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Land-use change on Peri-Urban: The role of rural-urban centralized and segregated planning strategy

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Abstract

The growth and development of urban spaces worldwide have led to dramatic changes in the landscape of peri-urban villages. In Iran, rapid urban sprawl has also reduced agricultural land and increased scattered construction. In this study, the sprawl and its effects on land-use change periphery of the city were measured by satellite imagery using remote sensing (RS) and Geographic Information System (GIS) analysis. Thus, the trend of land-use change periphery the city of Hamedan from 1990 to 2020 separately in 7 types of land use, i.e., residential construction, non-residential construction, convertible wasteland, arable land, garden land, pastures, and the road was inspected. The present survey findings show that the adoption of centralized settlement strategies and separate rural and urban planning in Iran, especially in rural- interconnected urban areas such as the study area, causes land-use change and subsequent spatial anomalies in the city and rural settlements.

1. Introduction

Urbanization is the most important social and economic phenomenon taking place on a large scale worldwide (Sun et al., 2013). In large cities and towns in developing countries, uneven population growth and unplanned activities have led to a lack of infrastructure facilities in cities (Chettry and Surawar 2021, Theobald 2001). However, urban centers cover a small part of the earth's surface. But the rapid expansion of cities has dramatically changed the natural landscape and led to huge changes in the ecosystem of the peripheral (Berling-Wolff and Jianguo 2004, Kappas et al. 2020); It also discusses the natural resources and changes in the valuable agricultural lands of that area (Hart and Milstein 1999). Also, major global trends that have increased competition for land have led to uneven urban development, with half of the world's population living in densely populated cities. The ratio is still increasing (Ludlow and Jupova 2016). In this regard, the adoption of economic adjustment policy, the "top-down development approach," and the accelerated industrialization of the peripheral rural economy with the growth-oriented attitude of urban economies have transformed cities into unplanned areas (Chambers 1994), with the inevitable consequences of uncontrolled expansion Population growth and migration to urban areas have caused "urban sprawl" (Club 1999). In recent decades, the imposition of new maps and functions by cities on the surrounding spaces has led to disorders in the economic, social, and spatial organization of the surrounding areas (Ebrahimi and Talebi 2013). In other words, the outsourcing of activities and the subsequent uncontrolled expansion of urban constructions to their surrounding spaces, as well as the irregular and irregular growth of these constructions have caused changes in the spatial structure of the suburbs. So that this imbalance in the spatial structure in terms of order and size of settlements, urbanization of rural landscape, change in the basic economy of villages, change of land use, composition of population and activity, are the most important manifestations of change. In addition, due to population density and resource pressure in rapidly expanding cities, destructive environmental damage remains, including the loss of valuable agricultural land, the loss of pristine landscapes, and eventual destruction. Hence, the change of agricultural land use due to the rapid urbanization and its consequence of "urban sprawl" and its environmental and socio-economic consequences is a question that can be answered around

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the metropolises and large cities of each country. Thus, the present study has tried with a new approach; In addition to analyzing the change of agricultural land use affected by the consequences of urban sprawl, pay attention to the role of separate rural-urban planning and centralized settlement policies and environmental capacities and internal capabilities of villages in accelerating urban sprawl; And analyze its impact on land-use change; And to provide a scientific solution to reduce the effects of centralist policies.

2. Method

The study area of this research is the southwestern and southeastern part of the city of Hamadan in Iran. In terms of relative position in the study area, the location of rural settlements is different from other rural settlements in Hamadan province. This difference is due to its proximity to Hamedan and its place in its area of direct influence. Also, the existence of wide flatlands, the significant expansion of the network of roads and highways, etc., has given a particular position to the rural settlements of the study area in terms of rising land prices. A descriptive-analytical method was used to measure the consequences of urban sprawl phenomena in the study area. In other words, the method of analysis of land-use changes trends during the three periods of 1990, 2006, and 2020, by satellite imagery and remote sensing (RS) and the GIS analysis. According to US Geological Survey (USGS) standards, analyses were performed on seven types of land use: residential construction, non-residential construction, convertible wasteland, arable land, garden land, and pastures and roads. The consequences of urban sprawl in rural settlements periphery Hamedan city and its effective factors were studied. Data were collected, including Landsat TM Year 1990 and ETM + the Year 2006, OLI 2020, and 1:50000 map of Hamadan, to identify the phenomena better and compare them with subsequent land-use changes.

3. Results

In recent decades, due to the proliferation of scattered construction and urban sprawl periphery the city of Hamadan, the problem of demolition and alteration of agricultural land and unauthorized construction has occurred, with consequences such as changes in the natural landscape, construction in lands, indiscriminate exploitation of natural resources resulting in ecosystem imbalances. The implementation of urban and rural development projects such as rural, detailed, and comprehensive urban conduction plans and the construction of roads and highways by official and governmental organizations to protect the land ignored agricultural lands. In this way, much of the agricultural land has been legally demolished and altered as part of their implementation. This subject has caused severe changes in the environmental and ecological dimensions of the area.

The results showed that in the Hamadan area, due to urban development and the highest rate of land-use change was observed over 30 years, namely from 1990 to 2020, in arable, horticultural, and pasture lands, respectively, with a total area of 1017 hectares, there were 272 hectares and 189 hectares (Fig. 1). In contrast, residential construction increased by 805 hectares, non-residential construction increased by 346 hectares, and road network increased by 20 hectares. In addition, 307 hectares out of 6446 hectares have become a wasteland, transformed into different construction uses. The statistics show that residential construction is still increasing, with the number of construction sites in the study area increased by about 17.8% from 1990 to 2020. But in contrast, agricultural land declined from 71.2 percent to about 51 percent.

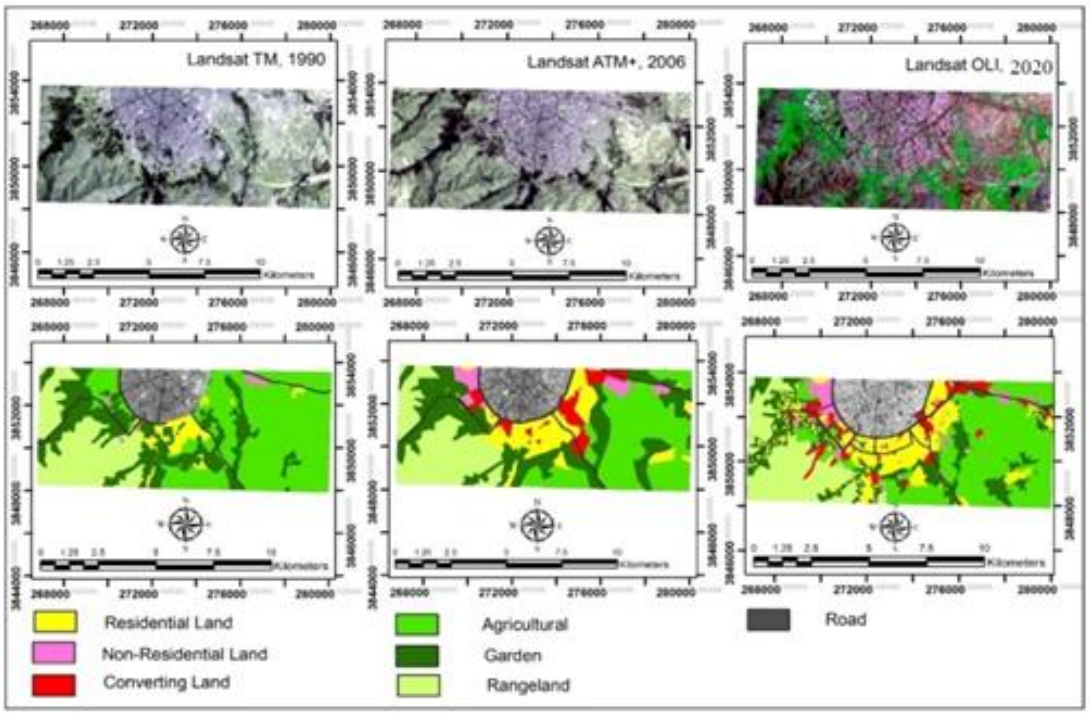

Figure 1. Distribution of the extracted classes in the three study periods from 1990 to 2020

The study of land-use changes in the periphery villages of Hamadan revealed. The rapid spread of the city of Hamedan to the suburbs and surrounding areas was more in the villages that had more cultivated and abandoned agricultural lands and gardens. In addition to the centralized settlement policies that accelerate the city's expansion to the suburbs and periphery areas, this land-use change is more observed in villages with more internal capacity, such as:1: more extensive cultivation and gardening 2. More extensive abandoned farmland and gardens due to lack of water 3. Nearer to the city and more accessible 4. Broader infrastructure and services 5. The people in their villages were more willing to sell land and convert the agricultural land 6. The fragmentation of agricultural land whose economic surplus from their sales price for construction and machinery is much greater than the surplus from the production and sale of agricultural products. Thus, the negative socio-economic and environmental-ecological consequences of urban sprawl in these villages have been more pronounced due to severe land-use changes and subsequent agricultural performance changes.

3.1. Centralized settlement policies and accelerated urbanization expansion

In the last few decades, the rapid growth and development of urban centers in developing countries, especially Iran, has led to unrest and imbalances in their rural settlements. This phenomenon has been influenced mainly by socio-economic developments and the nature of the political economy in Iran**.** Rapid migration and population movement to the city of Hamedan increased the need for land for residential and non-residential construction. Therefore, the rapid urbanization has caused a change in the quantity and quality of rangeland and forest lands, soil, surface and groundwater, waste and sewage disposal, changes in the area of agricultural and garden lands, etc., in the study area. Also, the study of demographic changes in rural settlements in the study area has revealed an increasing trend from 1996 to 2016. In other words, 15 villages in the study area were affected by urban sprawl (Table 1).

Table 1. T Evolutionary trend of rural settlements population in the study area during 1986-2016

Row	Village	1986	1996	2006	2016
1	Cheshin	1313	1366	1447	1804
2	Cheshmeh Malek	333	242	252	266
3	Silvar	589	467	373	282
4	Sangestan	1324	1227	1127	1195
5	Tafrijan	2410	2404	2134	2149
6	Shouring (on the verge of conversion into city)	3703	3800	4021	4473
7	Ali Abad Taghipour	2510	2598	4453	7759
	Total	12182	12104	13807	17928

It is worth mentioning that between 1986 and 2016, 4 villages in the study area were annexed to Hamedan. Economic and demographic loads in these settlements are affected mainly by the concentration of many facilities, activities, and services in Hamadan and its surroundings. Due to the high cost of land and housing in Hamedan, job seekers and low-income immigrants are forced to move to the larger rural settlement's periphery, where agricultural lands have been abandoned due to lack of water. Accommodation without a plan has caused an imbalance in the urban-rural space organization. It has led to the duality of traditional and modern texture in the periphery of the village of Hamedan.

3.2. Changes in the amount of garden land

The calculations of the cultivated area of horticultural crops during the last four decades (1973, 1983, 1993, 2003, and 2014) showed that out of the total of 15 villages in the study area, in 1973, the total area of irrigated (irrigated and dry-farming) lands was about 1760 hectares. It was reduced to 1214 hectares in 2014 (Table 2). The amount of garden land calculated based on satellite images in 2020 compared to the Statistics Center of Iran data was about 240 hectares. This difference was due to the drying up of garden lands.

Table 2. Fertile cultivable horticultural land area (irrigated/dry farming) in the rural settlements in the study area per hectare from 1973 to 2013

Row	Village	1973	1983	1993	2003	2013
1	Cheshin	0	20	24	60	54
2	Cheshmeh Malek	27	17	19	45	40
3	Silvar	50	33	27	35	31
4	Tafrijan	6	63	79	67	55
5	Sangestan	200	57	33	54	50
6	Shourin	100	62	57	82	72
	The villages converted into a city	1377	1274	1184	976	912
	Total	1760	1526	1423	1319	1214

4. Conclusion

It is essential to study spatial evolution and change in agricultural land use, which changes slowly and which elements change more rapidly. This study found that agricultural (agricultural and horticultural) land had no significant changes to other areas. However, lands without vegetation (rock mass) and pasture have changed to a lesser extent. Also, the roads' width is noticeable with the increase in construction and the entrance of buildings to the roadside. Because of the use of the road, there has been no significant increase periphery Hamadan. The sharp increase in urban and residential construction has led to a decrease in arable and garden land and an increase in land abandoned. Another reason for urban sprawl in the study area is the expansion of the roads. The development of roads and public transport has made it easier and less time-consuming to move the rural and urban areas. People go to urban centers for work and money every day and return to their neighborhoods at night to settle in the suburbs.

According to the study's findings, rural immigrants who come to the area's central city, whose income level does not meet the city's cost, turn to suburbs where economic conditions are more favorable. It is noteworthy that, due to ethnic and religious beliefs, many rural residents in some settlements close to the city did not wish to sell the land. The sprawl in the study area was discrete. More urban and rural sprawl has also occurred in settlements with greater intrinsic capacity in irrigated land abandoned and more fragmented agricultural lands. For this reason, the influx of population in these rural hubs is accompanied by discrete urban sprawl. Discrete sprawl periphery of the urban area in the study area has led to a severe decline in agricultural land resulting in severe agricultural instability and numerous environmental and socio-economic issues. Also, it has changed the economic performance of the villages from agricultural to non-productive and mainly false services, which has had many negative spatial and socio-economic consequences.

Therefore, the local government will abandon previous measures of centralized residential policies, separate urban and rural planning with a "top-down" approach to Urban expansion, and thus intensify the discrete urban sprawl. Policies and measures are needed to integrate the local government's urban and rural land use planning to prevent this process from continuing. To preserve the environment of rural settlements periphery the city, sustain their natural, social and economic dimensions, and preserve valuable agricultural land, the local government must enforce rigorous and stringent land-use change laws and strict controls. On such constructions, it will prevent any exploitation of landowners and speculators in destroying such areas.

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