

TEMPORAL CHANGES OF LAND USE CAPABILITY CLASSIFICATION DEPENDING ON THE URBAN DEVELOPMENT: CASE STUDY OF TRABZON PROVINCE

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ABSTRACT:

Achieving high efficiency by taking advantage of agricultural land at a high level allows the continued vitality of the soil and also contributes to the country's economy. The land with the most fertilizer from agricultural land is generally the first class agricultural land (I.) followed by second (II.) and third class (III.) agricultural lands. It is accepted that all these lands are considered to be protected and various restrictions have been introduced to these lands. Soil conservation, use and development of balanced is possible to be defined in detail by exploiting the developing science and technology possibilities, determination well-defined properties and the implementation of policies by making the necessary plans. For this reason, Trabzon province is selected as the pilot region land use capability of agricultural land classes (especially urban-rural area and plateau) ongoing changes in the past years until today are examined depending on the land use first, second and third class. In this context, satellite images for 2002, 2005, 2009 and 2017 and land use data including the non-agricultural use of the province of Trabzon has been discussed and the temporal changes of agricultural areas depending on land use capability have been examined using Geographic Information Systems (GIS). In all the productive areas of Trabzon Province, the increase in urban-rural development has been examined in detail because of especially the creation of planned areas and the occurrence of construction needs. This study is a small-scale case study and the results are examined and analyzed using GIS.

1. INTRODUCTION

Agricultural land generally is considered suitable for agriculture in terms of topography and climate characteristics or has been converted into cultivated land areas. Agricultural areas are classified according to their importance by considering certain standards for the purpose of the proper use of agricultural land in agricultural production and to transfer it to other uses. This classification is mainly aimed at preventing the unintended use of agricultural land (T.C. Official Gazette, 2005; URL-1, 2016). In 2001, the decisions taken in the Turkish Civil Code didn't prevent the disintegration of agricultural land (T. C. Official Gazette, 2001). For this reason, in Turkey, "Law on Soil Protection and Land Use, Law No:5403" was issued in 2005 (T.C. Official Gazette, 2005). The purpose of the "Law on Soil Protection and Land Use" determine procedures and principles that provides conservation and development of soils, classification of agricultural land, determination of minimum and sufficient agricultural land sizes and prevention of their division and the planned use of agricultural land and sufficient income agricultural land in accordance with environment priority sustainable development principle (T.C. Official Gazette, 2005). In this context, it is aimed to protect the soil.

The average between 50 and 100 thousand hectares of land every year in Turkey is exposed to non-agricultural use departing from agricultural production (xxxxx). In particular, in the evaluation of use agricultural areas covering the years 2004-2013 carried out by Turkish Statistical Institute, it has been determined that 27.8 million decare of agricultural land are left out of production in Turkey (TUIK,2016). As long as the agricultural use of the agricultural land areas continues in our country, the limited amount of fertile agricultural land areas will decrease rapidly and destroyed. At this point, at the 2023 target of the Ministry of Development has report of the Working Group on the Sustainable

Use of Agricultural Land. There are some regulatory initiatives in this report about the vision of the future (T.C. Kalkınma Bakanlığı, 2014) and it is aimed to protect agricultural land areas in our country. In the conducted national studies about land use have been continued and determinations have been carried out (Yılmaz,2001; Yavuz, 2005; Kayıkçı,2005; Topçu, 2012; Dengiz ve Turan, 2014; Geymen, 2017).

For this study, Trabzon province was selected as pilot region since the geological structure of Trabzon province is not suitable for agriculture, a large part of the land can not be used for cultivation purposes. Especially when important agricultural land areas are located in coastal areas, people search for new habitats which leads to the creating of important agricultural land to construction. The agricultural land class maps of 1996, obtained from the General Directorate of Agricultural Reform shows that important agricultural land areas has more precedence in Trabzon. But lack of alternative areas in recent years and especially the creation of planned land areas cause agricultural land to be used out of agriculture and this has led to a reduction of the existing productive agricultural land areas. On the other hand, in recent years especially in the province of Trabzon, rapid urbanization process and activities and determining the form of land use the creation of planned areas such as industry, tourism in the plateaus has led to an increase in non-agricultural use. However, the result of the use of agricultural land areas for non-agricultural purposes such as urbanization, industry and tourism reveal the danger of extinction so that there is no recycling of agricultural land.

In the province of Trabzon selected as the pilot region in the study, non-agricultural uses in land use capability, creation of new living spaces, the creation of planned lands within economic purposes such as tourism, industry has been carried out. Ministry of Food, Agriculture and Livestock Provincial Directorate of

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Trabzon have provided Datas belonging to agricultural land areas. As the spatial data in the execution of the work, earth maps and satellite images of different years are used. Spatial datas of the 1st, 2nd and 3rd degree agricultural land subject to the study is evaluated using the soil map produced in 1996. The satellite images that temporal changes can be analyzed are provided satellite images from 2002, 2005, 2009, and 2017 located in Google Earth program. In the point of providing the spatial data on the obtained images, digitization were done using Geographic Information Systems and Google Earth program jointly. The amount of increase in the construction was calculated by taking into account the regions where the temporal change is most observed through the spatial data and the size of the progression from the coastal parts of the new settlement to the rural areas and plateau has been examined. Spatiotemporal changes depending on years were examined and current situation at major small locations are examined with as a case study.

2. MATERIAL AND METHODS

2.1. Study area

This study was carried out in the province of Trabzon, which is one of the largest cities in the eastern Black Sea region of north east Turkey. The province is located between the eastern meridian of 38° 30' - 40° 30' and the northern parallel of 40° 30' - 41° 30'. The area selected as the pilot zone is shown in Figure 1.



Figure 1. Study area

2.2. Data acquisition and regulation

In this study, it was examined the impact of construction on the agricultural lands both urban and rural areas, and also plateau especially in relation to tourism in Trabzon Province. Temporal change analysis were performed using land maps and satellite images. For this purpose, relevant spatial datas were evaluated in ArcGIS 10.4 software. In this context, the land data was provided from the Provincial Directorate of Agriculture of Trabzon in 1996 and satellite images for 2002, 2005, 2009 and 2017 were provided via Google Earth program. First of all, datas on agricultural lands taken from the Provincial Directorate of Agriculture have been arranged. On the spatial data with the help of the map of classes of agricultural lands called land use capability classification map, agricultural lands have been identified and the degrees of these fields have been added to the attribute table (I., II, III.). 1st, 2nd and 3rd degree agricultural lands were divided into separate layers on the remaining agricultural land using ArcGIS 10.4 software (Figure 2).

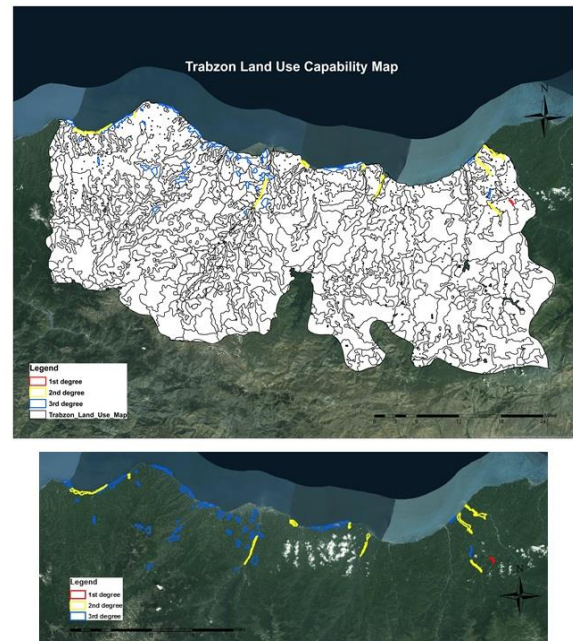


Figure 2. Trabzon land use capability classification map

The surface area of these lands was calculated with the help of the program. In order to determine the extent to which the construction has increased based on the images available in 2002, 2005, 2009 and 2017, the existing spatial datas were transferred to Google Earth and the constructions are digitized using Google Earth and ArcGIS program together. All datas were then integrated into the ArcGIS 10.4 program to create a spatial database. The database of the GIS layer showing the land use capability of Trabzon province was shown in Figure 3. In this context, the locations of the 1st, 2nd and 3rd degree agricultural land were searched through questionnaires in the related database (Figure 3).

OBJECT_ID	Shape	STID	STON	STLN	STAZ	STAZ2	STAZ3	STAZ4	STAZ5	STAZ6	STAZ7	STAZ8	STAZ9	STAZ10	STAZ11	STAZ12	STAZ13	STAZ14	STAZ15	STAZ16	STAZ17	STAZ18	STAZ19	STAZ20	STAZ21	STAZ22	STAZ23	STAZ24	STAZ25	STAZ26	STAZ27	STAZ28	STAZ29	STAZ30	STAZ31	STAZ32	STAZ33	STAZ34	STAZ35	STAZ36	STAZ37	STAZ38	STAZ39	STAZ40	STAZ41	STAZ42	STAZ43	STAZ44	STAZ45	STAZ46	STAZ47	STAZ48	STAZ49	STAZ50	STAZ51	STAZ52	STAZ53	STAZ54	STAZ55	STAZ56	STAZ57	STAZ58	STAZ59	STAZ60	STAZ61	STAZ62	STAZ63	STAZ64	STAZ65	STAZ66	STAZ67	STAZ68	STAZ69	STAZ70	STAZ71	STAZ72	STAZ73	STAZ74	STAZ75	STAZ76	STAZ77	STAZ78	STAZ79	STAZ80	STAZ81	STAZ82	STAZ83	STAZ84	STAZ85	STAZ86	STAZ87	STAZ88	STAZ89	STAZ90	STAZ91	STAZ92	STAZ93	STAZ94	STAZ95	STAZ96	STAZ97	STAZ98	STAZ99	STAZ100	STAZ101	STAZ102	STAZ103	STAZ104	STAZ105	STAZ106	STAZ107	STAZ108	STAZ109	STAZ110	STAZ111	STAZ112	STAZ113	STAZ114	STAZ115	STAZ116	STAZ117	STAZ118	STAZ119	STAZ120	STAZ121	STAZ122	STAZ123	STAZ124	STAZ125	STAZ126	STAZ127	STAZ128	STAZ129	STAZ130	STAZ131	STAZ132	STAZ133	STAZ134	STAZ135	STAZ136	STAZ137	STAZ138	STAZ139	STAZ140	STAZ141	STAZ142	STAZ143	STAZ144	STAZ145	STAZ146	STAZ147	STAZ148	STAZ149	STAZ150	STAZ151	STAZ152	STAZ153	STAZ154	STAZ155	STAZ156	STAZ157	STAZ158	STAZ159	STAZ160	STAZ161	STAZ162	STAZ163	STAZ164	STAZ165	STAZ166	STAZ167	STAZ168	STAZ169	STAZ170	STAZ171	STAZ172	STAZ173	STAZ174	STAZ175	STAZ176	STAZ177	STAZ178	STAZ179	STAZ180	STAZ181	STAZ182	STAZ183	STAZ184	STAZ185	STAZ186	STAZ187	STAZ188	STAZ189	STAZ190	STAZ191	STAZ192	STAZ193	STAZ194	STAZ195	STAZ196	STAZ197	STAZ198	STAZ199	STAZ200	STAZ201	STAZ202	STAZ203	STAZ204	STAZ205	STAZ206	STAZ207	STAZ208	STAZ209	STAZ210	STAZ211	STAZ212	STAZ213	STAZ214	STAZ215	STAZ216	STAZ217	STAZ218	STAZ219	STAZ220	STAZ221	STAZ222	STAZ223	STAZ224	STAZ225	STAZ226	STAZ227	STAZ228	STAZ229	STAZ230	STAZ231	STAZ232	STAZ233	STAZ234	STAZ235	STAZ236	STAZ237	STAZ238	STAZ239	STAZ240	STAZ241	STAZ242	STAZ243	STAZ244	STAZ245	STAZ246	STAZ247	STAZ248	STAZ249	STAZ250	STAZ251	STAZ252	STAZ253	STAZ254	STAZ255	STAZ256	STAZ257	STAZ258	STAZ259	STAZ260	STAZ261	STAZ262	STAZ263	STAZ264	STAZ265	STAZ266	STAZ267	STAZ268	STAZ269	STAZ270	STAZ271	STAZ272	STAZ273	STAZ274	STAZ275	STAZ276	STAZ277	STAZ278	STAZ279	STAZ280	STAZ281	STAZ282	STAZ283	STAZ284	STAZ285	STAZ286	STAZ287	STAZ288	STAZ289	STAZ290	STAZ291	STAZ292	STAZ293	STAZ294	STAZ295	STAZ296	STAZ297	STAZ298	STAZ299	STAZ300	STAZ301	STAZ302	STAZ303	STAZ304	STAZ305	STAZ306	STAZ307	STAZ308	STAZ309	STAZ310	STAZ311	STAZ312	STAZ313	STAZ314	STAZ315	STAZ316	STAZ317	STAZ318	STAZ319	STAZ320	STAZ321	STAZ322	STAZ323	STAZ324	STAZ325	STAZ326	STAZ327	STAZ328	STAZ329	STAZ330	STAZ331	STAZ332	STAZ333	STAZ334	STAZ335	STAZ336	STAZ337	STAZ338	STAZ339	STAZ340	STAZ341	STAZ342	STAZ343	STAZ344	STAZ345	STAZ346	STAZ347	STAZ348	STAZ349	STAZ350	STAZ351	STAZ352	STAZ353	STAZ354	STAZ355	STAZ356	STAZ357	STAZ358	STAZ359	STAZ360	STAZ361	STAZ362	STAZ363	STAZ364	STAZ365	STAZ366	STAZ367	STAZ368	STAZ369	STAZ370	STAZ371	STAZ372	STAZ373	STAZ374	STAZ375	STAZ376	STAZ377	STAZ378	STAZ379	STAZ380	STAZ381	STAZ382	STAZ383	STAZ384	STAZ385	STAZ386	STAZ387	STAZ388	STAZ389	STAZ390	STAZ391	STAZ392	STAZ393	STAZ394	STAZ395	STAZ396	STAZ397	STAZ398	STAZ399	STAZ400	STAZ401	STAZ402	STAZ403	STAZ404	STAZ405	STAZ406	STAZ407	STAZ408	STAZ409	STAZ410	STAZ411	STAZ412	STAZ413	STAZ414	STAZ415	STAZ416	STAZ417	STAZ418	STAZ419	STAZ420	STAZ421	STAZ422	STAZ423	STAZ424	STAZ425	STAZ426	STAZ427	STAZ428	STAZ429	STAZ430	STAZ431	STAZ432	STAZ433	STAZ434	STAZ435	STAZ436	STAZ437	STAZ438	STAZ439	STAZ440	STAZ441	STAZ442	STAZ443	STAZ444	STAZ445	STAZ446	STAZ447	STAZ448	STAZ449	STAZ450	STAZ451	STAZ452	STAZ453	STAZ454	STAZ455	STAZ456	STAZ457	STAZ458	STAZ459	STAZ460	STAZ461	STAZ462	STAZ463	STAZ464	STAZ465	STAZ466	STAZ467	STAZ468	STAZ469	STAZ470	STAZ471	STAZ472	STAZ473	STAZ474	STAZ475	STAZ476	STAZ477	STAZ478	STAZ479	STAZ480	STAZ481	STAZ482	STAZ483	STAZ484	STAZ485	STAZ486	STAZ487	STAZ488	STAZ489	STAZ490	STAZ491	STAZ492	STAZ493	STAZ494	STAZ495	STAZ496	STAZ497	STAZ498	STAZ499	STAZ500	STAZ501	STAZ502	STAZ503	STAZ504	STAZ505	STAZ506	STAZ507	STAZ508	STAZ509	STAZ510	STAZ511	STAZ512	STAZ513	STAZ514	STAZ515	STAZ516	STAZ517	STAZ518	STAZ519	STAZ520	STAZ521	STAZ522	STAZ523	STAZ524	STAZ525	STAZ526	STAZ527	STAZ528	STAZ529	STAZ530	STAZ531	STAZ532	STAZ533	STAZ534	STAZ535	STAZ536	STAZ537	STAZ538	STAZ539	STAZ540	STAZ541	STAZ542	STAZ543	STAZ544	STAZ545	STAZ546	STAZ547	STAZ548	STAZ549	STAZ550	STAZ551	STAZ552	STAZ553	STAZ554	STAZ555	STAZ556	STAZ557	STAZ558	STAZ559	STAZ560	STAZ561	STAZ562	STAZ563	STAZ564	STAZ565	STAZ566	STAZ567	STAZ568	STAZ569	STAZ570	STAZ571	STAZ572	STAZ573	STAZ574	STAZ575	STAZ576	STAZ577	STAZ578	STAZ579	STAZ580	STAZ581	STAZ582	STAZ583	STAZ584	STAZ585	STAZ586	STAZ587	STAZ588	STAZ589	STAZ590	STAZ591	STAZ592	STAZ593	STAZ594	STAZ595	STAZ596	STAZ597	STAZ598	STAZ599	STAZ600	STAZ601	STAZ602	STAZ603	STAZ604	STAZ605	STAZ606	STAZ607	STAZ608	STAZ609	STAZ610	STAZ611	STAZ612	STAZ613	STAZ614	STAZ615	STAZ616	STAZ617	STAZ618	STAZ619	STAZ620	STAZ621	STAZ622	STAZ623	STAZ624	STAZ625	STAZ626	STAZ627	STAZ628	STAZ629	STAZ630	STAZ631	STAZ632	STAZ633	STAZ634	STAZ63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determined. The total surface area of these areas were 3289.29m². Some of these lands were close to the city center and coastal parts, while some remain in mountainous areas. Fertile agricultural land areas close to the city center and coastal areas have been almost disappeared exposed to construction as a result of increasing population growth and people needing new places to live. Fertile agricultural land areas located in mountainous areas, there was no improvement in the construction of these areas due to the fact that they were far away from construction. These lands were located in: Ortahisar district Akoluk village, Araklı district Yigitozu village, Arsin district Yanbolu village, Besikdüzü district coastal part, Carsibasi district coastal part, Hayrat district, Ortahisar district Kasüstü town, Of district (4 agricultural land areas), Vakfikebir district. The 3rd degree agricultural land was 36 and the total surface area is 9605.10m². While some of these agricultural lands protected its existence by unstructured, agricultural lands were built at high rates and deprived of destruction together with the creation of planned areas near the city center.

Given the 3rd degree of agricultural land, 9 of them in Akcaabat district, 15 of them in Ortahisar district, 3 of them in Vakfikebir district, 1 of them in Macka district, 1 of them in Of District, 1 of them in Arsin district, 2 of them in Besikdüzü district, 1 of them in Duzkoy district, 1 of them in Hayrat district. According to the obtained findings, a total of 49 agricultural lands were found in the form of efficient land classification.

2.3. Examining of increase in construction on fertile agricultural land

Considering the current agricultural land in the province of Trabzon, it has been identified 1 in total 1st degree, 12 in total 2nd degree and 36 in total 3rd degree agricultural land. These were obtained through Google Earth based on the years in which these agricultural land areas are adequate for satellite imagery. The constructions on both of the received satellite images were digitized with the help of Google Earth and ArcGIS 10.4. So, the increase in the constructions and development between years was observed. Since the 1st degree agricultural land was located in the mountainous area, there was no settlement here. It was discussed 2nd and 3rd degree agricultural land that the construction has increased visibly over the years, creation of planned areas and urban change due to the search for new settlements. Accordingly, two 2nd degree agricultural land area, two 3rd degree agricultural land area was carried out. While Araklı and Vakfikebir districts were examined 2nd degree agricultural land areas, Akcaabat district and Hidirnebi plateau were examined 3rd degree agricultural land areas.

2. RESULTS

As a result of the application, it was seen that there was no construction in the Hayrat district, which has the 1st degree agricultural land area. When the fields encountering the secondary agricultural land were considered, 2009 and 2017 satellite images were taken as basis for Araklı district. As a result of the digitization process performed in 2009, there were 127 construction buildings in this area and in 2017 the number of construction buildings has increased to 164. In the 8 years, the number of buildings increased by 37. Construction was increased by about 29.13% in this area (Figure 4).

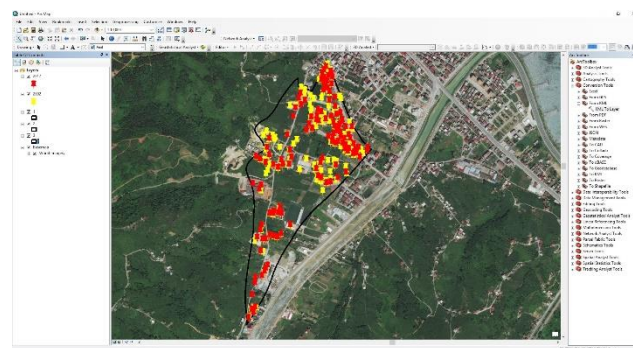
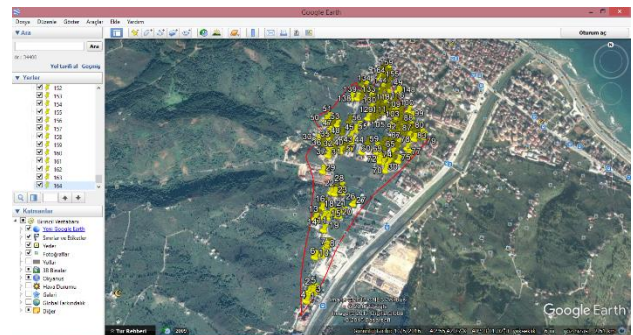


Figure 4. 2nd degree coinciding part of urban development in the Araklı district

2009 and 2017 satellite images were taken as basis for the Vakfikebir district located on the coastal area. As a result of the digitization process performed in 2009, there were 209 construction buildings in this area and in 2017 the number of construction buildings has increased to 222. In the 8 years, the number of buildings increased by 13. Construction was increased by about 6.22% in this area (Figure 5).

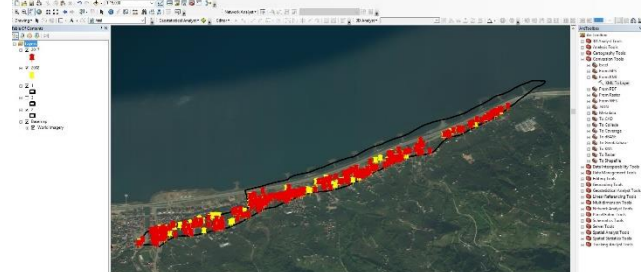
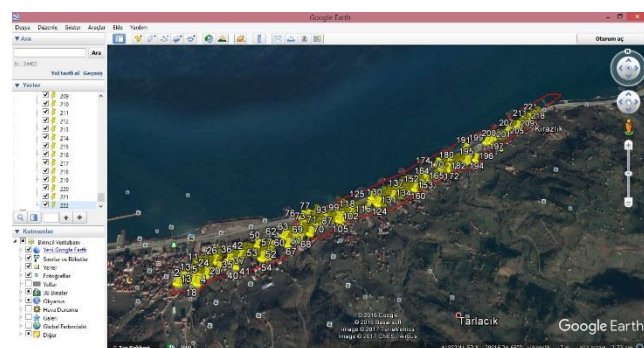


Figure 5. 2nd degree coinciding part of urban development in the Vakfikebir district

Looking at the 3rd degree areas covered in the application, 2002 and 2017 satellite images were taken as basis located at the center of the Akcaabat district in the coastal area. Because of the digitization process performed in 2002, there were 303 construction buildings in this area and in 2017 the number of construction buildings has increased to 575. In the 15 years, the number of buildings increased by 272. Construction was increased by about 89.72% in this area (Figure 6).

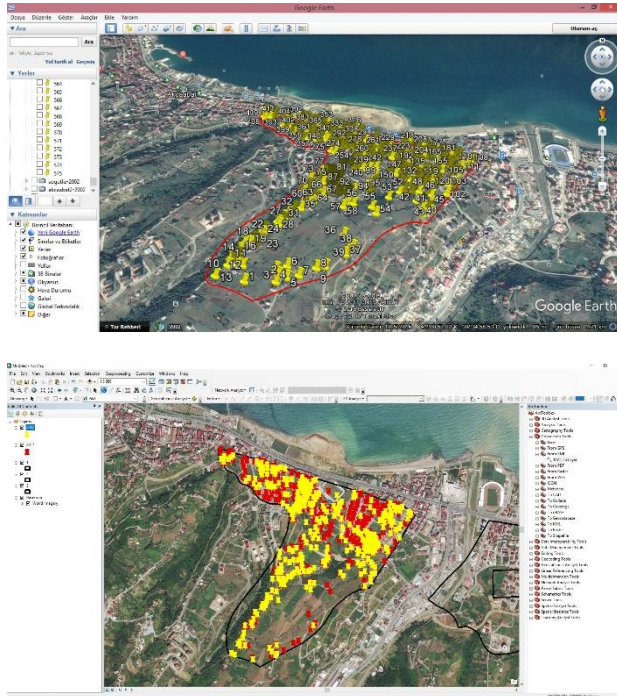


Figure 6. 3rd degree coinciding part of urban development in the Akcaabat district

Another 3rd degree agricultural land, was located on the Hidirnebi plateau, satellite images for 2005 and 2017 were taken as basis. As a result of the digitization process performed in 2005, there were 196 construction buildings in this area and in 2017 the number of construction buildings has increased to 313. In the 15 years, the number of buildings increased by 117. Construction was increased by about 59.69% in this area (Figure 7).

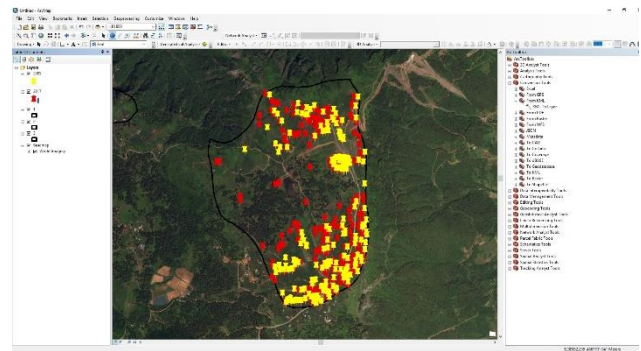
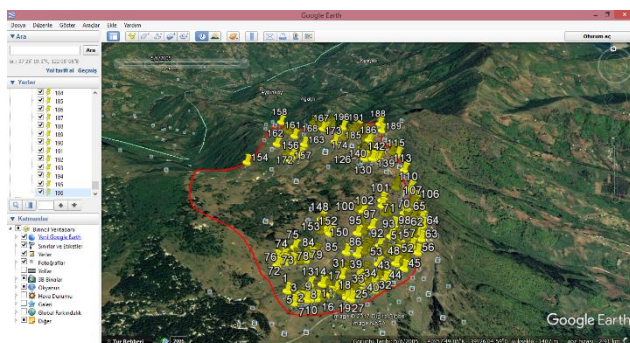


Figure 7. 3rd degree coinciding part of urban development in the Hidirnebi plateau.

4. CONCLUSION

Geographical conditions in the province of Trabzon, due to the excessive formation of land slope, inadequacy of suitable alternative areas for settlement and geological structure, land use control is restricted and therefore the agricultural land areas seems to have begun to be built over time. While many parts of agricultural land in mountainous areas are not observed to be constructed, in many agricultural areas close to the city center and the social structure due to the both creating planned area and the increase in population density has improved over the years and the rate of non-agricultural use has increased. This construction seems to be increasing day by day. As a result of further increase in the misuse of agricultural land, this land areas begun to transform ordinary concrete piles. So, the agricultural land has lost its quality over the years. Accordingly, the remaining agricultural land needs to be used and protected effectively.

In this study, the chosen pilot Trabzon province, land use capability classes subject to construction due to urbanization, opening of planned areas and increase in economic investments depending on time and also the changes that took place during the non-agricultural use were examined. This study was a case study, which deals with the development of the settlement, both in urban areas, in rural areas and especially in plateau. In this regard, it has been provided primarily land use map of Trabzon Province. Satellite images were then provided for easy viewing of the area. Land use capability classes of agricultural land have been determined and the areas that were most exposed to construction are discussed. Changes in these areas over time were compared via satellite images and the results were evaluated. As a result of the study, in the Province of Trabzon, it was seen that there was only one region the 1st degree agricultural land areas, this area was located in Hayrat district and there was no construction in this part and the fertile land continues to be used for agricultural purposes. In the 2nd degree agricultural land area of Arakli district, it was monitored that there was partly constructed area and after the year 2009, with the construction of 29%, the period of pressure for the purpose of urbanization in agricultural land. It can be said that only 6% of the restructured settlements have occurred in the last eight years in Vakfikebir district where was very little construction and with the same quality of agricultural activities. In the 3rd degree agricultural land area of Akcaabat district, it was said that about 90% of construction, which was the most construction since 2002 and it has been observed that there were almost no areas where agricultural activities have been carried out in the designated lands. Akcaabat district compared to the other provinces is an

attractive location in the name of urbanization due to the increasing population density, proximity to the provincial center and the possibility of public investments. Because of this, it was observed that the 3rd degree agricultural land was transformed into construction. In the 3rd degree agricultural land area of Hidirnebi plateau located in the town of Akcaabat, a build-up of approximately 60% has been observed since 2005. In addition to tourism-oriented businesses, rapid urbanization in this region was concerned because the people of the region have built houses for summer. As the plateau starts to build up in an unplanned and uncontrolled manner, the already limited agricultural land has been faced with the pressure to build up. Areas like a plateau for the use of the animal for animal activities so that exposure to construction and non-purpose plateau use, it will confront as a threat factor for tourism activities at the same time in the coming years.

With this study, it is aimed to show the oppression that the arable land is exposed to because of the construction. As a result of the evaluations performed by analysis, development of policies for agricultural land and it was observed that in practice every new area opened to the plan gave rise to settlement pressures in the immediate vicinity. In addition, when the provinces of Akcaabat and Vakfikebir are compared, the speed up to 90% of the construction in Akcaabat district, which is very close to the provincial center, poses a big threat in agricultural areas close to the city center. Therefore, policies to be applied to agricultural land should be rearranged so as not to adversely affect the environment. At the same time, the Turkish Statistical Institute should keep statistics on non-agricultural use of agricultural land regularly. National Soil Database should be created by using current methodologies of methods such as Remote Sensing and Geographic Information Systems.

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