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Determination of the Impact of Population Change on the Land Use via GIS; Case Study of Kastamonu-Küre

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Abstract

Kastamonu, the city in the Western Black Sea part of Turkey is an example of the provinces with higher emigration rates. Kastamonu, most of its area is covered with forests (65%), does not possess any significant business fields other than forestry activities. One of the reasons behind the migration movement in Kastamonu is that the forestry activities in the local community do not provide a satisfactory economic return.

Due to the emigration from Kastamonu province, the population of villages decreases, which causes several changes in land use. These changes are mostly evident in forest and agricultural areas. GIS applications can be used effectively in the determination of changes that occur in these areas.

In this study, the change of population in time in villages within the area of Küre Forestry Operation Office in Küre district of Kastamonu (1990-2010) and land use (1997-2010) were examined using GIS techniques.

Key words: GIS, Land Use, Kastamonu-Küre, Population

Nüfus Değişiminin Arazi Kullanımı Üzerine Etkisinin CBS Tekniği ile Belirlenmesi; Kastamonu-Küre Örneği

Özet

Ülkemizin Batı Karadeniz Bölümünde yer alan Kastamonu TÜİK verilerine göre çok fazla göç veren illere bir örnek oluşturmaktadır. Alansal olarak büyük bir kısmını (%65) ormanlık alanların oluşturduğu Kastamonu'da, ormancılık faaliyetlerinin dışında belirgin herhangi bir iş sahası bulunmamaktadır. Kastamonu'da göç hareketinin gerçekleşmesinin altında yatan sebeplerden biri de ormancılık faaliyetlerinin de yerel halka tatmin edici bir ekonomik getiri sunamamasıdır. Kastamonu ilinde gerçekleşen göçlerden dolayı köylerdeki nüfusun azalması arazi kullanımlarında çeşitli farklılıklara yol açmaktadır. Bu farklılıklar özellikle orman ve ziraat alanlarında gerçekleşmektedir. CBS uygulamaları bu alanlarda oluşan farklılıkların tespitinde etkin bir şekilde kullanılabilmektedir.

Bu çalışmada, Kastamonu-Küre Orman İşletme Şefliği alanı içerisinde kalan köylerde nüfusun (1990-2010) ve arazi kullanımının (1997-2010) zamansal değişimi CBS kullanmak suretiyle incelenmiştir. Çalışma alanı olarak 1997 Amenajman Planı ve 2010 Amenajman Planı kapsamındaki Küre İşletme sınırları baz alınmıştır.

Anahtar kelimeler: CBS, Arazi Kullanımı, Kastamonu-Küre, Nüfus

Introduction

Turkey is scarce in terms of more effective and rational use of public resources, which is of great importance in ensuring a sustainable economic and social development (Urfalıoğlu et. al., 2004). As a result of the process of social change; Variable speeds over time, ongoing since the 1950s in Turkey, mostly in rural areas of eastern and western parts of the right parts of the urban residential areas, the movement has experienced a population defined as fundamentally economic causes. While the developed cities receive emigration, other provinces that are less developed has a net immigration. Migration movements emerges usually economic, social and political reasons (Bülbül et. al., 2010).

The distribution of the population of our country takes place depending on surface types and climatic conditions. In the shapes of the distribution of the population, climate, natural vegetation, water resources, natural conditions, such as determining the

countries, regions and regions lagging behind economically are the places. The distribution of the population of developed countries and regions are more dependent on economic conditions.

Assessment is made in Turkey by region; Western Black Sea part of -50.3% and net migration between regions are the first place. Department of the Western Black Sea province of Kastamonu is in the underdeveloped part, according to economic development and migration among the provinces. Most of the agricultural economy of the province of Kastamonu generates animal husbandry, forestry and forest products industry.

Due to the emigration from Kastamonu province, the population of villages decrease, which causes several changes in use of land use. These changes are mostly witnessed in forestry and agricultural areas. GIS applications can be used effectively in the determination of changes that occur in these areas.

Geographic Information System

Geographic Information System (GIS), including integrated graphics and non-graphic information and a system configured to respond to various queries. Geographic Information System (GIS) that sub-system of Information systems has been developed in order to spatial data, large amounts of input, production and storage, generation, analysis and presentation (Köse and Başkent 1993).

Material and Methods

To investigate the effect of land uses change in population based on forest management plans for different periods in research area. In this study, the forest development plans for the years 1997 and 2010 belonging to Küre Forest Directorate, Küre Forestry Operation Office in Küre district of Kastamonu have been taken as basis. The stand types in forest development plans were evaluated in GIS environment. The land uses was classified in GIS environment in the study area and different land use areas have been presented. Land use values obtained for the years 1997 and 2010 were compared to determine the differences in land use between these two periods.

General Topographical Structure and Position

Küre Forestry Operation Office is located Küre Forest Directorate, Forestry Regional Directorate Kastamonu. Küre is located in the Department of Western Black Sea Region, which altitude is 950m (Figure 1).

Küre of high mountains and rugged topography and forest land in terms of covering a wide space, has led less than the amount of agricultural land. Starting from 350 meters to 1559 meters on the mountain height Harami, height differences increases with topographic features, the change in short distances. Because of increased degree of slope of the land, these areas couldn't be agricultural areas. Küre river and its tributaries divide deep valleys the land. Accumulated in the fields of Küre river and its tributaries are the most productive agricultural areas (İbret 2007).

Due to the rocky, rugged landscape and high altitude in Küre, livelihoods are forestry and animal husbandry. In regions with slow economic development leads to migration mostly because of less job opportunities. Unemployment created by economic bottlenecks and steep terrain structure has caused immigration of forest villagers.

Copper mine has operated within Küre Forestry Operation Office by Etibank Holding AŞ. and Karadeniz Bakır İşletmeleri AŞ. The study which is the subject Küre Forestry Operation Office is located Küre Forest Directorate, Forestry Regional Directorate Kastamonu.

Climate features

Küre district is 950 meters above the sea level is the highest in the annual average temperature is 7.6^{o}C in the Küre. The range of average monthly temperature of the Küre into the winter season, December, January and February the average temperature goes down under 0 ^{o}C. The highest temperature in July and 16.89 ^{o}C, while the lowest temperature in January is -2 ^{o}C. The average annual rainfall of Küre is 750.7 mm. The distribution of monthly precipitation in Küre; the lowest average rainfall in July (39.3 mm) and the highest average rainfall in February (82.3 mm) (İbret 2007).

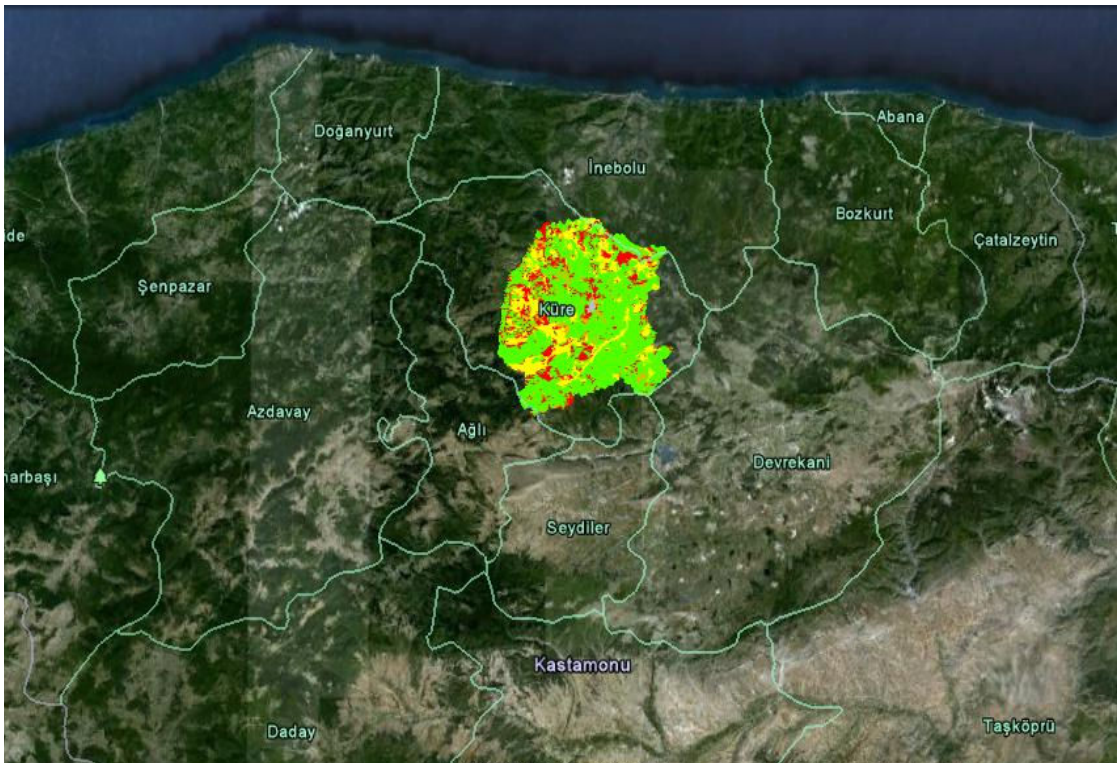

Figure 1. General geographic location of the study area

The amount of the population and increases

Turkey's 10-year periods in the term population growth rate was calculated 20% in the 1990-2000 and 8.7% for the 2000-2010 period. Kastamonu-term population growth rate was calculated between 1990-2000, as -11.3% and between 2000-2010 as -3.6%.

Küre district population growth rate was calculated between 1990-2000, as -27.1% and between 2000-2010 as -30.4% The remaining 19 village within the boundaries of Küre Forestry Operation Office population growth rate was calculated between 1990-2000, as -39.4% and between 2000-2010 as -33.8% (Anonymous, 2011).

Arithmetic Population Density (APD) has determined population data obtained from Research area. Arithmetic Population Arithmetic Population Density (APD) is parameter of a population increase determining the number of persons per km^2.

Arithmetic Population Density (APD) = Poulation (people) / Area (km^2)

Period Population Growth Rate (PPGR) = [(Pre. Per. P. – Next Per. P)/ Pre. Per. Pp.] * 100

In this study, the data was entered to the geographic information systems on computer. Data has processed contour curves, rivers, roads, settlements and forest management map. Küre Forestry Operation Office in the existing villages and Forest Management Plans (1997 and 2010) have transferred using GIS. Graphic data are provided access to a computer to transfer data using the ArcGIS 9.3 program.

Transferred to a computer to store the graphic and non graphic data, processing, analyzing, and the results obtained from the use of ARC / INFO 9.3 and software used. The necessary corrections on digitized Forest Management Plan were completed and the maps created topologies. In addition, the villages existing within the study area has been evaluated using GIS.

Form of land use

Land uses classification of research was made over the inquiry forest management maps. The research area of land uses patterns in the GIS maps are based on forest management plan.

Results

Land use status

For study area, land use maps belonging to the years 1997 and 2010 were constructed using GIS. Land uses belonging to the area were classified as: productive forestry areas, degraded forestry areas, FS (forest soil) areas, agriculture-residence areas and other areas (water and rocky) (Table 1).

Evaluation of land uses by the year 1997; It have been identified as agroforestry areas 31.59%, FS (Forest Soil)areas 5.65% and forest areas 61.57% of area. In addition, the productive forest areas as 28.24% and degraded forest areas as 33.33% were determined.

Evaluation of land uses by the year 2010; It has been identified as agroforestry areas 17.52%, FS (Forest Soil)areas 4.33% and forest areas 78.13% of area. In addition, productive forest areas as 63.84% and degraded forest areas as 14.29% were determined. For the years 1997 and 2010 land uses maps in GIS environment for the evaluation; have been identified in a reduction agricultural and settlement areas 44.54%, degraded forest areas 57.12% and FS (Forest Soil) areas 23.36% in this period.

These results have showed that FS and degraded forest areas were transformed into productive forest areas. At the same time in such fields as agriculture and settlement are significantly reduced. The productive forest areas increased by 126% from 5974.43 hectares to 13507.17 hectares, whereas degraded forest areas decreased from 7052.26 hectares to 3024.24 hectares and agricultural-residence areas decreased from 6683.85 hectares to 3705.90 hectares (Figure 2-3).

Table 1. Spatial variation of the different land uses (1997-2010)

	1997		2010		Variation
Land use	Area (ha)	Rate (%)	Area (ha)	Rate (%)	
Productive forest areas	5974.43	28.24	13507.17	63.84	126.06
Degraded forest areas	7052.26	33.33	3024.24	14.29	-57.12
FS (Forest Soil) areas	1195.83	5.65	916.54	4.33	-23.36
Agriculture areas	6683.85	31.59	3705.90	17.52	-44.54
Other areas (Water and rocks)	249.97	1.18	2.50	0.01	99.02
Total	21156.34	100.00	21156.34	100.00	

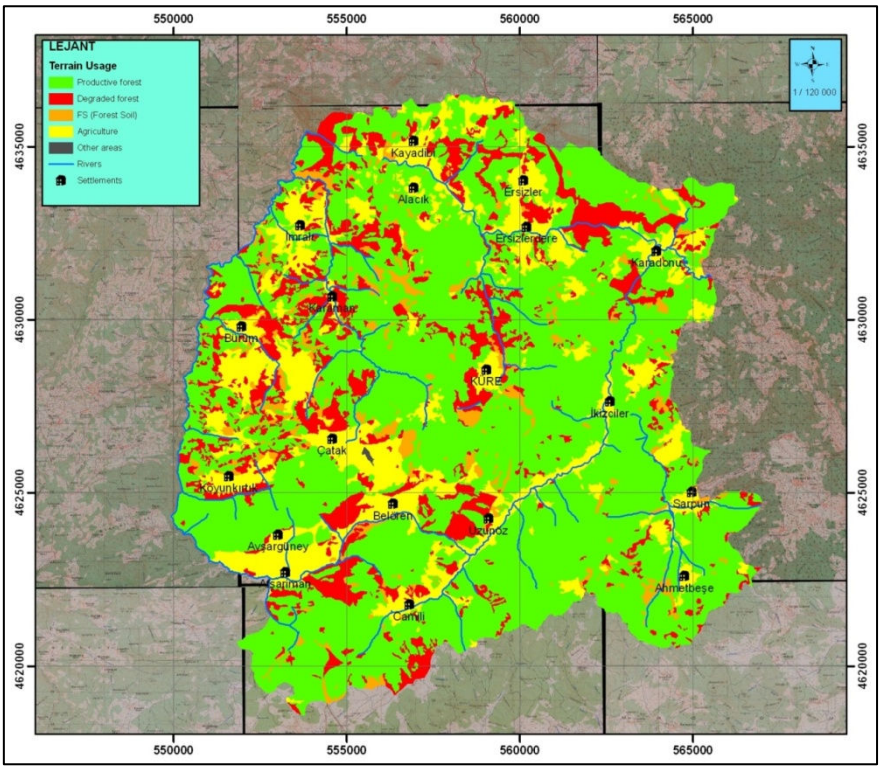

Figure 2. Land uses map (1997)

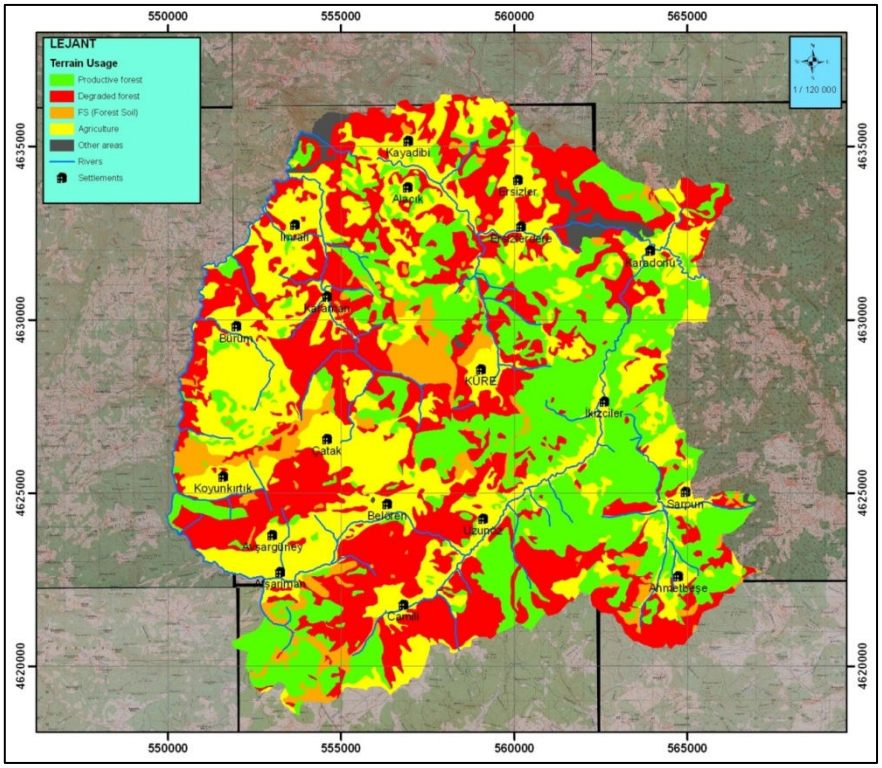

Figure 3. Land uses map (2010)

Results of Population Density

The population changes of research area have been determined for the years 2000-2010. At the same time in parallel to the same period, have been found Küre district population, population change in Kastamonu and Turkey. While there was an overall increase in population in Turkey, a significant reduction occurred in the town of Kastamonu and Küre. Particularly there is a reduction by half the village populations.

While there is a reduction in the rate of 26.46% of the population of the villages in Turkey, this reduction have been identified for the province of Kastamonu as 17.52%, and for Küre district as 35.26% and remaining 19 villages within the boundaries of Küre Forestry Operation Office as 33.86%.

According to Arithmetic Population Density evaluated that while Turkey's population increased over the years, decreased Kastamonu (General), Küre district and remaining 19 villages within the boundaries of Küre Forestry Operation Office. However, the population center of Kastamonu has increased due to migration surrounding villages and towns from the city center (Table2). While Arithmetic population density has inreased in Turkey (9.64%) and the center of Kastamonu (19.64%), it has showed a decrease in Küre district -31.58% and remaining 19 village within the boundaries of Küre Forestry Operation Office -30.76% (Table4).

While Period Population Growth Rate (PPGR) between 1990-2010 years are 20% in Turkey, -11.3% in Kastamonu, -27.1% Küre district and -39.4% in remaining 19 villages within the boundaries of Küre Forestry Operation Office. Additional while Period Population Growth Rate (PPGR) between 2000-2010 years are 8.7% in Turkey, -3.6% in Kastamonu, -30.4% Küre district and -33.8% in remaining 19 villages within the boundaries of Küre Forestry Operation Office (Table 3).

Table 2. Population data table

	1990	1990	2000	2000	2010	2010
	Total Pop.	Village Pop.	Total Pop.	Village Pop.	Total Pop.	Village Pop.
Türkiye	56.473.035	22.816.760	67.803.927	23.797.653	73.722.988	17.500.632
Kastamonu	423.206	274.345	375.476	201.456	361.823	166.163
Küre District	13.132	9.383	10.223	6.343	7.112	4.106
Küre F.O.Of.	4.616	4.616	2.796	2.796	1.849	1.849

Table 3. Period population growth rate

	1990	1990-2000	2000	2000-2010	2010
	Total Pop.	PPGR (%)	Total Pop.	PPGR (%)	Total Pop.
Türkiye	56.473.035	20	67.803.927	8.7	73.722.988
Kastamonu	423.206	-11.3	375.476	-3.6	361.823
Küre District	13.132	-27.1	10.223	-30.4	7.112
Küre F.O.Office	4.616	-39.4	2.796	-33.8	1.849

Table 4. Population density table

	Area (km^2)	2000	2000	2010	2010
		Population	APD	Population	APD
Türkiye	814.578	67.803.927	83	73.722.988	91
Kastamonu (General)	13.153	375.476	29	361.823	28
Kastamonu (Center)	1.829	102.059	56	123.972	67
Küre District	541	10.223	19	7.112	13
Küre F.O.Office	212	2.796	13	1.849	9

Table 5. Changes of population remaining 19 villages within the boundaries Küre Forestry Operation Office (2000-2010)

Villages	Years		Villages	Years	
	2000 (Pop.)	2010 (Pop.)		2000 (Pop.)	2010 (Pop.)
Afşargüney	65	42	Ersizlerdere	302	264
Avşariman	140	85	İkizciler	131	84
Ahmetbeşe	29	18	İmralı	227	102
Balacık	233	174	Karadonu	171	64
Belören	40	37	Karaman	338	169
Bürüm	70	31	Kayadibi	338	277
Camili	122	96	Koyunkırtık	133	83
Çatak	130	85	Sarpun	97	62
Çatköy	207	157	Uzunöz	89	97
Ersizler	141	79			

Discussion

Land use maps belonging to the years 1997 and 2010 were evaluated in GIS environment and the change in land use were displayed. In the evaluation, it was found out that agricultural and residence areas significantly decreased in this period, whereas forestry areas tended to increase on the contrary.

Forest areas have a significant increase, because of the study of the geographical structure of the region, socio-economic structure and economic resources is only possible to give forestry activities.

Indeed, different results reveal effects of changes in population density in different regions in our country. Determined the change in essential land uses parallel to especially population increase in the study area as a result of the applications and analysis conducted in Alibeyköy dam basin Özdemir et al. (2009). The fact that the changes felt the pressure of settlement and industry pressure of Alibeyköy dam attracted attention. Another research; Reis, S. (2007) was on the determination of time-related change of terrain cover of Rize province (1976-2000) with remote perception and geographical information systems. . It was found out that terrain cover classes in study area showed huge changes in this process. The most important change was witnessed in tea areas and caused the decrease of meadows, specially forest areas.

Geymen et. al. (2007) examined by using GIS and remote perception methods the change in land use in water basins within Istanbul metropolitan area in their study related to the change in land use and population increase in Istanbul metropolitan area. In their study, it was determined that such high level of concentration of population and economic activities in a restricted area on both natural resources and urban area generates an increasing pressure on social and environmental infrastructure in urban area. It was determined that especially the industrial zones and industrial facilities around the basin accelerated population increase and settlement.

Land uses belonging to the area were classified as: productive forestry areas,

degraded forestry areas, FS (forest soil) areas, agriculture-residence areas and other areas (water and rocky). While productive forests were 5974.43 ha in 1997, clear a piece of land forest and settlement areas to be covered forest because of migrations and elimination of social oppression, degraded forest areas have restored and have become productive. The productive forest areas have increased by 126% from 5974.43 hectares to 13507.17 hectares. Productive forest areas proportion have increased from 28.24% to 63.84% of the years 1997-2010. Degraded forest areas decreased from 7052.26 to 3024.24 hectares. While degraded forest areas rate in whole areas are 33.33% in 1997, it have pull backed 14.29% by the year 2010. Destruction of forests have decreased because of removal social pressure, also degraded forest areas have decreased. FS (Forest Soil) areas decreased from 1195.83 to 916.54 hectares. While FS (Forest Soil) areas rate in whole areas are 5.65% in 1997, it have pull backed 4.33% in 2010.

According to population density of the study area; remaining villages within the boundaries of Küre Forestry Operation Office have determined the reduction in the rate of 33.86%. While Turkey's population increased over the years, it have showed a decrease Kastamonu general, Küre district and remaining 19 villages within the boundaries of Küre Forest Chief. Küre Forestry Operation Office. But, the population center of Kastamonu have increased in this period and become migrations to Kastamonu city center from surrounding villages and towns. In order to explain this situation beter; Arithmetic Population Density (APD) which number of persons per square kilometer were calculated for Turkey in general, Kastamonu in general, Küre district and remaining 19 villages within the boundaries of Küre Forestry Operation Office. While Arithmetic Population Density (APD) has increased whole over Turkey (9.64%) and Kastamonu center (19.64%), decreased significantly Küre district (-31.58%) and remaining 19 villages within the boundaries of Küre Forestry Operation Office (-30.76%).

According to the results obtained, it have revelead that a significant increase in forested areas in parallel with a decrease in population between the years 1990-2010 in the study area. Forested areas have changed not only quantity but also as quality. A big part of degraded forest and FS (Forest Soil) areas have turned productive forest areas.

Forest workers need for forest establishment has increased, population decline due to economic reasons, migration from villages to district and provincial centers in research area. While population decline has caused an increase in forest areas, also impeded economic development in the region and especially hasn't permitted the continuation of forestry activities in an efficient manner.

The projects are needed that will contribute economically to the region not only ensure sustainable development but also protect forests in the region. It was the first step of a project carried out.

Prevent the problem because of forest workers cannot meet the needs arising from the villages, European Union, TC. Ministry of Environment and Forestry, Öz Orman-İş Union, TC. Ministry of Labour and Social Security, TC. Ministry of Education and İŞ-KUR in cooperation with the project has started to purpose train skilled forest worker technical high school level for the first time in Turkey. Innovative project of vocational training modules and training of forest workers, supported by European Union and TC., applied and monitored by İŞ-KUR have started to be implemented within "Youth Employment Supported" be accepted. The project applicant is Öz Orman-İş Union and project partner are Sinop and Kastamonu Regional Directorate of Forestry. Forestry enterprise is expected to contribute to the economy by giving forest villager this education and forest worker will become permanent jobs. The destruction of the forest and migrations will be reduced, due to forest villager will be permanent jobs, so will be reflected in the national economy by forestry and livestock revenues an increase.

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