The Scientific Journal of Cihan University – Sulaimaniya **PP: 24-45**
Volume (8), Issue (1), June 2024
ISSN 2520-7377 (Online), ISSN 2520-5102 (Print)

Land cover change and its causes in Goizha Mountain

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Abstract:

Iraq has recently been dealing with a variety of environmental problems, such as the destruction of the natural habitat, erosion and soil deterioration, and the threat of desertification; the key factor in these changes is the alteration of natural features throughout the development of urbanization with the globalization process. This study aims to investigate and comprehend the changes in land use and land cover change (LULCC) on Goizha Mountain, located in the northern part of Sulaimani city. The primary objective is to identify the reasons for these changes, the individuals responsible, In addition to their impact on the citie's identity. Also, significant environmental repercussions that might develop later. This study used a combination of quantitative and qualitative research methods to achieve its objectives. Data collected through a spatial-temporal study from 2017 to 2021 and a questionnaire survey to gather citizens' opinions on the causes and those responsible for LULCCC on Goizha Mountain. The goal was to gather comprehensive and accurate information about the changes and identify the underlying factors. The results of the study show built-up areas significantly increases in the study area on recent years at the expense of natural vegetation, and the identity of Goizha Mountain during the years 2017 to 2021. The study's findings confirm that human encroaching causes have a greater impact on natural change in the study area than natural disaster causes. In order to develop the necessary policies and laws, the results of the research have an important impact on reducing and eliminating this phenomenon and protecting the natural remains of Goizha Mountain that still exist.

Key words: Land use and land cover change (LULCC), Built-up area, Human encroachment, Goizha Mountain

DOI: http://dx.doi.org/10.25098/8.1.24

The Scientific Journal of Cihan University – Sulaimaniya **PP: 24-45**
Volume (8), Issue (1), June 2024
ISSN 2520-7377 (Online), ISSN 2520-5102 (Print)

الملخص:

يتعامل العراق في الآونة الأخيرة مع مجموعة متنوعة من المشاكل البيئية، مثل تدمير الموائل الطبيعية، وتآكل التربة وتدهورها، وخطورة التصحر؛ العامل الرئيسي في هذه التغييرات هو تغيير السمات الطبيعية في جميع أنحاء مناطق تطوير التحضر مع عملية العولمة. الغرض من هذه الدراسة هو إبراز وفهم التغيرات في الغطاء الأرضي لجبل جويزة في شمال مدينة السليمانية، وأسباب هذا التغيير والمسؤولين عنه وتأثيره على هوية المنطقة، بغض النظر عن كيفية تأثير هذا التغييرات على البيئة المنطقة في السنوات القادمة. تم نشر مناهج البحث الكمي والنوعي في هذه الدراسة كمنهجية لتحقيق أهداف الدراسة ؛ بالطريقة التي تم بها تطبيق الدراسة المكانية-الزمانية لمنطقة الدراسة لعام (2017-2021) ، وتم جمع آراء المواطنين حول أسباب التغيير، و المسؤولين عن هذا التغير عن طريق الاستبيان. تظهر نتائج الدراسة زيادة كبيرة في المناطق العمرانية في منطقة الدراسة في السنوات الأخيرة على حساب الغطاء النباتي الطبيعي، وهوية لجبل جويزة خلال السنوات الماضية. تؤكد نتائج الدراسة أن أسباب التعدي البشري لها أسباب أكبر من تأثير الكوارث الطبيعية على التغيرات الطبيعية في منطقة الدراسة. من أجل تطوير السياسات والقوانين اللازمة، فإن نتائج هذا البحث لها تأثير مهم في تحديد الحد لهذه الظاهرة والقضاء عليها وحماية البقايا الطبيعية لجبل جويزا التي لا تزال موجودة.

الكلمات الرئيسية: المناطق العمرانية، الزحف البشري، جبل جويزا(LULC)

پوختە:

لەم دواییانەدا مامەڵە لەگەڵ چەندین کێشەی ژینگەیی دەکات، وەک لەناوچوونی شوێنی نیشتەجێبوونی سروشتی، وەرینی زەوی و تێکچوونی خاک و مەترسیی بە بیابانبوون؛ هۆکاری سەرەکی ئەم گۆڕانکاریانە گۆڕینی تایبەتمەندییە سروشتییەکانە بە درێژایی گەشەسەندنی شارنشینی لەگەڵ پرۆسەی جیهانگیریدا. مەبەست لەم لێکۆڵینەوەیە تیشک خستنە سەر گۆڕانکارییەکانی ڕووپۆشی زەوی بۆ چیای گوێژە لە باکوری شاری سلێمانی , هۆکارەکان و ئەوانەی بەرپرسن لەم گۆڕانکارییە و کاریگەرییەکانی لەسەر ناسنامەی ناوچەکە، وە ئەم گۆڕانکارییە چۆن کاریگەری لەسەر ژینگەیی دروست دەکات لە ساڵانی داهاتوودا. ڕێبازەکانی توێژینەوەی چەندایەتی و چۆنایەتی لەم لێکۆڵینەوەیەدا وەک میتودۆلۆژیایەک بۆ بەدیهێنانی ئامانجەکانی توێژینەوەکە جێگیرکراون؛ بە شێوەیەک کە لێکۆڵینەوەی فەزایی-کاتیی لە نێوان ساڵانی (٢٠١٧ تا ٢٠٢١) بۆ ناوچەی لێکۆڵینەوەکە جێبەجێ کراوە، و بۆچوونی هاوڵاتیان سەبارەت بە هۆکارەکانی گۆڕانکارییەکە، ئەوانەی بەرپرسن لەم گۆڕانکارییە بە ڕاپرسی پرسیارنامە کۆکراوەتەوە. ئەنجامی توێژینەوەکە دەریدەخات کە ناوچە بنیات نراوەکان بە شێوەیەکی بەرچاو لە ناوچەی توێژینەوەکەدا زیادیان کردووە لەسەر حیسابی ڕووەکی سروشتی، و ناسنامەی چیای گوێژە لە ماوەی ساڵانی ٢٠١٧ تا ٢٠٢١. دۆزینەوەکانی توێژینەوەکە پشتڕاستی دەکاتەوە کە هۆکارەکانی دەستتێوەردانی مرۆی کاریگەری زیاتریان هەیە لە گۆڕانکاریە سروشتیەکان لە ناوچەی لێکۆڵینەوەکەدا لە چاو هۆکارەکانی کارەساتی سروشتی. بەمەبەستی پەرەپێدانی سیاسەت و یاسای پێویست، ئەنجامی لێکۆڵینەوەکە کاریگەری گرنگی هەیە لەسەر کەمکردنەوە و نەهێشتنی ئەم دیاردەیە و پاراستنی پاشماوە سروشتییەکانی چیای گوێژە کە تا ئێستاش هەن.

كليلي وشە: ناوچەی بیناسازی، دەستتێوەردانی مرۆی ، شاخی گوێژە(LULCC)

DOI: http://dx.doi.org/10.25098/8.1.24

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Volume (8), Issue (1), June 2024
ISSN 2520-7377 (Online), ISSN 2520-5102 (Print)

List of abbreviation

Abbreviation	Definition
LULCC	Land Use Land Cover Change
ESS	Ecosystem Services
TES	Total Ecosystem Services
AG	Agricultural
SEAP	Sustainable Energy Action Plan
GIS	Geographic Information System
RS	Remote Sensing

1. Introduction

Urbanization basically covers the processes of; population urbanization (population migration and mobility), spatial urbanization (urban expansion and sprawl, landscape change, regional transformation, and increased numbers of cities and towns), economic urbanization (industrial restructuring) and social urbanization (lifestyle changes) [1]. Cities have had more complex after urbanization, the continuity of human need for land and other urban services and continuous human activity in cities lead to an interaction between systems within cities; it signifies that nature is being threatened upon more and more. The eco-environmental system basically means land use and land cover (soil environment and impervious surfaces), water resources (water balance), biodiversity, the atmosphere, energy consumption, CO_2 emissions, the urban thermal environment, and ecosystem carbon and nitrogen cycles [1].

During the process of urbanization, natural ecosystems will be transformed into semi-natural and semi-artificial ecosystems and artificial ecosystems, which pose a great threat to the structure and function of ecosystems [2]. According to F. Chuanglin et al , several of the problems from the process of urbanization have increased the vulnerability of ecosystems and threatened the health of nature and human well-being [1]. Urbanization both planned and unplanned– promotes habitat loss and has an effect on ecosystems on which cities and the citizens' health depends on [3]. After fast urbanization, there is an increase in human activity; pressures have already affected the stability of the earth system but right now frequent and as a result of this process, unexpected environmental incidents will occur [1]. Exploitation of natural area, change the land cover to the land use and incised built up area inside city, this means decreasing in the total ecosystem services (TES) [2]. Due to uncontrolled urbanization, unexpected environmental degradation has been occurring and causing a variety of issues, such as land insecurity, decreased water quality, noise, excessive air pollution, and issues with waste disposal [4]. Continuous deforestation has led to a series of ecological problems, such as a decline in ecological carrying capacity, biodiversity loss, accelerated soil erosion, and increases surface water runoff [5, 6]; important factor for illegal deforestation, forest conversion to agriculture, and access to areas that had been excluded from human intervention [6, 7]. The cutting and occupation of natural landforms, particularly hills, has been recognized as a significant environmental issue. In Chittagong city, Bangladesh, over a period of 36 years, nearly 200 hills within the city have been unlawfully excavated, flattened, and divided into smaller plots for the construction of residential areas or infrastructure projects. This reckless development has resulted in a number of

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disastrous environmental and human incidents, including notable deaths caused by large landslides. Moreover, hill cutting has been accompanied by deforestation, which has consequently aggravated the problem of water logging in the city and put the main seaport of the entire country at risk [8].

Research suggests that when urbanization is excessive, more than half of precipitation runoff and just a small portion of it are absorbed deeply [29]. Flooding during rainstorms is another detrimental effect of ground cover loss; according to studies when a piece of land is converted to urban purposes, there are effects arising from such land uses that may affect the original conversion site with spillover impacts that may be felt at a much larger spatial scale, flood is among them. Floods, rapid soil erosion, several different forms of soil deterioration have emerged as a result of the conversion of vegetated land to mixed agricultural and urban areas, which has negatively impacted the ecosystem overall [23, 30, 31]. Md Moniruzzaman.et al reveals that the extreme growth of 41.9% in built-up area in Dhaka City between 1978 and 2018 increased runoff from (24.44%) to (57.36%) [31]. In Previous studies LULCC, distance to roads, and distance from urban area are of those 16 factors are affecting fire occurrence with other factors such as elevation, Topographic, and wind speed. According to the factor weight results as mention in the study area in local level of [28].

The ability to monitor the state of the environment and the likely impacts of human activities on natural resources is fundamental to evidence-based decisions on development choices, to the design of appropriate management strategies, and to mitigate biological and ecological consequences [7]. Understanding and monitoring the trends of changing land use from a physical, social, and spatiotemporal point of view are becoming increasingly important. Such work represents a multidisciplinary research frontier within academia [8]. Everything on our planet is interconnected, and we all depend on each other's actions as well as how we handle our natural resources [9]. The identity of cities (natural or artificial) is a factor in identifying and distinguishing the city from other places, so their preservation is important for the identity of the city. In and around metropolitan areas, pressure on natural and cultural landscape resources will persist. Apart from concerns about ecological sustainability, the growth of urban areas, an increase in the number of people living in cities, and the degradation of both natural and cultural resources generate questions about the identity and image of urban landscapes [21].

Sulaimani governorate participated in the global Sustainable Energy Action Plan (SEAP) in 2018 and presented some proposals to voluntarily try to reduce the percentage of CO_2 emissions to 40% by the year 2030 through residential, utilities, Industry, etc. A comprehensive plan to protect the natural features of the city can be a good step towards the agency's objectives. Despite the regional and global significance of this issue, no efforts have been made to document this phenomenon and define the impact of land use and land cover changes on the climate, environment, and ecosystem in Sulaimani city because of the lack of awareness among politicians and officials about the significance of this matter and its implications for future generations ; as Ahmad support that fact in (Azmar-Goizha Plant Field Guide as a result of the building of new high-rise residential areas, commercial facilities, amusement park construction, road expansion, and tunnel construction, there has been a substantial loss of natural habitats and great disruption in the Goizha Mountain [26]. Despite the lack of geospatial data and time-series information and difficulties on providing mechanisms and scientific requirements, we try in this study to document the phenomenon, receiving citizens' opinions about

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this case and detect the reason for this change measure its effects on the components of the natural environment of Goizha Mountain in the city of Sulaimani.

1.1 Literature review

In order to analyze and determine the existing resource status and sustainable design resource management alternatives, land cover change is becoming an increasingly significant topic in the study of environmental change. It's crucial to understand not just the dynamics but also their direction, what caused them, and how this shift is affecting people and the environment [6]. Based on a literature review of existing studies about land cover change, one of the major causes of this change is human encroachment, which has been mentioned under many names in previous studies, such as urbanization. The environmental consequences of these changes directly affect the environment and ecosystem services, with dynamic implications for human livelihood systems Fig 1 shows the causes (an independent variable) and effects (a dependent variable) of land cover change according to the literature review.

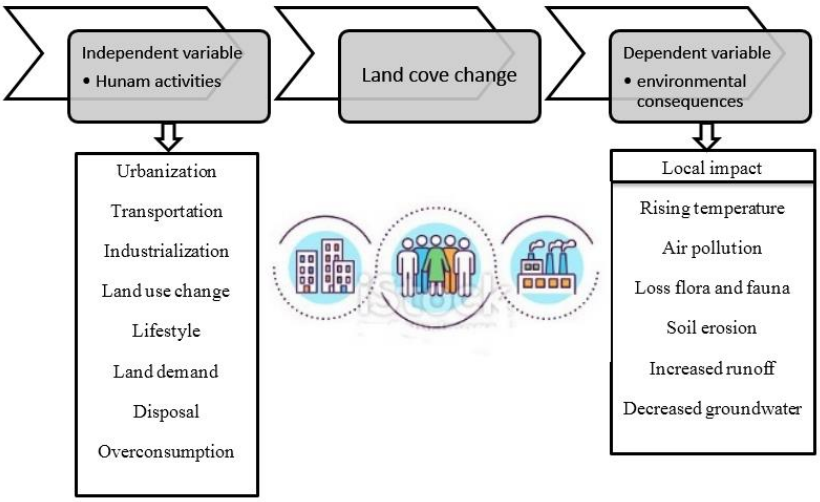

Fig. 1 Conceptual frameworks of land cover change. (Source: Author)

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1.2 Land use land cover change in the light of previous studies in Iraq

"Urbanization holds out both the bright promise of an unequaled future and the grave threat of unparalleled disaster, and which it will be depended on what we do today" this is warn of United Nations Secretary-General Wally N'Dow about the Urbanization [1]. The report of the Millennium Ecosystem Assessment (MEA)(2005) pinpointed that human is induce of land use land cover change (LULCC) while the LULCC is responsible to 60% degradation in the provisioning of ecosystem services (ESs), and also these changes have caused growing environmental costs [10-13][11, 12][14, 15]. According to (Ye Zhang et al) the main causes for LULCC is human activities not natural causes; the human activities to the process of vegetation cover change was 59.66%, which was greater than 40.34% in the study area for climate change [16].

Iraq has recently been dealing with a variety of environmental problems, for instance, destroying the natural habitat, erosion and soil deterioration are prevalent to an extreme degree, and in certain locations, the threat of desertification is growing; the key factor in these changes is the alteration of natural features or LULCC throughout the development of urbanization with the globalization process. According to (Ardalan A.); the urban area increased (78.42 km2 - 115.71 km^2) in Sulaimani governorate from 1998 until 2010; it is the outcome of population increase and regional economic growth following 1998; urbanization and re-urbanization in the governorate of Sulaimani led to deforestation in some scrub and tree areas [17]. According to (A. A. Othman et al) the grasslands mainly located in the areas that have high elevation in the northern region of Iraq [18]. Evergreen and deciduous tree changed to agricultural (AG) resulting from new urbanization, which simultaneously results to deforestation [17]; as is the case in the area of study. Although urban growth was hampered in the northeastern direction of the city of Sulaimani because of topographically high and steep slopes of the Azmar-Goizha Mountain, expansion began across the city's northern and southern regions. Because of the rising demand for residential areas, and the preservation of the ideal circular shape of Sulaimani city, and landscape modification were required to accommodate expansion to the north [19]. The Sulaimani governorate's natural forests are prone to phenomena like fire occurrence and tree cutting, whether due to natural or human causes, is confirmed by (Hossam .K); researcher believes that; human factors have a major role in the fire occurrence and tree cutting in Sulaimani; due to tree cutting, natural forests lost 1643 km^2 of their area between 1969 and 2007 [20].

2. Study area and data source

2.1 Study area

There are several natural features in Sulaimani city, including a mountain, hill, natural scenery, spring water, river, and natural tourist attraction. One of Sulaimani's most notable natural features is Goizha Mountain. Despite the reality that there is not really much evergreen area in the Province of Sulaimani, but Goizha Mountain in north of city of Sulaimani is among the evergreen area [17]; Goizha Mountain is part of Azmar-Goizha Mountain; and it's a part of the massive Zagros Mountain range that has a view of Sulaimani city. This mountain spans a region of around 250 km^2 between 35°29' to 35°42'N but our case is covered 10.33km^2 in Goizha Mountain Fig (2).

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Goizha Mountain in Sulaimani city is one of the natural areas; according to the master plan of Sulaimani city 2009, this area is a green belt around the city from N and NE of the Sulaimani city and it is an ecological conservation zone as the support of Sulaimani sustainable development. Goizha Mountain is the key ecological barrier and source for the high quality of life in the city, and it has a beautiful environment with a variety of natural plants and trees, a high level of biodiversity, and many different ecosystems. Accelerated economic growth in Iraq and Kurdistan after 2003 led to rapid population growth, a migration from rural to urban areas, and a rise in land demand. This, in turn, resulted in changes in land cover; Goizha Mountain as a one of this places Which faced this challenge from the past years and is still considered one of the most important issues within Sulaimani Governorate.

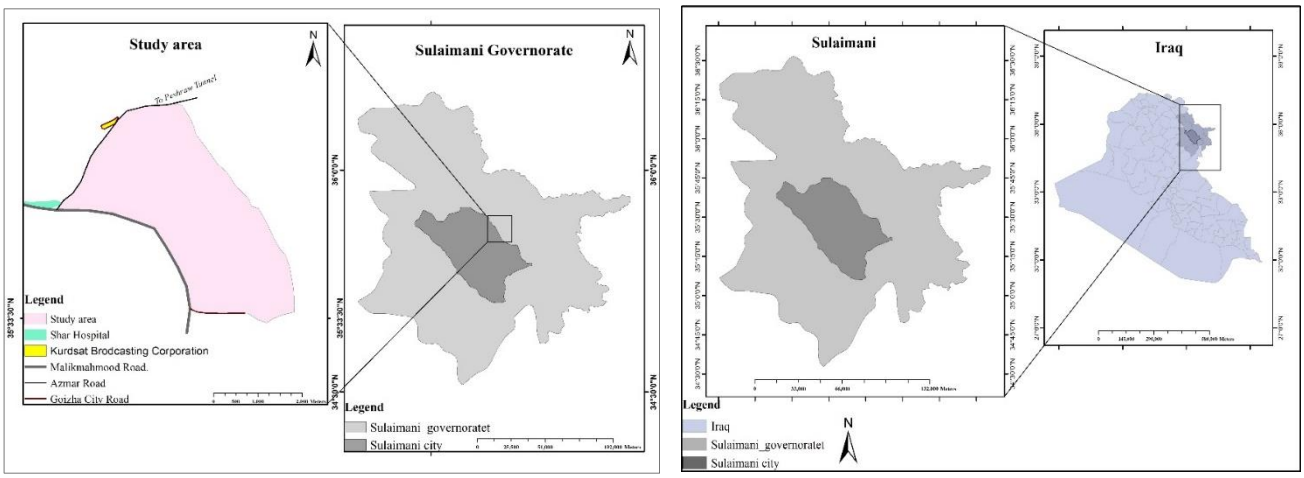

Fig. (2) Sulaimani location, study area location (Source: Author)

2.2 Data source

Researchers use primary and secondary data to achieve the objective of researches. Primary data include surveys, questionnaires, focus groups, interviews, and observation, which collected by the author and are especially use for a specific study. The term "secondary data" refers to information that has already been acquired and published by a publisher in a paper, book, government document, satellite image, or thesis.

Questionnaire survey and observation as primary data, and satellite image as a secondary data used in this paper to achieve the objective of research.

This research utilized a time-series of Landsat satellite image data covering the period between 2017 - 2021. Data on LULC collected by many agencies at various levels of government and from various sensors. However, they have mostly operated individually and without cooperation. Hence, there is numerous multilevel system of LULCC categorization. The LULC classification scheme used in this paper for detecting land use LCC is a global time series of land cover produced by Impact Observatory, Microsoft, and Esr. Applying this model to the "Sentinel-2" scene collection on "Microsoft's Planetary Computer", this processes over 400,000 earth observations annually to produce the worldwide maps Table (1).

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Table. (1) Details about Landsat aerial photos.

Variable mapped	Land use/land cover in 2017, 2018, 2019, 2020, 2021
Source of image	Sentinel-2 L2A
Data Source Coordinate System	Universal Transverse Mercator (UTM) WGS84
Cell Size (resolution)	10-meters.10

Study area is divided into five categories of LULC which are describes in Table (2).

Table (2) Category descriptions for land cover

land cover type	Description
Rangeland	Natural fields and meadows covered by native vegetation; grass-like plants and little or no taller tree; grasses, >10% ground cover, but tree shrub cover is < 10% and show soil or rock land.
Bare land	Rock or soil areas that are completely devoid of vegetation or have only a few plants during the whole year. Land with minimum ability to support vegetation; < 10% vegetated cover.
Built-up Area	Residential neighborhoods, buildings, parking garages, and significant road and rail networks are examples of human-made structures.
Crops	Humans have cultivated certain areas; grains and grasses are examples of crops that are not grown at tree height.
Trees	Places covered with dense, towering vegetation that is at least 15 feet tall.

3. Research design

3.1 Methodology

The questionnaire is the main method for collecting data from a target population, allowing researchers to gather quantitative data. The land use map for the study region created using the observation approach in this research. The observation approach allows the researcher to collect qualitative data. The quantitative and qualitative research approaches deployed in this study as a methodology.

3.2 Methods

The change identification approach uses multi-temporal datasets to pinpoint areas where the land cover has changed since the imaging dates. It is frequently used in remote sensing applications that analyze datasets with many temporal dimensions; it is capable of identifying many categories of LLC at any particular time.

3.2.1-Spatio-temporal study

Spatio temporal study of LULCC used in this research to identify the change was happed in study area; by using Landsat satellite images from Impact Observatory, Microsoft, and Esr. To analyze the satellite images data and to conduct the study several essential and efficient steps are required, namely: image data acquisition, image processing, and detecting the transformation of LC during time. All final maps in this study produced in ArcMap.

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3.2.1.1 Image processing

Check the land cover after downloading a Landsat satellite image from Sentinel-2. Add an image for processing to the Arc GIS tool. Firstly, add study area layers to the image and clip them; second, use the Conversion tool to convert the image from a raster layer to a polygon. To integrate the boundaries for each category and convert them to the same category by doing the dissolve process. Finally, rename each category based on Sentinel-2 land use and land cover site and calculate the area and percentage for each.

3.2.2- Observation method

An observational approach employed to build the required land use map of research area, and GIS tool used to add this information to satellite image in 2019, in addition to figuring out the percentages and kinds of land use in research area. The process cannot be completed without land use map, which it is not available.

3.2.3- Questionnaire survey

The questionnaire collects three main types of data:

1- Personal information.
2- Residents' opinions about the phenomenon are mentioned and its causes.
3- The officials behind the phenomenon and the opinions of residents to solve the phenomenon

In total, 112 online surveys were given out to collect the information required to complete the study. Individuals picked from the academic staff that had expertise in the relevant fields for the research subject (like planners, architects, geologists, and biologists) and by those employed by organizations fighting to protect the environment offered answers to the questions. To analyze this data, SPSS software used.

4. Result

The results discussed in this part. According to the spatio-temporal study used to detect the percentage of change in study area. A questionnaire survey shows different tables and charts related to subject.

4.1- Spatio-temporal study of LULCC in study area

The Landsat images used to recognizing a change in the research area for LULC involve 5 categories. These categories include Rangeland, Bare ground, Built Area, Crops area, and Trees area, the description of these categories presented in (Table 2). The LULC area in was present in Table (3) it is cover 10.33km^2.

Based on the results of the spatial-temporal study, the primary ecosystem in the research area is rangeland, which is more than 6 km^2 in 2017. The built-up area is the next area, which surpasses 2 km^2, and the third area is the bare ground area, which extends more than 1.5 km2. However, the vegetation area, which includes crop and tree areas, was less than 0.5 km2 in 2017.

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Table. (3) LULC area (km^2) and percentage (%) in 2017, 2018, 2019, 2020 and 2021.

Year / LULC type	2017		2018		2019		2020		2021	
	Area-km^2	Pre %	Area-km2	Per %	Area-km^2	Per %	Area-km^2	Per %	Area-km^2	Per %
Rangeland	6.2903	60.87 %	7.0840	68.54 %	6.1192	59.21 %	4.7052	45.53 %	5.7696	55.8322 %
Bare ground	1.5125	14.63 %	0.6905	6.68 %	1.0869	10.51 %	0.9449	9.14%	0.8393	8.1217 %
Built Area	2.4433	23.64 %	2.5458	24.63 %	2.9133	28.19 %	3.1100	30.09 %	3.3519	32.4365 %
Crops	0.0867	0.83%	0.0114	0.11 %	0.1681	1.62%	1.5511	15.01 %	0.3627	3.5100 %
Trees	0.0002	0.001 %	0.0025	0.023 %	0.0463	0.447 %	0.0222	0.215 %	0.0098	0.095%
Total	10.33	100%	10.33	100%	10.33	100%	10.33	100%	10.33	100%

As illustrated in fig (3); built-up area increased their footprint all over the area in each year with the significant decrease in Rangeland and Bare ground area. In 2017 the built-up area covered 2.4433km^2 that does 23.64% of the research area's overall average. In 2019 the range was increased to 2.9133km^2 which is 28.19% of total average of research area, this range has continuously increased until 2021, reaching 3.3519km ^{2} the average was 32.4365% show in table(3). The Rangeland and Bare ground area came out as a giant class with coverage of 7.8028 km^2 in 2017 on research area, but the range decried to 6.6089 km^2 until 2021. Crops and trees area grew slowly in the opposite direction of built-up area in 2017 average of crops was 0.83% and 0.001% for tree area , as for 2021, the average has reached to 3.51% for crops and 0.095% for tree area Fig (4).

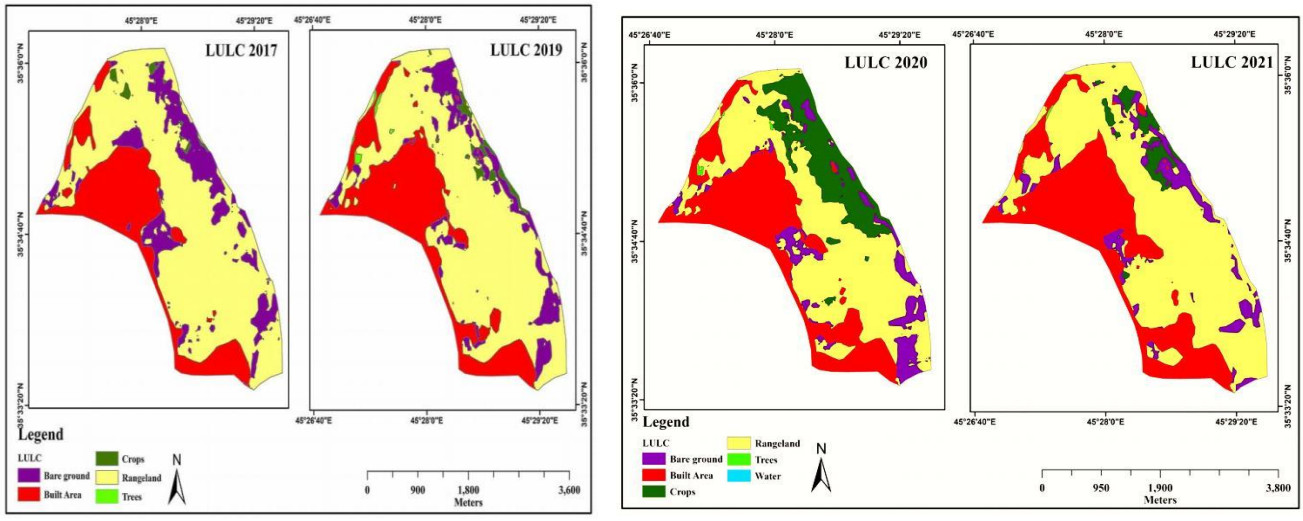

Fig. (3) Spatio-temporal study of LULCC in 2017 until 2021.
(Source: Author)

DOI: http://dx.doi.org/10.25098/8.1.24

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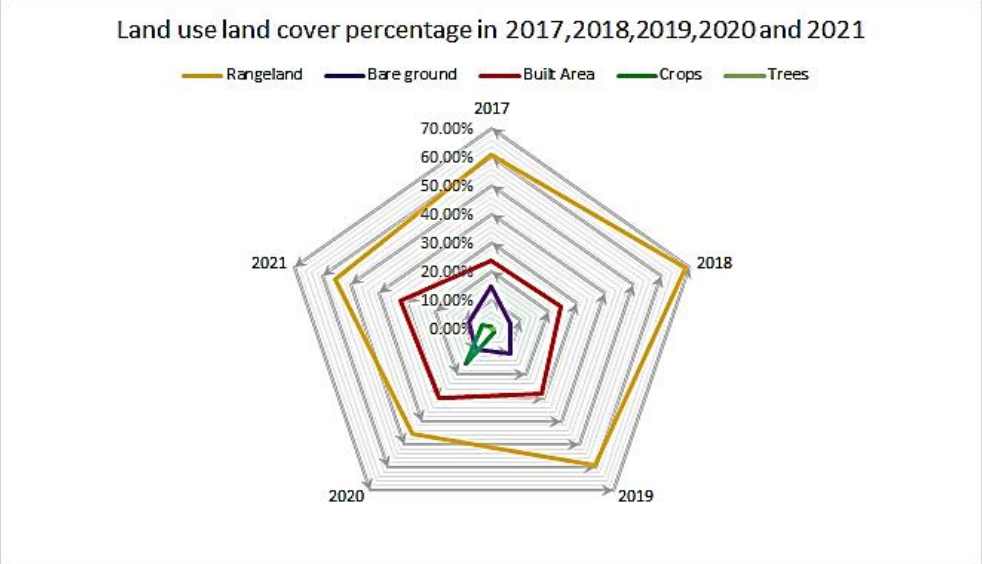

Fig. (4) Radar chart of Spatio-temporal patterns of LULC changes in the study area in 2017until 2021.

4.2- Land use

There are various land uses within the research region, such as (residential, commercial, recreational, educational, hotels, religion, mix used, restaurant, gas station, hospital, and park) Fig. (5). as shown in Fig. (6), the dominant type of built-up area is residential, as it covers 1.5260 km2, which is about 56% of the overall area. The second portion, which makes up 30% of the overall land, used for recreational activities and has an area of around 0.8267 km^2. The regions used for various forms of land usage, such as commercial areas and mixed uses, range from 0.0769 km^2 to 0.0504 km^2. Military purposes are one of the other uses for the research area; its covers 1.29% of the overall region.

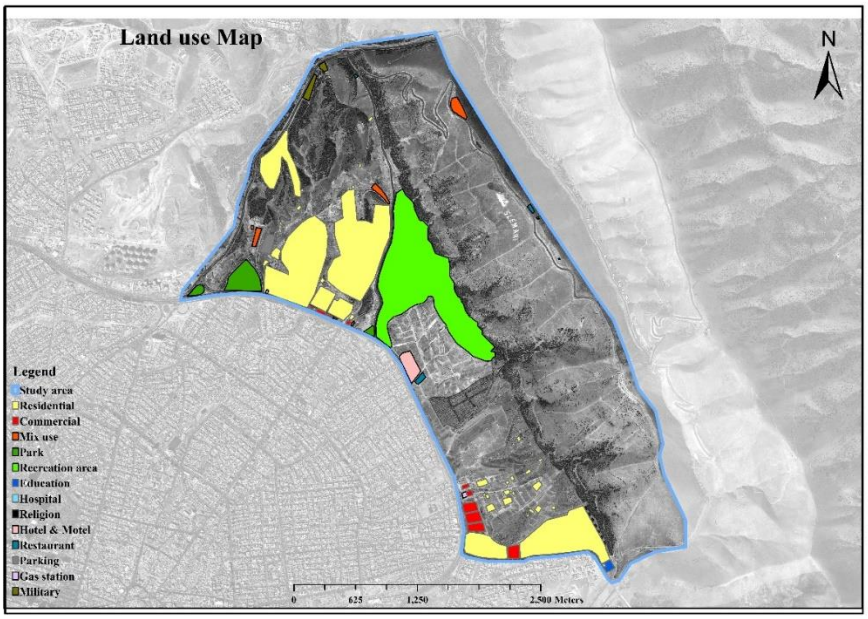

Fig. (5) Land use map in Goizha Mountain (Source: Author, 2023)

DOI: http://dx.doi.org/10.25098/8.1.24

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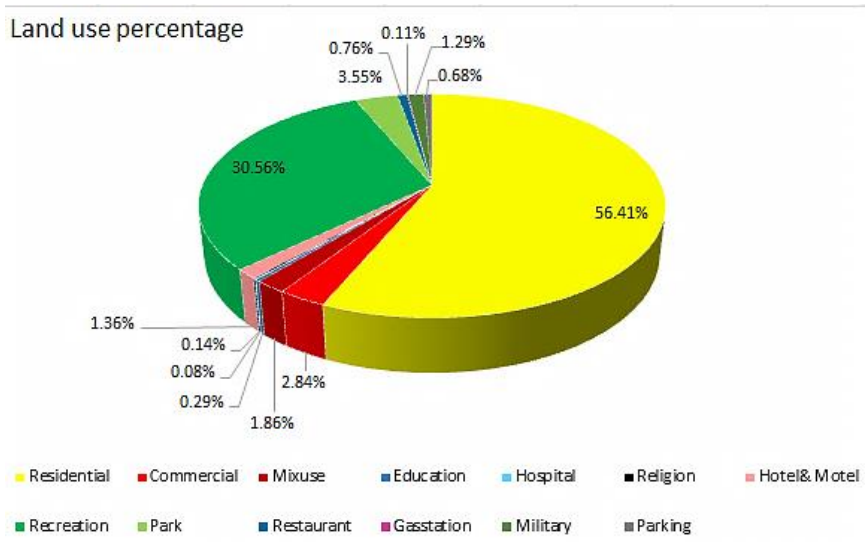

Fig. (6) Pie chart for land use percentage of built-up area in Goizha Mountain.

4.3- Questionnaire survey

The participants who responded the Questionnaire are in different age class and in different accommodation also in a different certificate to achieve the survey's purpose.

As shown in the Fig. (7) the overall that participations: 55.3% were aged between 18 and 40 years old, 38.3% were aged between 40 and 60 years old, and more than 52.1% of the overall respondents have a higher education certificate, while only 7.4% of the overall participations have a pre-university degree. As for the living accommodations, 87.2% of the total samples who reside in Sulaimani city, and 12.8% they are residing in other cities.

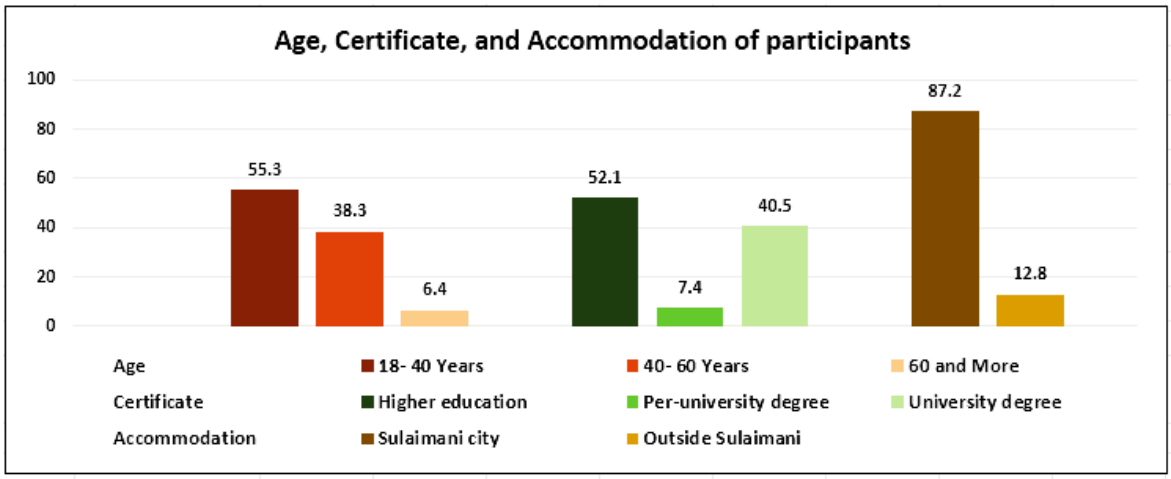

Fig. (7) Age, Certificate, and Accommodation distribution for participants.

As shown in Table (4,5), there was no significant relationship between accommodation and consideration of Goizha Mountain as a Sulaimani landmark; this demonstrates that the place of residence has not changed that fact, whether they reside in Sulaimani city or another city in Kurdistan. Out of 12 people f who responded to the survey and who live outside Sulaimani city, only one person was not sure about that the Goizha Mountain regarded as a one of identity of Sulaimani city. Although

DOI: http://dx.doi.org/10.25098/8.1.24

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only 4.3% in the total participants from the 18–40 year class also wasn't sure about that fact; this is still interest.

Table (4): Comparing to Age and Is Goizha Mountain considered as a landmark of Sulaimani

Count		**Is Goizha Mountain considered as a landmark of Sulaimani city/ Frequency (%)**						Total
		Yes		No		Not sure		
Age	18- 40 Years	48 (51.0)		0 (0.0)		4 (4.3)		52 (55.3)
	40- 60 Years	36 (38.3)		0 (0.0)		0 (0.0)		36 (38.3)
	60 and More	6 (6.4)		0 (0.0)		0 (0.0)		6 (6.4)
Total		90 (95.7)		0 (0.0)		4 (4.3)		94
Chi- Square		3.37	P-value		0.185	Result	No Significance	

Table (5): Comparing to Accommodation and Is Goizha Mountain seen as a landmark of Sulaimani city

Count		**Is Goizha Mountain considered as a landmark of Sulaimani city**						Total
		Yes		No		Not sure		
Accommodation	Sulaimani city	79		0 (0.0)		3		82 (87.2)
	Outside Sulaimani	11		0 (0.0)		1		12 (12.8)
Total		90 (95.7)		0 (0.0)		4 (4.3)		94
Chi- Square		0.561	P-value		0.454	Result	No Significance	

Because 83% of participants responded positively in respect to whether city landmarks challenged by collapsing and perishing, this confirms considering that this is the case in Suleimani; Table (6). Additionally, 68.1% concur that the landmarks in Suleimani city are poorly safeguarded, but just 7.4% of participants think the landmarks well protected.

Table (6): Comparing to how much Sulaimani city landmarks protected and Are the city landmarks (manmade-natural) confronted by collapsing and perishing.

Count		**Are the city landmarks (manmade-natural) confronted by collapsing and perishing?**						Total Frequency %
		Yes		No		No idea		
How much sulaimani city landmarks are protected	A lot	0 (0.0)		7 (7.4)		0 (0.0)		7 (7.4)
	Low	55 (58.5)		0 (0.0)		9 (9.6)		64 (68.1)
	Nothing	23 (24.5)		0 (0.0)		0 (0.0)		23 (24.5)
Total		78 (83.0)		7 (7.4)		9 (9.6)		94
Chi- Square		97.89	P-value		0.000	Result	No Significance	

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It is evident in the Fig. (8,9) that 70.5% of total samples said the city's landmarks (manmade and natural) are collapsed and perished by human causes (Human intervention)[X]; in total, 78 respondents said yes to confronting the city's landmarks with collapse and destruction caused by natural disasters or human causes. Absence of legislation to protect landmarks is most typical human cause (35%), but climate change (temperature, floods) is most typical natural disaster that causes city landmarks to collapse and perish (50.6%).

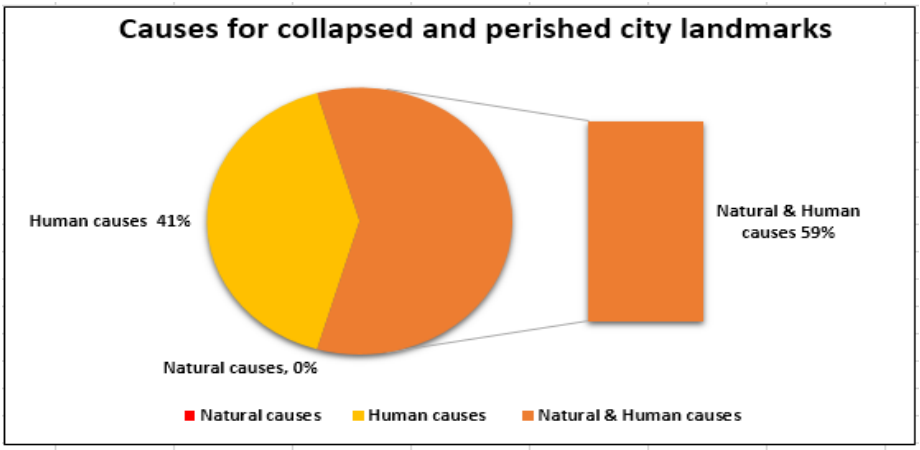

Fig. (8) Cases for collapsed and perished city landmarks

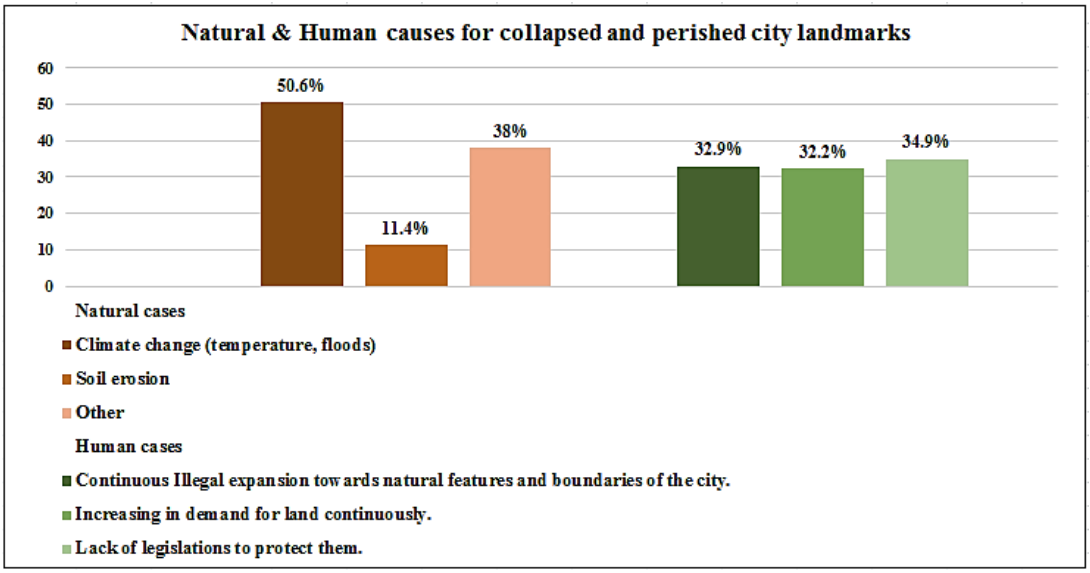

Fig. (9) Natural and Human cases for collapsed and perished city landmarks.

DOI: http://dx.doi.org/10.25098/8.1.24

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As illustrated in Table (7), nearly all of the samples said Goizha Mountain is not protected considered a landmark for the city (71.3%), while the minority of the samples said the mountain protected.

Table (7): Is Goizha Mountain protected as a city landmark?

Group	**Frequency**	**Percent**
Yes	12	12.7
No	67	71.3
Not sure	15	16.0
Total	**94**	**100.0**

Goizha Mountain like other landmarks in Sulaymaniyah, is being encroached upon by humans; respondents to the survey confirm this fact when 38.7% believe that ignoring it by stakeholders is the main reason, but 37.3% believe that removing trees and using the space for numerous activities associated to the spread of civilization of Sulaimani city is a reason Table (8).

Table (8): What are the main reasons for distortion the identity of Goizha Mountain?

Group	**Frequency**	**Percent**
Cutting trees and exploiting its area for different activities relating to civilization in the growth of Sulaimani city	53	37.3
Ignoring it by stakeholders.	55	38.7
Fire occurrences and burnings in the area.	34	24.0
Total	**142**	**100.0**

The municipality's stakeholders, in the opinion of the locals, are mostly to blame for the encroachments on the city's natural and man-made attractions, including Goizha Mountain. Additionally, the Governor's Council and Invest stakeholders are accountable for allowing intrusions on Sulaimani's identity. Table (9)

Table (9): Who are those stakeholders that are responsible in allowing encroachments with the city's natural and manmade landmarks such as (Goizha Mountain)?

Group	**Frequency**	**Percent**
Municipality.	84	43.7
Invest.	55	28.4
Council of the Governor.	54	27.9
Total	**193**	**100.0**

The respondents expressed their views on restoring the Goizha Mountain function as a Sulaimani city identity; officials can use these views to restore city identity. According to Table 10, 29.9% of total respondents suggested prohibiting rezoning in the area of study, particularly for residential purposes, through legislation and publicizing environmental protection awareness among citizens the need to restore the Goizha Mountain's function as a city identity.24.6% proposed designating the area

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a place that is protected, improving wildlife habitat restoring the functionality of Goizha Mountain as a city identity.

Table (10): What are your suggestions for restoring the Goizha Mountain function as a city identity?

Suggestions	**Frequency**	**Percent**
Greening by suitable plants with nature of the area such as pine trees, and evergreen plants.	16	19.7
Recognize the place to safeguard it and to further the wildlife habitat in it.	20	24.6
Using the area as a tourism area, and emphasize the status of the area as a natural tourism area.	11	13.5
The prohibitions of changing the land cover to land use especially for residential purposes via legislation, and publicize awareness about environmental protection by citizens.	24	29.9
Create a green belt to eliminate human interferences and separate its boundaries by law.	4	4.9
Protecting all natural and manmade landmarks in the city by using and following legislations.	2	2.5
Using modern science & technologies to preserve the area's natural beauty and developing strategic and scientific plans for the survival of the area by scientists.	4	4.9
Total	**81**	**100.0**

5. Discussions

In the world researchers use GIS and (RS) techniques for environmental monitoring and evaluation and to identifying the effects of urbanization on the environment. GIS and Landsat image in Remote sensing techniques were employed during this research to detecting the study area's changing land use and land cover during 2017- 2021.

Population growth, lifestyle changes, migration, as well as economic growth all contribute to increased demand for land and reductions in all natural resource categories, resulting in environmental pollution. The identity of cities is a factor in identifying and distinguishing the city from other places; however, urban growth generate concern about the identity of cities.

The determination of the study area as an identity of Sulaimani by those who reside in different cities of Kurdistan demonstrates the reality that Goizha Mountain is one of Sulaimani's natural and historical identities. Of the 12 respondents outside of Sulaimani, only one is not sure of this fact, which confirms that the place of residence has not changed this fact. The results show that recent changes to the area's natural landscape have an adverse effect on Goizha Mountain's identity when 4.3% of participants in the age group of 18- to 40-year-olds did not support this question. This demonstrates the detrimental effects the use of Goizha Mountain in the growth of Sulaimani city has had and will continue to have on this mountain's identity. The transformation of Goizha Mountain from a natural land cover feature to a center of human land use and civilization is a worrisome

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development. The alteration of the area's ecosystem services and negative impact on the environment is of concern. Additionally, the changes have resulted in the loss of the mountain's distinctive identity and uniqueness. These developments have significant implications for the area's ecological integrity and societal well-being, emphasizing the need for sustainable and responsible management practices that balance human needs with environmental conservation.

Land covers change quickly in its many forms; due to the yearly effects of a number of different both human and natural causes. Although climate change, soil erosion and additional factors like low rainfall had a negative impact in study area, they were not as effective as human factors. Because the nature of natural effects is such that they take longer to appear, the effects appear much slower than human-induced changes. The impact of human interference on all of Sulaimani's identities is the primary cause of the collapse and destruction it, especially Goizha Mountain. The main reason of human cases for collapse and perish of city landmarks is lack of legislations to protect them. Under the pretext of providing the need for land in the boundary of municipality Sulaimani; stakeholders do the rezoning of study area; especially to provide land for residential and commercial. This means ignoring it by stakeholders, the investment are increasing in Goizha Mountain. Because it provides a better living environment with nature, and good contacting with nature too; an annual growth in the built-up area is proof of such, as indicated by the results of a spatio-temporal analysis of Land Use and Land Cover for the study region.

One of the key topics in the study of LULCC is the removal of vegetation cover is a noticeable sign throughout the urbanization process. This topic has been widely studied both globally and locally. The finding of this study indicate that increases of built up area are noticeable in the study area at the expense of Rangeland and Bare ground area which it is cover by native tree.. To meet the requirements of urbanization, the tree cover area has been unsustainable exploited, and cutting down trees randomly to develop new residential projects and commercial buildings, which are causes of changing the ecosystem on Goizha Mountain, has happened throughout time. The phenomena of fire occurrence in Goizha Mountain in different season is one of the primary causes for distortion the identity of Goizha Mountain as mentioned by the respondents to the survey. A sizable chunk of the grassy region became barren because of the fire. Burnings the areas of Goizha Mountain during the year is reasons for loss of native trees, shrublands, and loss of soil. The regions with the highest potential for runoff are those with dense built-up surfaces. Continuously increasing built-up areas in Goizha Mountain reduces the area's ability to absorb rainwater and increases the possibility of runoff. The evident cause of many environmental issues in the research region is the building of roads. The most serious of these problems are direct habitat loss, habitat fragmentation, and habitat degradation, previous studies proved that fact.

In summary, the shift in perception of Goizha Mountain from a natural feature to a site of human land use and development has profound implications for the environment, ecosystem services, and the identity of the area. The alteration of land cover and the associated loss of natural habitats and biodiversity has adverse effects on the ecosystem's health and resilience. Moreover, human activities such as deforestation, mining, and construction can cause soil erosion, water pollution, and air pollution, leading to negative impacts on the environment and human health.

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The loss of the mountain's unique identity and characteristics is another critical concern. As a result of human interventions, the natural features that once made Goizha Mountain distinctive and unique have been lost, eroding the area's cultural and aesthetic value. This has significant implications for the community and its sense of place, leading to a disconnect between the people and their environment.

To address these challenges, there is a need for sustainable and responsible management practices that balance human needs with environmental conservation. This requires a comprehensive approach that considers the ecological, social, and economic dimensions of land use and development. The protection and restoration of natural habitats, and forestry, and the use of environmentally friendly technologies are some of the strategies that can support sustainable land use and development. Additionally, involving the local community in decision-making processes and promoting environmental education and awareness can help foster a sense of stewardship and responsibility towards the environment.

6. Conclusion

A decrease in ecosystem services, climate change, the loss of natural habitats and indigenous trees, air pollution, and soil erosion are some of the most significant environmental effects of urbanization that threaten human survival and global health; this influence has confronted the world with climate change concerns.

The findings show that modifications to natural features have gone from being an unusual occurrence to a common phenomenon. Goizha Mountain., one of Sulaimani's defining characteristics, has been altered as a result of these changes, like the city's other monuments, whether natural or artificial. Unplanned, fast urbanization has negative effects on the environment that have a significant influence on the soil erosion and local climate, as well as on the ecosystem services that the population of the region depends on. The study's findings confirm that human encroaching causes have a greater impact on natural change in the study area than natural disaster causes. According to the opinions of the locals, one of the main reasons why these illegitimate modifications in Goizha Mountain have been permitted is the indifference of stakeholders and the government. While it was a protected and green area when the Sulaimani Master Plan published in 2009, it has now changed to a land use area. The most ideas that they may apply to gain the identity of the city are prohibitions on modifying and public awareness raising for stakeholders and people. Also recognize the place as a protected and tourism area, improve the wildlife habitat, to safeguard the Goizha Mountain remnants, it should be emphasizing that Goizha Mountain is a natural protected area destination in Sulaimania city. Protecting natural features in cities from human intervention requires a combination of strategies and actions, such as zoning and land-use regulations, green infrastructure, education and awareness, collaborative planning and management, and enforcement and monitoring. These strategies can include creating protected areas, establishing buffer zones 'green belt', and implementing restrictions on certain activities that may cause damage to natural features. They can also help promote responsible behavior and support the preservation of these areas, as well as provide information on the benefits of natural features, encouraging sustainable practices, and fostering a sense of community ownership and responsibility. Finally, they can involve collaboration between stakeholders, including

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community members, to ensure that natural features protected and managed in a way that balances environmental, social, and economic needs.

The results of this research can be used to formulate a comprehensive policy and legislation to prevent the collapse and perish of natural and historical landmarks from any natural disaster and human encroachment.

7. Recommendation

There are several approaches and strategies that can be used to reduce land use and land cover change in cities include:

1-Compact and mixed-use development: Encouraging compact and mixed-use development can help reduce urban sprawl and the conversion of natural land into developed areas. This can be achieved by promoting infill development, revitalization of existing urban areas, and the creation of public transportation systems that support dense and diverse development patterns.

2- Green infrastructure: The incorporation of green infrastructure, such as parks, green roofs, and urban forests, can help mitigate the effects of urbanization on the environment by enhancing biodiversity, improving air and water quality, and reducing the urban heat island effect.

3- Smart growth policies: The implementation of smart growth policies, such as zoning regulations, land-use planning, and urban growth boundaries, can help direct development towards already developed areas, protecting natural lands from conversion.

4-Public participation and awareness: Engaging the public in decision-making processes and raising awareness about the importance of sustainable land use practices can help foster a culture of responsible land use and development.

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