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Evaluation of urban development changes (case study of Bandarabbas city)

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Abstract

In recent years, the rapid growth and expansion of urbanization and the rapid increase in urban population have created countless problems for cities, including the destruction of the urban environment, the lack of proper access of citizens to urban services, the existence of urban uses incompatible with other uses, lack of social justice, etc. As a result of the need to pay attention to urban planning and management, the purpose of this research is to investigate the urban development of Bandar Abbas in (2001-2020) using remote sensing technology and satellite images to prepare land use maps for the years 2001 and 2020 from satellite images. Landsat ETM7 and OLS8 were used. They were classified by the supervised method (maximum similarity algorithm) in 5 land use classes (urban area, gardens and vegetation and barren land, pastures, water). The results of the research show that the area of agricultural lands and gardens decreased by 137,900 and 118,191 square kilometers during the years 2001 and 2020, respectively, and gave way to urban areas, which increased by 96,933 square kilometers in 2001 and 2020, and also in 2001, the area of pastures was 179,421 percent. In 2020, the area decreased by 140.686% and the area of barren lands increased by 68.483 square kilometers in 2020, and the water area of 0.324 square kilometers has had a constant trend, according to this, the land cover has undergone changes in this period.

Keywords: urban development, Landsat 7 and 8 satellite images, land use changes, remote sensing, Bandar Abbas

Introduction

Today's world is an urban world, the result of which, unfortunately, is the distance from the natural environment and the unwanted acceptance of imbalances that originate from the unbalanced relationships between humans and the urban space (Farid, 1375:8). How to use urban land is one of the most important issues of today's life (Saif al-Dini, 161:1381). Urban development, which covers large areas of the earth's surface, is important today in low latitudes, especially in developing countries. in which the growth of cities has overtaken Europe and North America (Chengtani: 1990: 960).

Physical development in Iranian cities due to geographical features, human density, population growth and rural migrations will always be accompanied by changes in the city structure, and these factors have had a great effect on the formation of unbalanced urban development. In this way, the growth of urbanization over the past decades has not been proportional to the ability to equip urban spaces and expand infrastructures, and has caused many problems; Such as the high cost of housing, unemployment and informal settlements in the appearance of cities (Abedini and Moghimi, 150:1391). Based on this, in urban planning and physical development patterns of the city, it is necessary to pay attention to risks and search for risk-free platforms to reduce the vulnerability of the population and future developments (Motamedinia, 154:1389). Sprawling is a dominant phenomenon in most cities, and with the characteristics of dispersion and low density, it occupies more land than dense and compact cities (127: Bullard et al., 2000); even though human areas Construction covers only 3% of the earth's surface, on a global and local scale, they have had important effects on environmental conditions (Hirold et al., 2003: 286-302); For example, the encroachment of urban areas on agricultural lands has had very adverse environmental consequences; such as desertification and soil erosion; Therefore, it is necessary to have up-to-date and accurate information about land use change to understand and manage the consequences of such changes (Giri et al., 2005: 123-132).

Cities are always affected and developed by various forces and factors (Hoshiar, 7931) and all over the world, countries are increasingly urbanizing (Dutta, 2012). Today, urbanization has become one of the factors that change the surface of the earth (Gutman et al, 2004), so that the increase in population in the last hundred years has changed about one third of the surface of the earth (Yang & Li, 2013) and according to the prediction of the organization It is likely that by 1212, about 32% of the world's population will live in cities (Jha et al, 2012). Physical development in the form of activities

It shows human or land use changes in cities and villages (Amoateng et al, 2013) and this physical development leads to extensive land use and adverse environmental effects (Shen, 2012). Also, in some cases, the expansion of urban spaces leads to environmental hazards and threats to human societies (Sanders & Clark). This means that urban areas will become the main place of many potential disasters (Leon & March, 2014). The physical development of cities should be based on the correct principles of urban planning. Urban development without considering the morphological background and the risks resulting from it leads to the development of the city in high-risk areas and leads

to the vulnerability of residents and residential and industrial centers. In fact If the process of creating new settlements does not fit with natural capacities and facilities, it will create unpleasant consequences in the physical-biological space of the inner city. Among these consequences are: the occurrence of natural hazards, disturbing the balance of the environment and disrupting the provision of services. Esfandiari, 7931).On this basis, the settlement of the city and its related activities in the area of space that has not been investigated in terms of topography and surface formations, is far from geographical areas, and the comprehensive knowledge of this space in the direction of locating and expanding Cities in the field of applied geography, especially geom Applied morphology is real (Tab. 1).

Table (1) specifications of satellite images used

Specifications				
The number of bands		**History**	**The name of the gauge**	**Name of the satellite R0w/path**
41.160	8	2001. 01.05	ETM	Landsat7
41.160	11	2020.01.10	OLS	Landsat8

Landsat sensor:

Since 1972, Landsat satellites have continuously acquired spatial images of the Earth's surface, providing data that are used as valuable resources for research on land use change. This satellite as well as the Sentinel satellite have been able to make many users and experts in the field of remote sensing eager to analyze its images. These satellites help a lot in various projects, including environmental projects.

The Landsat satellite is part of the Landsat program, which actually includes Earth observation satellite missions. Today, these satellites are very important for NASA and the United States

Landsat 7 satellite:

The Landsat 7 satellite has an Advanced Thematic Display (ETM+) with 30m visible, near IR and SWIR bands, a 60m thermal band and a 15m panchromatic band. On May

31, 2003, unusual artifacts appeared in the data collected by the device (ETM+). The investigation determined that the scan line correction (SLC) of the satellite's forward motion for recovery and reverse scanning to create an image had failed. Attempts to recover SLC were unsuccessful, and without the SLC factor, 22% of the image data would have been lost, resulting in data gaps in intermittent gaps that increased in width from the center to the edge of the image. The Landsat 7 satellite continues to acquire accurate geometric and radiometric data around the world, but there are methods that enable users to fill in data gaps.

Landsat 8 satellite:

This satellite is called the Landsat data continuity mission (LDCM) which was launched on February 11, 2013. This satellite has two sensors: one called OLI (land observation) and The other is TIRS (thermal). Together, these two sensors form 11 bands, 7 of which are shared with ETM+. 8 bands have a resolution of 30 meters, a panchromatic band of 15 meters and two thermal bands of 100 meters. These two sensors collect image information for nine short wave bands and two thermal wavelength bands, respectively. The design of the satellite took 5.25 years, however, this satellite has enough fuel to operate for more than ten years.

Supervised classification (most similar):

The maximum likelihood method (maximum similarity) is one of the most well-known and widely used information classification methods among the supervised classification methods. In this method, the probability that a pixel belongs to all classes is calculated and it is assigned to the class with the highest probability. For this purpose, it is assumed that the data has a normal distribution. In fact, educational examples should represent that class. As a result, there should be a number of educational points that meet the characteristics of the samples accurately and completely.

The most similar classification is not only focused on the center of the clusters, but in this regard, the shape, size and direction of the clusters are also considered. This is done by calculating the statistical distance based on the mean and standard deviation and the covariance matrix of the clusters. A statistical interval is a probability value. The probability of seeing a pixel x that is associated with a cluster. A pixel is assigned to a cluster that has the highest probability of similarity and belonging to it. Many classification systems based on logic of greatest similarity assume that the data has a normal distribution. Also, the maximum similarity method provides the possibility to define a threshold for the distance based on the maximum probability value. The average of the ellipse created for the privacy of each cluster is determined in its center and represents the values that have the highest degree and membership probability for that class. Accordingly, as we move away from the center of the ellipse and go to the edge, the degree of membership probability of those pixels to the desired class also decreases. For a better understanding of this issue, pay attention to the figure below.

Evaluation of classification results

In researches and investigations related to the classification and preparation of different maps, it is necessary to determine the accuracy of the classification. The purpose of checking the accuracy is to evaluate the degree of agreement of the map obtained from the classification with the ground reality by comparing each pixel of the classified map with the corresponding pixels in the ground reality map. It is determined how many pixels are correctly classified in different classes and how many are wrongly classified in different classes. The result of this evaluation is presented in the form of an error table (Pal and Mader. 2005). Using the error table, the overall accuracy and kappa coefficient are calculated.

One of the most widely used methods for evaluating the accuracy of classification is calculating the error matrix, which is widely used. After classifying the images, the Kappa index and the overall accuracy of the classified map are calculated based on the error matrix. These values show that the classification and types of land use classes are in good agreement with each other. Since it is very important to know the accuracy of any information, in this research, the accuracy of the classifications, the overall accuracy and the Kappa coefficient for each image in the desired time frame have been calculated. According to table (2), the overall accuracy and Kappa coefficient for the year 2001 were 95.20 and 0.93, respectively, and for 2020, 95.25 and 0.90, respectively. The classification accuracy for the extracted land use map of 2001 and 2020 show that the overall accuracy and kappa coefficient are both higher than 0.90%.

Table-2: Overall validity and kappa coefficient

Kappa coefficient	Overall health	Year
0.93	95.20	2001
0.90	92.25	2020

Study area

Bandar Abbas city is located in the center of Bandar Abbas city, one of the provinces of Hormozgan province, at a distance of 1470 km from Tehran, in the south of Iran and bordering the waters of the Persian Gulf. Bandar Abbas city is bordered by Haji Abad, Minab and Bandar Lange cities from the north, east and west, and is adjacent to Fars province from the northwest and is limited to the waters of the Persian Gulf from the south. In terms of geographical coordinates, it is located between 14 56 to 22 56 east longitude and 15 27 to 59 27 north latitude. From the north it leads to the heights of Mount Hawa and from the south to the sea, so the general slope of the city is in the

direction of north to south. The distance of Bandar Abbas city is 27316 square kilometers with a population About 435,751 thousand people

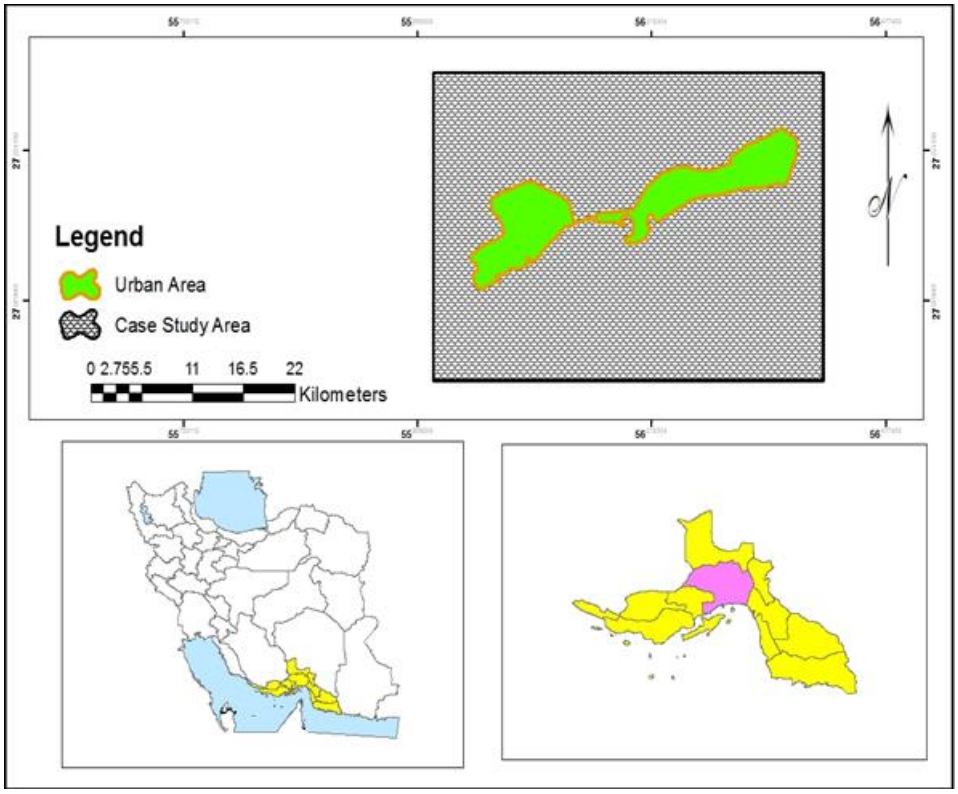

Figure-1: Location map of Bandar Abbas city

Discussion and findings

The land use map of the region with supervised classification method (maximum similarity) and using famous points in 2001 is presented in figure (2).

By examining this map, it was found that the lowest land use is related to water use 0.324% and the largest area is related to pasture use with 179.421%.

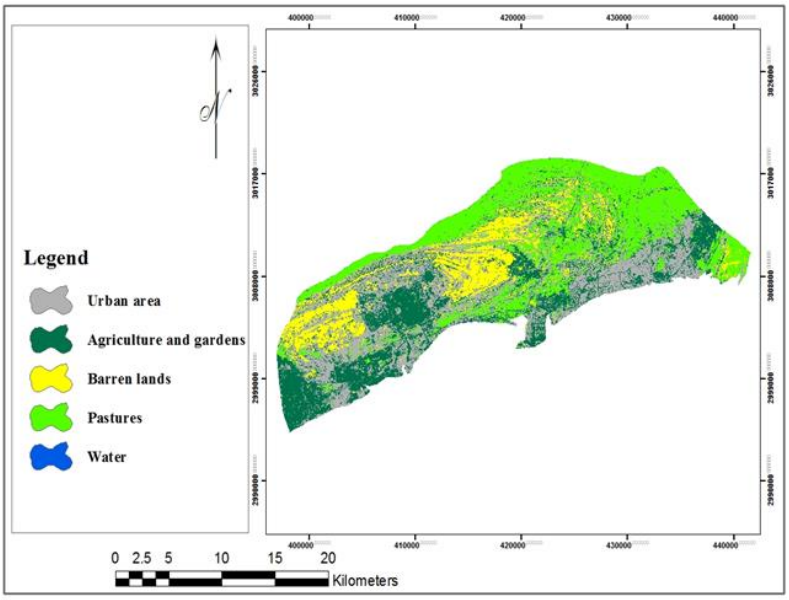

Figure-2: Land cover map in Bandar Abbas city in 2001

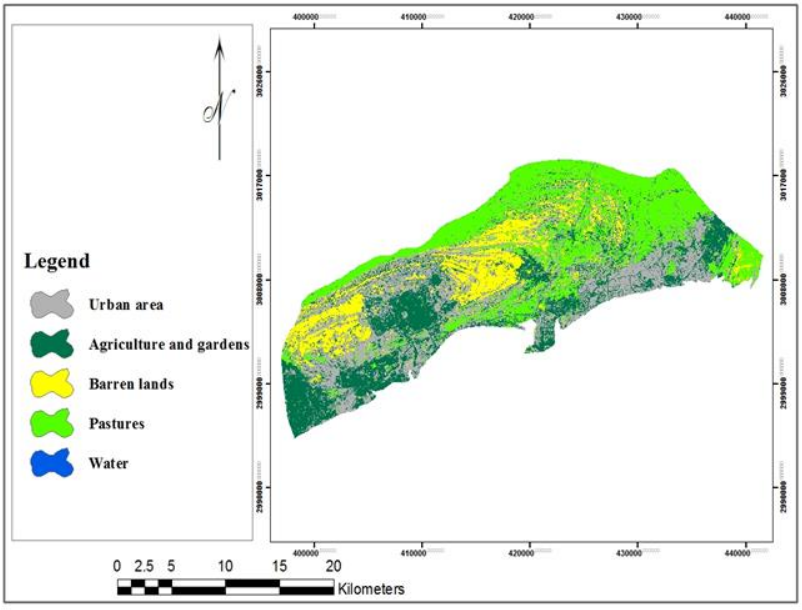

Figure-3: Land cover map in Bandar Abbas city in 2020

The land use map with the supervised classification method (maximum similarity) in 2020 is presented in Figure (3).

Table (3): Land area in 2001-2020 (in square kilometers)

2020	2001	Land cover	Row
143.444	96.933	Urban area	**1**
118.191	137.900	Agriculture and gardens	**2**
68.483	56.538	Barren lands	**3**
140.686	179.421	pastures	**4**
0.324	0.324	water	**5**

As it is clear from the table (3), during the period from 2001 to 2020, the amount of pasture land use has decreased and the land of the urban area has been increased, so that the amount of this increase for urban land use has increased from 96.933 square kilometers to 444.93 square kilometers. It has reached 143 square kilometers. Barren lands have also increased, so that their area has reached from 56.538 to 68.483 square kilometers.

Results

The results show that the trend of urban and barren land use changes has increased and the use of gardens, vegetation and pastures has decreased in the region. Table (3) shows the types of uses and the area allocated to each use in the years 2001 and 2020.

Land use changes:

Between 2001 and 2020, the trend of land use changes shows that in 2020, the urban and barren areas have increased and decreased in 2001. The reason for these changes is the encroachment of urban areas on agricultural lands and pastures and has resulted in very undesirable environmental consequences. The excessive growth of the population and rural migration causes the use of pastures and agriculture to undergo changes and the urban area increases with the destruction of agricultural lands and pastures and their transformation into urban areas and the reduction of vegetation and pastures.

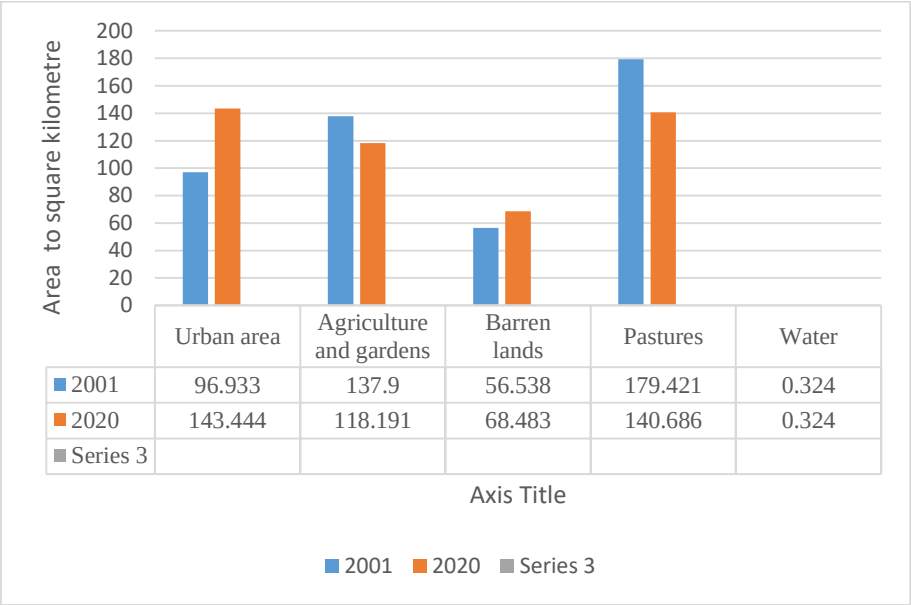

Figure-4: Display of uses and their changes related to the years 2001-2020

According to figure (4), which shows the graph of land uses and their changes, the largest area in 2001 is related to the use of pastures with 179.42 square kilometers, followed by the use of gardens and vegetation with 137.900 square kilometers, the urban area is 96.93 kilometers Barren plains are 56.56 square kilometers, and water 0.324 square kilometers have the least amount of area. On the other hand, in 2020, the largest amount of area related to the urban area with 143.444 square kilometers, followed by pastures with 140.686 square kilometers, gardens and vegetation with 118.191 square kilometers and barren lands with 68.483 square kilometers and at the end of water with 0.324 The square kilometer covers the smallest amount of area.

The largest amount of changes in this time period is related to the increase of the urban area (47 square kilometers), but the decreasing trend of the area of pastures (39 square kilometers) and the area of gardens and vegetation (19 square kilometers) during the years 2001 to 2020 can be seen and the amount of water area in both time periods. It is certain that nothing has changed.

Conclusion

Urban life is expanding rapidly in the world, and this speed is much faster in developing countries than in developed countries. The process of urbanization in Iran is very fast and accelerated, which has caused problems and dilemmas. The results of the present analysis showed that the use of remote sensing and satellite data can be useful for identifying and evaluating land use changes over time and is one of the fastest and least

expensive methods for preparing land use maps. And they are considered ground cover. According to the results of the comparison of land use maps, it can be concluded that during the period under study, the highest level of land use changes is related to the two uses of pastures (decrease in area) and urban areas (increase in area). Also, the results of this research show indicates that the largest share of land use changes in the region is mainly due to the expansion of human activities, which have caused many changes in the land cover, and unfortunately, such changes, in addition to having negative effects on the environment and natural resources of the region, cause Risks and damages caused by natural disasters such as floods also increase. Finally, it can be stated that the preparation of land use maps and the investigation of changes in land cover in different temporal and spatial scales increase the knowledge of the environment, efforts towards the sustainable management of natural resources and the implementation of appropriate management plans.

The process of urbanization in Iran is very fast and accelerated, which has caused problems and dilemmas. The results of the present analysis showed that the use of remote sensing and satellite data can be useful for identifying and evaluating land use changes over time and is one of the fastest and least expensive methods for preparing land use maps. And they are considered ground cover. Among the major changes that have occurred, it is possible to mention the increase in the use of urban areas and barren lands and the decrease in gardens, vegetation and pastures, so that the area of use of urban areas and barren lands in 2001 was 96/933 and 538/5, respectively. 56 and in 2020, it reached 143/444 and 68/483 square kilometers, respectively, the area of gardens, vegetation and pastures in 2001, 137/900 and 179/421, and in 2020, it reached 118/191 and 140/686 square kilometers. And the area of water has had a constant trend of 0.324 square kilometers in two periods and has not changed. During the years 2001 and 2020, the pasture area has decreased and the urban area has increased, and these consequences of this increase and expansion have been shown in the form of agricultural land destruction and environmental damage. In any case, urban development and changes in land use patterns cause extensive social and These effects include the reduction of natural spaces, the increase in the accumulation of vehicles, the reduction of agricultural land with high production capacity, the impact on natural drainage and the reduction of water quality.

This research shows that the development of Bandar Abbas city with the continuation of the past development process in the coming decades, the urban area of Bandar Abbas will expand east and northwest in 2020 with the maximum similarity method. And according to the obtained maps and the table including the changes of use, the expansion of Bandar Abbas city has been more eastern.

The area of pastures and agricultural lands became urban areas, and due to the ever-increasing development of the population along with the widespread migration of villagers to urban areas and the emergence of environmental problems, including the destruction of high-quality agricultural lands and pastures, these changes have been caused. Since the city of Bandar Abbas is a coastal city and is the most important strategic and commercial center of Iran in the Persian Gulf and the Oman Sea, it causes the

migration of villagers to the cities and attracts labor force, and the beaches cause the arrival of many foreign and domestic tourists to this city, and the coast is one of the biggest It is demographic and creates a strong connection between social, cultural and economic life in the city space with the physicality of the city.

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