage caused by it. Thus, earthquake affects human being and their possessions in different ways. This is not unrelated to the effects of human activities on the natural
environment since different locations are differently vulnerable to this phenomenon. In other words, if natural hazards are an important aspect of the interaction between human and nature, the relationship between human and their environment whether in its positive form, i.e., human’s use of natural resources, or in the negative form, i.e., the natural hazards and disasters, should be focused in the future (Gibson, 1996).

The earthquake is a disaster that could cause secondary disasters such as: fires, tsunamis, liquefaction, landslides and ground failure. Overall, most earthquakes occur at boundaries of tectonic plates and are associated with tectonic processes (Ghazban, 2012). So earthquake is one of the disasters which occur without or minimal human interference.

However, sometimes human and human activities can also cause earthquakes. Among these activities are construction of high dams in earthquake-prone areas, mining and changes in rock strength, injection of fluids, and increased pressure on the rocks. In 1960, in Denver, small-scale earthquakes happened. Then, the existing evidence indicated that the relationship between injections of fluids into the wells by the army in Rocky Mountains might have caused these earthquakes. First, the army denied this relationship, but the studies showed that there was a direct relationship between injection of fluids and earthquake. In this way, in 1969 it was found by Evans that injection of fluids had acted as a fault lubricant and had made the old faults slide. In other words, increased pressure of water among the pores as the result of pumping liquids into the wells lead to decreased power of resistance and causes earth movements in the fault areas. Furthermore, the experiments conducted on an oil field in Colorado showed that there had been similar cases. In this location, when the pressure of the liquids pumped into the earth exceeded a certain threshold, the old faults seemed to be reactivated. The experiments in other regions confirmed this fact (Ghazban, 2012). What is more, dams and hydroelectric power plants can also lead to induced earthquakes with a lower intensity or intensify the occurring earthquakes.

In summary, although urbanization and fast development, which have happened without taking into account the issue of safety against disasters, have led to urban development and growth and improved facilities and services. But these facilities have never promoted safety against the natural disasters particularly earthquake. Therefore, the risks of earthquake is not only due to the direct influence of likely earthquake on the cities but also the population growth and unplanned urban development. An examination of the amount of damages and casualties caused by earthquakes in the cities showed that in many cases a high percentage of the casualties is directly concerned with the inappropriate planning for identifying and decreasing urban risks. Numerous human factors such as inappropriate land use, inappropriate design and construction of the buildings, and inefficient urban infrastructures have led to increased vulnerability of the human settlements to earthquakes (Tucker, 1994).

**Opinion**

In recent decades, a considerable tendency towards increasing casualties and monetary losses due to natural disasters can be seen all over the world. One of the important and affective factors for this increment is growing urbanization and most importantly the settlements that are exclusively exposure to natural disasters. Although there is mainly a reverse relationship between deaths and casualties caused by disasters in the developed countries, in the developing countries the number of people who are affected is on the increase. Unplanned development of the cities in the developing countries has turned them into areas with high vulnerability to natural hazards. Under the dynamic changes (both environmental and human) in the world, human settlements particularly in the metropolises have faced an increase in the risks. Furthermore, the additional
pressure on the environment, and also increased space use are all concentrated in the urban areas; the use of resources such as energy and water is excessively increasing and land subsidence has turned into a big issue as most of the metropolises are located on the coasts and floodplains.

During the recent years, the use of land by human being in the urban context led to an increase in the number and strength of floods particularly in the cities. Population growth, urban development, and industrialization leave undesirable effects on catchment and basin hydrology leading to increased downstream pollution, reduction of base flow, and reduced recharge of aquifers.

Climatic changes may also play a determining role in the occurrence of heavy and destructive rainfalls, but damaged ecosystems are to be blamed for heavy devastating overflows more than anything else. Different factors such as deforestation, damaged plains due to excessive grazing, changing and conversion of watersheds and wetlands into farms, unorganized and unplanned development of the urban areas and overloading and blocking of the natural drainage systems along with the increasing amount of waste and garbage are only some of the factors intensifying the disastrous effects of floods. Among the factors, human being plays a more important role providing the ground for the occurrence of this landslide by inappropriate constructions and by disrupting the ecosystem. Therefore, landslides are among the hazards that occur if the particular environmental conditions are provided. Furthermore, it can be stated that one the most important reasons of land subsidence is the rapid population growth and consequently the excessive exploitation of ground water resources for providing the water needs and demands of this crowd which led to various problems and difficulties that may cause fatalities and economic losses. Also earthquakes which have occurred in the last few years have shown that earthquake does not cause destruction in itself; it is human beings and the built environment that determine the amount of damage caused by it. Thus, earthquake affects human being and their possessions in different ways. This is not unrelated to the effects of human activities on the natural environment since different locations are differently vulnerable to this phenomenon. In other words, if natural hazards are an important aspect of the interaction between human and nature, the relationship between human and their environment whether in its positive form, i.e., human’s use of natural resources, or in the negative form, i.e., the natural hazards and disasters, should be focused upon.

However, sometimes human and human activities can also cause earthquakes. Among these activities are construction of high dams in earthquake-prone areas, mining and changes in rock strength, injection of fluids, and increased pressure on the rocks. In summary, the human is the most important factor in most disasters.

As social changes in the world are of concern, uncontrolled development of human settlements as well as the lack of planning for land use and control is mainly the result of rapid population growth. The structures and processes in the metropolises in the developing countries have a different definition and dimension. They normally develop at a considerably higher speed compared to the small cities. During the recent years or almost the past few decades, housing, infrastructures, jobs, and public, hygienic, and educational services should be provided to hundreds of thousands of citizens, which has often led to disproportionate growth of suburban and informal settlements. The problems created by informal settlements include a bad physical appearance for the city, limited services, unsecure jobs, provision and creation of an environment for accepting social harshness, and high vulnerability to the natural and man-made disasters. Overall, these settlements are located in regions with numerous hazards and because they have
been formed illegally and without planning, they lack any facilities such as access paths, drinking water, electricity, drainage system, and etc.

The problems related to the settlements and spatial development associated with rapid population growth as well as the inappropriate planning for land use are still among the unresolved issues. On the other hand, the existing symptoms such as economic, ecological, infrastructural, and socio-economic problems and pressures seem to be sadly worsening. So the major reasons for increasing disaster-related fatalities and damages, even if the frequency of geophysical events remains unchanged and despite a number of efforts for disaster reduction, are to be found in the following processes:

- **Population growth:** The number of people likely to be affected by disasters and their vulnerability are growing. This issue is one of the reasons of pressure to the natural environment and thereby increasing or intensification of disasters.

- **Rural land pressure:** Insufficient access to land resources and environmental degradation force people to adopt unsustainable land-use practices, whereby further areas are becoming regions at risk.

- **Urbanization:** Mainly rural-urban migration leads to the concentration of growing numbers of people in often unsafe, overcrowded, badly built, predominantly coastal cities.

Finally, it can be stated that natural hazards originate from the incompatibility of the processes in the nature with human or, in other words, incompatibility of human and their activities with the natural processes on the Earth. So there is a mutual interaction between environment and human and consequently between human settlements and natural disasters.

**CONCLUSION**

The present study examined the role of human being and human activities and also human settlements on the occurrence and intensification of natural disasters. The results indicated that human’s dependence on the nature involves a very wide and variable range of issues. Consequently, a major part of this range involves also a possibility for influencing and change by human. Therefore, human being influences the nature to the extent that they are related to and dependent on it. Whether the smallest human activities or the widest and largest ones such as establishing metropolises, they all involve human’s direct influence upon the nature. On the other hand, the nature of technology and the pressure from increased population have led to an overuse of the existing natural resources, which in itself leads to a decrease in the level of achievement of the sustainable development goals. In fact, human interference can increase the frequency and severity of natural disasters. Damaged vegetation has resulted in severe erosion and, with the inappropriate changes of the land use, it accelerates and strengthens landslides. In other words, all the disasters including floods, landslides, and land subsidence are related to the damage made to the environment and destruction of the ecological resources. Accordingly, human interference has reduced the protective function of the natural ecosystems leading to the occurrence of various disasters at different regions.

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