

## Altitudinal Zone Land Use Changes in Iğdır Plain Using Overlay Analysis Combined with Remote Sensing Methods

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### ABSTRACT

Increments in populations, variations in irrigation systems coupled with drainage conditions caused significant changes in land use. In order to examine the changes in land uses between 1987 and 2017, Iğdır plain and its surrounding area were investigated using ArcGIS and Erdas Imagine. During these periods, urban area has increased by 142%. In Iğdır province, urban areas expanded towards agricultural areas. Depending upon drainage-amendment, irrigation opportunities and ever-mounting mechanized agriculture, dry agriculture areas have transformed into irrigated agriculture areas. Moreover, available urban areas expanded in favor farming and pasture areas. Herein, urban area increased from 7 to 13% by raising the area 27.000 hectares for the last 30 years. With the overlay analysis, up to recent years, the urban areas which are in the 800-1000 meters altitude zone have increased from 2 to 6%. In addition, the agricultural areas which were of 121.500 hectares in 1987 decreased 9000 hectares to 112.500 hectares in 2017. In the same years, irrigated agricultural areas that were of 27.000 hectares increased up to 72.000 hectares in 2017. However, dryland agricultural areas that were of 94.500 hectares in the same year decreased as 40,500 hectares. Thereby while the irrigated agricultural areas which occupied the 6% of total use increased up to 16%, the dryland agriculture areas which was 21% decreased to 9% in 2017. While 84% of the lands of 800-1000 altitude zone were dryland agricultural areas and 6% of the land was irrigated agriculture areas in 1987, the dryland agricultural areas decreased to 19% and the irrigated agricultural areas increased up to 68% in 2017.

**KEYWORDS:** Iğdır plain; Overlay analysis; Remote sensing; Altitudinal zone; Land use

### INTRODUCTION

Sharp and sudden changes in land uses depending on the dynamic changes associated with population movements from rural to urban areas and economy can emerge. In this context, the land use changes must be monitored at regular intervals in order to reveal and clarify the extent of the changes using remote sensing methods. With the regular and proper monitoring the areas, hindering the anthropogenic sources on wetlands, forests and other ecological factors and decreasing the flood and soil erosion are essential. In the recent years in Turkey, wetlands disappeared and disasters increased depending on the improper monitoring the land use changes. Along with the current study,

land use changes in Iğdır plain- for the first time were examined for the last 30 years (1987 and 2017).

Iğdır, which is our field of study, is in Erzurum-Kars zone in Eastern Anatolia Region. Iğdır has a border with Armenia in the north, Azerbaijan and Iran in the east. The border of Iğdır with Armenia and Azerbaijan is Aras River. On the other hand, the border of Iğdır with Iran has been formed by eastern part of Little Mount Ağrı (Ararat). Iğdır has a border with Ağrı in the southwest and with Kars in the northwest (Figure 1). This city is between 39°59' and 44°49' east longitudes; and 39°37' and 40°07' north latitudes.

Iğdır province consists of two different geomorphic units; highland and bottom land. The northern half of the area is

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plain, and the southern half is mountainous. While its bottom land forms Iğdır Plain, its highland areas form Aras Mountains and Greater and Little Mount Ağrı (Ararat) which is in the east part of those mountains (HGM, 2014). The 922 km<sup>2</sup> of this land (25.2%) is consisted of bottom land areas (Iğdır Plain), the 2.742 km<sup>2</sup> of this land (74.8) is formed with mountains and plateaus which are fractured with valleys. In general, the northern part of the province is bottom land; but the southern part of the province is highland. Iğdır plain disunites into 3 zones as west, east and Dil plain. The Western Iğdır Plain is from Çalpala village to Taşburun village where lavas from Mount Ağrı (Ararat) have been entered the plain. The Eastern Iğdır Plain starts from here to Ateş Hill on which Kazım Karabekir Agricultural Enterprise is located. The Dil Plain, on the other hand, starts from Ateş Hill to the border with Nakhcivan (Azerbaijan) and Iran.

Iğdır plain's altitude above sea level changes between 800-900 meters. While the altitude is 800 meters around Gödeklı village which is in the eastern part of the plain, it is about 900 meters around Çalpala village which is in the western part of the plain. The plain is surrounded by high mountains from the north and the south. In the north, the altitude is about 4000 meters with Mount Alagöz (Aragsats); in the south, it is above 5.000 meters (5.137 m) with Mount Ağrı (Ararat). Thus, Iğdır plain is formed as low basin. Aras River and its distributaries which enter the plain with the water from the basin, which is surrounded by high mountains, by opening a narrow pass from the west.

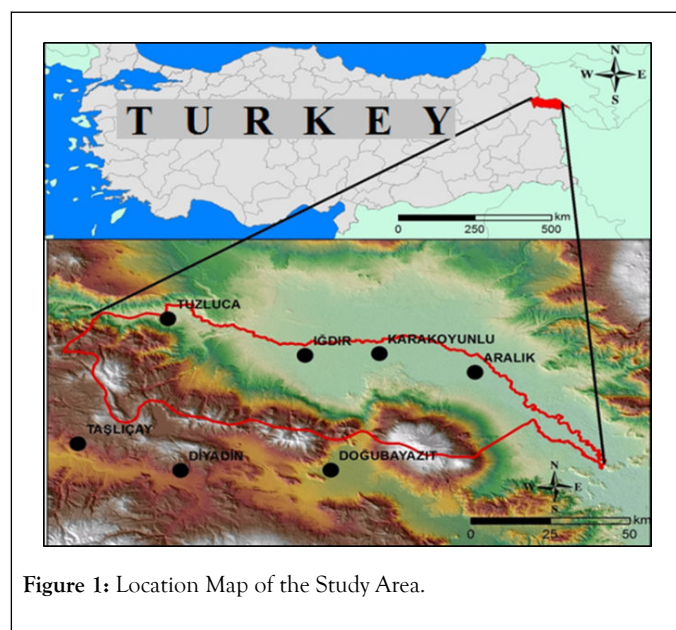


Figure 1: Location Map of the Study Area.

Iğdır plain is both depression and an area of subsidence. This plain got this feature in Pliocene. As a result of the new tectonism which has been seen from Pliocene and has continued along quaternary, a young-formed volcanism can be seen along E-W directed faults which are formed in the southern part of the plain. Young-formed orogenic movements have continued in the area which has been formed as land after top Pliocene and during quaternary [1]. In this term, alluviums that are sometimes 300 meters width has piled up and formed the current shape of the plain. The existence of alluviums and mid-

layered ebonite show that the volcanism had continued for a while in the past. Thus, pyroclastic and lava has covered the southern part of the plain based on the volcanic activities which occurred in the last geologic period [2]. From all reasons above, the investigation field is simple in terms of lithology. Main plain field is covered with alluviums that are mid-layered with ebonite. There are top Pliocene occurrences under the alluviums in general. Alluviums are formed of sand, clay and pebble. The big amount of pebble is ebonite-based. In the southeastern part of the plain, alluviums' width is 225 meters and in the Dil Plain, it is about 300 meters which is the peak value [2].

The southern part of the plain has formed with ebonite of which andesite, basalt and pyroclastic rock consist. In the southern part of the plain, from west to east, Durak Mountains (2811 m), Zor Mountain (3196 m), Pamuk Mountain (2639 m), Mount Ağrı (Ararat) (5137 m) and Little Mount Ağrı (Ararat) (3896 m) are in volcanic rock zone. In the western part of the plain, tertiary aged sediments which includes pebble stone, sand stone and clay stone can be seen. This area, roughly, covers the east of the central district and the half-north of the Tuzluca district. In the southern part of the same zone, there are basalt, andesite, trachyandesite and pyroclastic rocks.

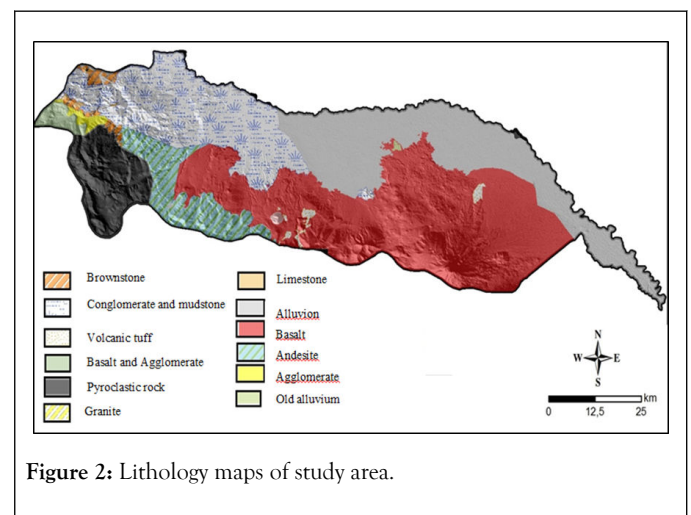


Figure 2: Lithology maps of study area.

Iğdır Plain, which is the lowest level of its area due to its altitude conditions, shows different climate features compared to its environment. Being surrounded by mountains has made it a convenient field in terms of temperature. Additionally, due to these mountainous fields, humid air cannot enter the field or, while the air descends towards to the plain, it gets hotter and makes humid deficit with the foehn effects. Thus, the field is poor in terms of rainfall conditions. Yearly average temperature in the plain is 12.1 C. This value is higher than other stations such as Ağrı (6.2°C), Kars (5.2°C) and Doğubeyazıt (9.3°C). However, plain with the 252.7 mm of rainfall is one of the areas that gets the least rainfall after Salt Lake (Konya, Karapınar) in Turkey (Table 1).

In addition to high temperature and low amount of rainfall, facilities that rainfall and temperature regime show induce that semi-arid conditions cover the plain. The main reason of the arid and semi-arid conditions is insufficient amount of rainfall

which occurs in the hot term that is called vegetation season and the high temperature values.

**Table 1:** Yearly Analysis of Monthly Average Temperature and Rainfall in Iğdır Plain. Source: Iğdır Provincial Directorate of Meteorology.

Meteorological factors	January	February	March	April	May	June	July	August	September	October	November	December	Annual Average
Average Temperature (°C)	-0,3	-3,4	-0,3	6,5	13,3	17,8	22,1	25,9	25,1	20	12,8	5,8	12,1
Amount of Rainfall	12,9	13,8	16,2	20	34,5	47,1	33	13,8	9,6	11,1	23,7	17	252,7

According to the index values which have been calculated with De Martonne's monthly aridness index, it is seen that there is water insufficiency in 9 month-period between March and December (exc. May) in Iğdır. These negative circumstances which causes serious problems in terms of flora and agricultural activities are diminished with the help of irrigation opportunity that Aras River and Karasu rivulet provides in plain zones. However, those circumstances have their effects on higher areas. Thus, apart from some forests that can be seen rarely on some high mountainous zones, the flora consists of steppe and anthropogenic steppe. The area itself is completely a part of Iran-Turan Flora Zone. Additionally, some relict and endemic species that are from Europe-Siberia flora zone can be seen in this area depending on climatic variation which happened in the ice age.

In 1990, there was a province (Iğdır), 2 districts (Aralık and Tuzluca), 1 town (Karakoyunlu) and 157 villages in the borders of Iğdır province [3,4]. Iğdır became a province in 1992. Tuzluca, Aralık districts and Karakoyunlu town were attached to the province and Iğdır had 3 districts at that time. In 1994, Halfeli and Melekli became town. In 1998, Hoşhaber became a town. The total area of those urban areas is 12,24 km<sup>2</sup> today [5].

In 1990, the total population in a province (Iğdır), 2 districts (Aralık and Tuzluca), 1 town (Karakoyunlu) and 157 villages was 142.601. The 36.4% of this population (51.867) live in urban area. The 63,6% of this population (90.734) lived in rural area. Today, there are 7 urban districts which includes 1 city center, 3 district centers and 3 town centers (Iğdır, Tuzluca, Aralık, Karakoyunlu, Melekli, Halfeli and Hoşhaber); and there are 161 village districts which are attached to those above. In 2018, the number of people living in those areas is 197.456. The 63.7% of this population (125.684) live in urban areas which includes city, district and town centers; the 36.3% of the population (71.772) live in villages.

In 30 year-period between 1990-2018, the population living in urban areas has increased 142%. Increasing the needs of food, sheltering etc., which is parallel to the population increase, has raised the amount of stress on agricultural fields and there have been significant changes about the use of land. Considering all of urbanization has been settled on the plain, it is easy to understand how strong the population stress on agricultural fields is.

## MATERIAL AND METHODS

Remote sensing provides vital easiness and superiority on monitoring and recording the changes in cultivated and wild vegetation on the earth, water resources and agricultural production processes. In this context, the land use changes between 1987 and 2017 in Iğdır plain and its surroundings were examined using remote sensing and the direction of change and its intensity have been analyzed.

In this research, a change of cultivated areas and its relations with natural environment conditions in Iğdır plain and its around have been investigated in 30 years period that is between 1987-2017 using Erdas Imagine. Accordingly, Landsat satellite images in 1987's and 2017's summer have been used. Landsat satellite data have been used in many other studies of which the subject is the change of land cover [6-11].

Controlled classification method has been applied to the satellite pictures via segmentation module and Maximum Likelihood technique. Maps of land use consist of 5 classes. Those classes are dry agriculture, irrigated agriculture, meadow/pasture, shrub/forest and settlement. Additionally, accuracy analysis has been applied to each classed map to determine how close each classification to the reality. Hereat, overall accuracy is 80%; and Kappa values are above 80%. (Table 2 and 3).

The lands in Iğdır have been classified into 4 classes; settlement, agriculture, meadow/pasture and shrub/forest; and the agricultural fields have been classified into 2 classes; dryland and irrigated farming fields. Thereby, investigating the changes in lands in the province in details has been provided even those things are inter-bedded. Lastly elevation zone and land use map is a component of spatial modeling using overlay analysis (Figure 3). "Overlay analysis" model was adopted in GIS to assign the class and theme-wise weights for input parameters and the weighted layers were integrated [12].

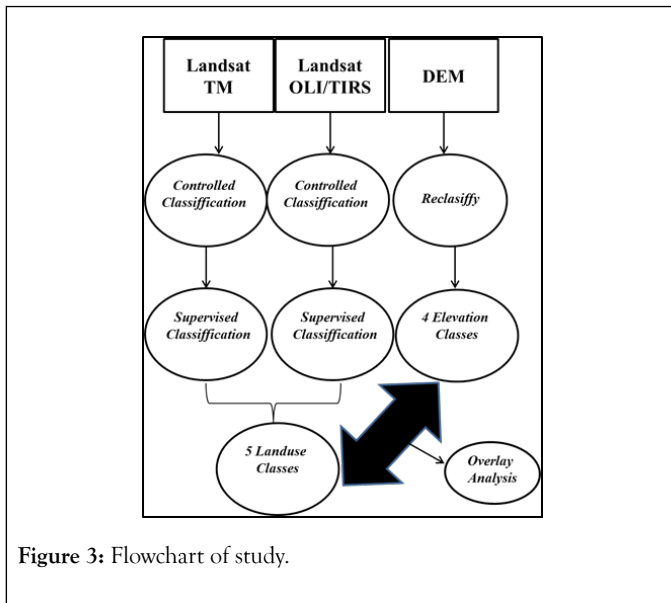


Figure 3: Flowchart of study.

Table 2: Accuracy Analysis Results of 1987 Land Use Map. 1987 Confusion Matrix Overall Accuracy 88%, Kappa 80%.

Usage	Settlement	Irrigated Agriculture	Dryland Agriculture	Meadow/Pasture	Shrub/Forest	Total	User Error (%)
Settlement	3	0	2	0	0	5	0.5
Irrigated Agriculture	0	5	1	0	0	6	0
Dryland Agriculture	0	1	35	3	0	39	0.07
Meadow/Pasture	0	0	5	26	0	31	0.13
Shrub/Forest	0	0	0	0	19	19	0.08
Total	3	6	43	29	19	100	
Producer Error(%)	0	0.25	0.12	0.08	0		0.18

Table 3: Accuracy Analysis Results of 2017 Land Use Map.

Usage	Settlement	Irrigated Agriculture	Dryland Agriculture	Meadow/Pasture	Shrub/Forest	Total	User Error (%)
Settlement	8	2	1	1	0	12	0.4
Irrigated Agriculture	0	23	0	0	0	23	0
Dryland Agriculture	0	0	22	3	0	25	0.09
Meadow/Pasture	0	0	1	20	0	21	0.02
Shrub/Forest	0	1	0	0	18	19	0
Total	5	27	31	37	0	100	
Producer Error (%)	0	0.07	0.06	0.1	0		0.08

2017 Confusion Matrix Overall Accuracy 91%, Kappa 87%.

RESULTS

LAND USE STATUS IN 1987

In 1987, 43% of the land in the province (193,500 ha.) consisted of grassland and meadow, namely pasture. (Table 4).

Table 4: Last 30 Years of Land Use Classes (1987-2017).

Land Classes	1987			2017		
	(%)	Area (km)	Area (ha)	(%)	Area (km)	Area (ha)
Irrigated Agriculture	6	270	27.000	16	720	72.000
Dryland Agriculture	21	945	94.500	9	405	40.500
Shrub and Forest	23	1035	103.500	22	990	99.000
Pasture (Grassland-Meadow)	43	1935	193.500	40	1800	180.000
Settlement	7	315	31.500	13	585	58.500

Pasture areas, which have wide spread area in mountainous regions, were also seen in lowland areas. For instance, 6% of the total land area between 800-1000 meters were composed of pasture areas. A significant portion of these areas were in the eastern part of the Iğdır Plain, especially in areas where the Karasu rivulet caused drainage problems. In this area and Dil Plain where the ground water was, any time or a part of the year, high enough to damage the plant growth, some of the fertile agricultural areas that could not be cultivated were used as grassland or pasture areas.

In 1987, the pasture and meadow areas were followed by shrubs and forest areas with 23% and 103.500 hectares. The shrub formation, which started at approximately 900 meters on the mountainsides, occupied more space as moving towards the mountainous areas. For example, the bush formation creating 2% of the land in the 800-1000 meter elevation zone constituted 22% of the 1001-1200 meter elevations, 19% of the 1200-1400 meter elevations and 19% of areas higher than 1400 meters.

In 1987, agricultural land constituted of 22% of total area of use in the province with 122.500 ha. 21% (94.500 hectares) of these areas were dryland, 6% (27.000 hectares) of were irrigated agricultural areas. Agricultural areas were in lowland areas and in some tributaries. Iğdır Plain covered a large part of the agricultural land.

90% of the land between the 800-1000 meter elevations where the plain is located, and 6% of the land between 1001-1200 meter elevations were composed of agricultural areas. In both highlands, agricultural areas lacked irrigation except some river valleys, and in a narrow area of only 800-1000 meters (6%) irrigated agriculture was carried out. Irrigated agricultural areas were located in the western part of the Iğdır Plain. The mentioned irrigation was made by the West Iğdır Irrigation which started in 1938-1939 and started to operate in 1963. In this period, irrigation could not be done in all projected areas due to some reasons such as land wasn't leveled, levels of the

Meadow and pasture areas were mostly located in areas higher than 1000 meters. e.g. 71% of the total land area between 1001-1200 meters, 81% of land area between 1201-1400 meters and %64 of land area over 1400 meters consisted of pasture areas (Table 5, Figure 3).

channel elevations was lower than some lands and lack of efficiency from the channels owing to siltation [13].

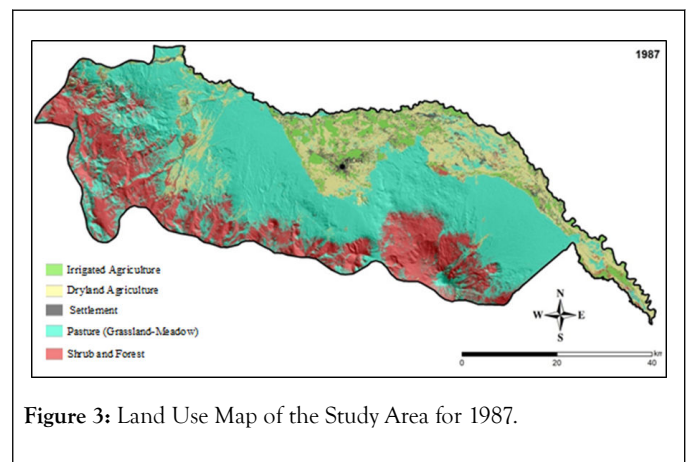


Figure 3: Land Use Map of the Study Area for 1987.

Table 5: Changes in Land Use According to elevation levels.

Elevation	Land Class (1987)	Land Class (2017)
800-1000	Dryland Agriculture 84%	Dryland Agriculture 19%
	Irrigated Agriculture 6%	Irrigated Agriculture 68%
	Pasture 6%	Pasture 6%
	Settlement 2%	Settlement 6%
	Forest 2%	Forest 1%
1001-1200	Pasture 71%	Pasture 70%
	Forest 22%	Forest 22%
	Dryland Agriculture 6%	Dryland Agriculture 7%

	Settlement 1%	Settlement 2%
1201-1400	Pasture 81%	Pasture 82%
	Forest 19%	Forest 18%
1401 and >	Pasture 64%	Pasture 63%
	Forest 36%	Forest 37%

In 1987, by 31,500 ha. area and %7 ratio, the lowest usage area in the province was settlement areas. The settlement areas were especially located around 800-1000 meters. Iğdır city center, the district center of Aralık and Karakoyunlu District and the villages of these settlements constituted the settlement areas in this region. Only 1% of the total area of 1001-1200 meter plateau areas corresponded to the settlements. Tuzluca district center and settlements connected to this district constituted mentioned settlement areas. In 1987, the area covered by the settlement areas in the province was 4500 hectares more than the irrigated agricultural areas in the province. This situation shows that irrigation problem was significant in Iğdır Plain on the same date.

#### LAND USE STATUS IN 2017.

When the land use status of Iğdır province in 2017 is examined, it is seen that the areas with the most usage area are pasture and meadow (pasture) areas with 40% ratio and 180.000 ha (Table 4). This is due to the fact that the area is completely covered with mountainous areas from south and west. When we look at the spatial distribution of grassland and meadow, it is seen that it continues like an uninterrupted strip, mostly in mountainous areas higher than 1000 meters (Figure 4). To be specific, pastureland areas with 6% ratio in Iğdır Plain and between 800-1000 meters constitute 70% of the total land between 1001-1200 meters, 82% of the total land between 1201-1400 meters and 63% of the total land over 1400 meters (Table 5).

When the settlement scale is examined, it is observed that meadows and pasture areas are more common in settlements near mountainous areas. For example, although it was established in the plain that 66% of the total land in Karakoyunlu district center, which is located on the northern sides of Mount Ararat, consists of meadow and pasture areas [14]. It can be seen that meadow and grassland areas combine with bush formation in higher parts of mountains and form shrub-step or shrub-meadow plant cover. The meadow and pasture areas on the plain actually are located in fertile agricultural land. On the other hand, in these soils, due to both natural conditions and human activities, there has been aridification, this aridification constitute an impediment in agriculture use and therefore the arid areas are used as pastures. With the improvement of the productivity of the agricultural lands which have the problem of aridification by the necessary reclamation and rehabilitation methods, these soils can be used for agricultural purposes [15].

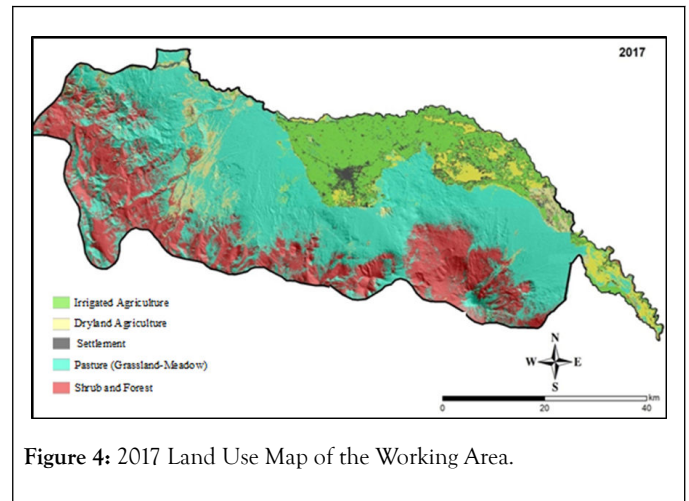


Figure 4: 2017 Land Use Map of the Working Area.

Another reason for the use of arable land in pasture areas as meadow and pasture is the higher salinity in the soil. More than one third of agricultural lands in Iğdır plain have lost their efficiency under the influence of salt [16]. In many places, high ground water and excessive irrigation of agricultural areas have a negative effect on agricultural activity by increasing the salinity in the soil. In such areas, agricultural areas are used as pastures. After the meadow and pasture areas, the most used lands are farmlands. Almost all of the agricultural areas being 112.500 hectares are located in Iğdır Plain. 68% of the total land area of 800-1000 meters in the plain consists of irrigated agriculture, 19% of them consists of dryland agriculture. Irrigated agricultural areas with a rate of 68% are in Iğdır and Dil plains between 800-900 meters.

The implementation of the irrigation of the East Iğdır Plain in 1991 played an important role in this regard. The dry agricultural areas, which constitute 19% of the area, are located on lowland area outside the irrigation area of Aras River and Karasu rivulet, low-pitched mountainsides in the 900-1000 meter elevation range, and plateau areas. Other agricultural areas in the province are some river valleys (Aras River and the secondary branches of this river, such as Gaziler and Buruksu Streams) and especially dryland agricultural areas in Düztap and Toptaş plateaus having 1600-1800 meters elevation, which are in the province of Tuzluca and the continuation of the Kars plateau. These areas, which are largely devoid of irrigation conditions, are among the main areas of grain production in the province [17].

After the agricultural areas, the land having the most area are shrub-forest lands consisted of 99.000 hectares. These lands corresponding to 22% of the total area are seen in the high parts of the mountains surrounding the province from the west and south. The shrubs and forest cover with a rate of 1%, which have an elevation of 800-1000 meters and a large part of these areas consisting of plain areas, can be seen in larger areas as they rise.

Shrub and forest cover constitutes 22% of all land between 1001-1200 meters, 18% of all land between 1201-1400 meters and 37% of all lands over 1400 meters.

As of 2017, areas with the least usage area in the province are settlement areas. Settlements having 58,500 hectares correspond to 13% of the total area of use. Since the main economic activity in the province is agricultural, the settlements are mostly in the plains. In the last 30 years, due to the rural settlements and the migrations from outside the province, the population has grown and expanded to the fields of agriculture and pasture. In 1987, the settlement areas occupied 31,500 hectares and it was 7% of total province acreage. In 2017, the area covered by the settlements reached to 58,500 hectares and the ratio of the total province acreage reached to 13%. This situation in the province is one of the most important environmental problems like the other bottom lands of our country [18].

## CONCLUSION

In the study area, there were significant changes in land use, particularly in agricultural areas, during the period. In this period, 121,500 hectares of agricultural land decreased by 9,000 hectares and decreased to 112,500 hectares. Another important change in the use of agricultural areas is the transformation of dry agricultural land into irrigated agricultural areas. In 1987, 27,000 hectares of irrigated land area increased to 72,000 hectares in 2017. On the contrary, 94,500 hectares of dryland agricultural area decreased to 40,500 hectares. Thus, in 1987, irrigated agricultural areas with a ratio of 6% increased to 16% in 2017 within total use of areas while the rate of dry agricultural areas with a ratio of 21% decreased to 9%.

The place where the change in agricultural land use occurred most is Iğdır Plain that has the most important and the largest agricultural land in the province. In 1987, 90% of the total area, which are between 800-1000 meters, consisted of agricultural areas, which decreased to 87% in 2017. Besides, in 1987, 84% of the land, which is between 800-1000 meters, was a dry agricultural area and 6% of the land was irrigated. In 2017, the dry agricultural areas declined to 19% while the irrigated agricultural areas increased to 68%. In last years, agricultural areas, which were mostly for cereal production with dry farming method, were converted to the irrigated farming for especially clover and silage corn production. Moreover, conventional agricultural production based on cereal production in mountain rural settlements mainly connected to Tuzluca district and Iğdır central district is carried out by dry farming method.

Another important change in land use during the period 1987-2017 is the expansion of some settlements against agricultural and pasture areas. In 1987, settlement areas, which had 7% ratio and 31,500 hectares of all usage areas, increased by 27,000 hectares in 2017 and reached 58,500 hectares; furthermore, its share in total usage areas increased to 13%. 9,000 hectares of growth of 27,000 hectares was realized on agricultural land. The total settlement area in the Iğdır Plain has grown three times as a result of the growth of Iğdır City. Iğdır became a province in 1992 and the Dilucu Border Gate was opened on the same date. Accordingly, the city has entered a rapid development process. This development has been more economic, and since the 1990s, the population has grown with intense migration towards the center. Thus, the agricultural

areas quickly began to transform into urban areas. The number of neighborhoods which were 9 in 1984 increased to 14 in 2001.

The population living in urban areas has increased by 142% in approximately 30 years period between 1990 and 2018. In parallel with the increase in population in urban areas, the increase of food, housing and similar needs increased the pressure on agricultural areas in particular, and in the last approximately 30 years, there have been significant changes in land use, mainly in agricultural land. Considering the fact that urban areas are established entirely in lowland areas, it can be better understood how strong the population pressure for agricultural areas is.

In 1987, the settlements areas in the 800-1000 meters elevation zone including the Iğdır Plain increased from 2% to 6%. The settlement areas, which are between 1001-1200 meters, have increased by 2 times from 1% to 2%. This increase is due to the fact that Tuzluca district center, which is the biggest settlement in this elevation range, has grown considerably over a period of 30 years.

In the 30-year period, pasture and meadow fields have decreased from 43% to 40%. Pasture and meadow fields have been turned into agricultural areas, especially in the lowland area where irrigation facilities have increased. Due to soil improvement studies, irrigation facilities and increasing mechanization, dry agricultural areas are rapidly transformed into irrigated agricultural areas. On the other hand, as in the whole province, the most important problem of the soils in the plains is aridification which causes agricultural areas to be used as pasture areas in some areas. In Iğdır province, no change is observed in meadow and pasture lands in mountainous areas as opposed to plains. This is due to the fact that there is no improvement in irrigation conditions in these areas and the tractor cannot be used owing to the mountainous terrain.

The fact that the soils where meadows and pastures are distributed are mostly shallow and they cannot provide the moisture needed by the plant are the most important problems of these areas of use. For this reason, when the spring rainfall ends, the vegetation in the meadow and grassland areas turn pale and get dry. Another problem with meadows and pastures is erosion. In addition to water erosion being effective in mountainous areas across the province, wind erosion also occurs in regions where Little Mount Ağrı (Ararat) meets with the Dil Plain (Aralık district center, Yukarı Aratan and Emince villages) Wind erosion is effective in 13554 hectares whose 82% is allocated to the pasture. Because of this erosion, pasture areas have lost their character. In order to prevent this situation and to protect the settlements from the danger of wind erosion, wind erosion prevention works have been carried out since 1978 in the field. Studies have begun to give positive results.

There was a 1% decrease in shrub and forest cover in the field and 103,500 hectares of forest and bushes in 1987 have declined 99,000 hectares. The decrease in the shrub and forest area can be seen as the negative effects of fires, which occur occasionally in Little Mount Ağrı (Ararat) or Greater Mount Ağrı (Ararat), on forests.

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