



Effects Of Land Consolidation At Application of Irrigation Projects On Rural Area

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Abstract: It is being known that land consolidation operations have a significant interference on rural environment. By the planning of agricultural sub and super structure and interference to property along with the consolidation projects, the natural structure of lands is being deteriorated. By this study, it has been tried to determine the effect of land consolidation on rural environment In order to determine the positive and negative effects, Yeşilova, Ormankadı, Tepecik, Bakırköy were selected among the villages take place on Bursa Mustafakemalpaşa plain where irrigation projects are being carried out without land consolidation and Sazlıca, Ortasarıbey, Eskisarıbey and Yenisarıbey were selected among the villages take palce on Bursa Karacabey plain where irrigation projects are being carried out with land consolidation. The study material has been derived from the data of questionnaire conducted with the employers intended for the selected villages take place on Mustafakemalpaşa and Karacabey district of Bursa in Türkiye. In this study, land consolidation has positive impacts on rural environment as well as adverse impacts.

Key Words: Land consolidation, rural area, t test, irrigation areas

Sulama Projelerinin Uygulandığı Alanlarda Arazi Toplulaştırmasının Kırsal Çevre Üzerine Olan Etkileri

Özet: Arazi toplulaştırması çalışmalarının kırsal çevreye çok fazla müdahalesinin olduğu bilinmektedir. Toplulaştırma projeleriyle birlikte tarımsal alt ve üst yapı hizmetlerinin planlanması ve mülkiyete müdahale edilmesi ile araziler üzerinde var olan doğal yapı bozulmaktadır. Bu çalışma ile arazi toplulaştırmasının kırsal çevreye yönelik etkisi belirlenmeye çalışılmıştır. Olumlu ve olumsuz etkilerin belirlenebilmesi için Türkiye’de sulama projelerinin bulunduğu ancak arazi toplulaştırmasının yürütülmediği bir bölge olan Bursa Mustafakemalpaşa Ova Köyleri’nden Yeşilova, Ormankadı, Tepecik, Bakırköy ile arazi toplulaştırmasının yürütüldüğü Bursa Karacabey Ova Köyleri’nden Sazlıca, Ortasarıbey, Eskisarıbey ve Yenisarıbey köyleri seçilmiştir. Çalışmanın materyalini, Bursa (Türkiye) Mustafakemalpaşa’da ve Karacabey’de bulunan araştırma köylerine yönelik işletme sahipleri ile yapılan anket verileri oluşturmaktadır. Yapılan çalışmada, arazi toplulaştırmasının kırsal çevreye olumlu olduğu kadar olumsuz etkilerinin de olduğu saptanmıştır.

Anahtar Kelimeler: Arazi toplulaştırması, kırsal alan, t testi, sulama alanı

1. Introduction

The most significant one among the agricultural substructure problems is that the lands are as dispersed and disordered small parcels at most of the agricultural facilities. This condition causes the farmers to perform production at small and dispersed lands and thus the agricultural improvement and efficiency to remain insufficient. The only solution of recovering such facilities from the disjoined and dispersed condition is land consolidation.

Land consolidation can be considered as rearrangement of rural regions in the direction of the requirements of society and individuals in accordance with the developed agricultural technology of today and as taking all the required measures for the operation of agricultural facilities in a more efficient manner (Banger ve Doğan, 1998). Takka (1993) has specified that land consolidation covers issues such as unifying the disjoined and dispersed lands as per modern

industry principles, constructing road networks, irrigation channels, draining system, drainage and soil conservation services within fields, grading of lands, soil improvement, environmental planning, protection of rural environment, meeting land requirements for social and cultural services, meeting land losses of common facilities for roads within villages, dams, highways, irrigation and drainage channels (Anonymous, 2002).

In European countries the structural amendment of agricultural businesses and villages has been preferred, and by the diversification of conditions and problems the principle of considering such area not only as an agricultural land has been revealed. As acting from this point, the purpose of land consolidation has been multi directional, and as it covers the options relations agriculture, environment, society, settlement, economic policies, this concept has been amended as organization of rural environment.

On the other hand, rural environment and agriculture were previously being deemed as a whole. But now it is different at many locations in Europe. Now the farmers are a minority in rural environment. Most of the residents of rural environments are not farmers; and most of them are living in cities and using the rural environment as settlement sites, recreation site and natural area (Klaus, 2003).

It is being known that land consolidation measures have a significant interference on rural appearance and create a significant opportunity in structural organization and in composition of rural appearance. Thus it is necessary to be attentive to acting in conformity with the existing rural structure at areas to be reorganized and enabling balance in the preserving the benefits of all relevant parties. The issue to be emphasized is acting respectfully against the rights of land owners and keeping on the forefront to support the rural structure, to preserve the nature and rural appearance, to prioritize agricultural and forestry benefits (Wolthaus,1986). As in the countries where environmental awareness has increased, along with the land consolidation operations it is necessary to first assess the environmental effects,

ameliorate the landscape, have environment specialists among planners and conform with the environment protection norms (Miranda et.al, 2006).

In Turkey, construction of roads, irrigation and drainage systems within fields, grading of land, land improvement –at required locations-, which are known as land services, are being performed along with the land consolidation projects (Akkaya et.al, 1997). But in addition to the scope of projects being carried out in Turkey, the land consolidation projects being performed in Germany also cover protection of nature, establishment and protection of recreation and sports facilities, establishment of energy supply facilities, renewal of villages in order to increase the life standards of villagers, protection of soil against erosion, protection and amelioration of water supplies such as lakes-brooks, environmental planning (Anonymous, 1999a; Anonymous, 1999b; Anonymous, 2006).

In Turkey, agricultural irrigation projects are mostly being realized at locations where soil and water resources are available. Due to reasons such as the property structure at such regions being fragmented and the lands being small and dispersed and the irrigation projects intend to transmit a specific amount of water to the land, the expected rural improvements can not be obtained and efficiency of agriculture can not be increased. Irrigation projects have significant benefits not only on the agriculture of any region but also on the social and economical life of rural environment. Large irrigation projects cover as a whole the multi directional operations such as land improvement services, reorganization of settlement, training, equipping and organization of farmers, marketing of products as well as project design, construction, operation and maintenance. Irrigation systems have been carried to about 5.61 mil. ha. area of Turkey (Anonymous, 2011), but these services are generally being carried out without land consolidation and they can not be applied in an economical and technical manner due to fragmented structure of lands and complex property structure. Land consolidation operations

are again being carried out at irrigation project areas. But the area where it is provided by the end of 2014 is 2.942.998 ha (Arıcı and Akkaya Aslan, 2014). Land consolidation is an operation that facilitates competition in European countries, but when it is performed unconsciously it significantly damages the natural assets which develop very slowly and hard in a long period. Magel (1986) has specified that the consciousness of protection of natural assets has become widespread in recent years besides the satisfaction of farmers and that the protection of environment shall be within the scope of the consolidation operations.

In this study, it has been determined that land consolidation operations were not being carried out at irrigation project areas which are at the same area and it has been tried to determine the effects of land consolidation on rural environment by the inspection of two plains. With this purpose, detailed questionnaires have been conducted with the land owners at villages selected from the two plains.

2. Materials and Methods

This study has been carried out at Yeşilova, Ormankadı, Tepecik, Bakırköy –among the villages of Bursa Mustafakemalpaşa plain where irrigation projects are available but land consolidation is not being carried out- and Sazlıca, Ortasarıbey, Eskisarıbey ve Yenisarıbey – among the villages of Bursa Karacabey plain where land consolidation is being carried out- in order to determine the effect of land consolidation on the rural environment. The data of questionnaire conducted with the employers intended for the examined villages at Bursa Mustafakemalpaşa and Karacabey consists the material of the study. In the preparation of the questionnaire of the study, the assessment guide prepared by European Union has been used (Anonymous, 2000).

In order to determine the farmers by whom a questionnaire will be conducted, the title deed records obtained from Bursa Provincial Special Administration, Villages of Karacabey plain irrigation association and villages of

Mustafakemalpaşa plain irrigation association have been used and 2.666 facilities have been determined for the villages subject to survey. In the assessment of data, as meeting individually with 2.666 facilities would be difficult in respect of cost and time, the facilities which would form the main audience have been selected by the sampling method.

During the on site visit of study area, it has been observed that trees and shrubs were not too many at small sized lands and that they were more on large sized lands. For this the facilities which would form the main audience has been organized on the frequency table as per the size of their lands and a distribution graph has been drawn.

In the direction of the results of distribution graph, layered random sampling method has been used in drawing samples from the main audience. Layered random sampling method has two purposes. First is: increasing the accuracy of estimations regarding population, and the second is: enabling the good representation of facilities having different specifications within the population (Güneş and Arıkan, 1988). As per this layers have been separated to 3 layers as being (0 – 25da), (26 -50da) and (51 - + da).

In the determination of facilities which will be sample of the study to be conducted at the villages of Mustafakemalpaşa plain and Karacabey plain, the following equation suggested by Neyman has been used (Yamane, 1967).

$$n = \frac{(\sum N_h S_h)^2}{(N^2 * D^2) + \sum N_h S_h^2}$$

$$D^2 = \frac{d^2}{z^2}$$

In the formula;

n: Number of samples,

S_h : Standard deviation for h th layer

N: total number of facilities

d: allowed error margin

N_h : Number of facilities for h th layer

z: t value at confidence interval

In the determination of sample volume for facilities located at villages of Mustafakemalpaşa ve Karacabey plains which have been deemed as the area of study, it has been worked with 95 % confidence interval and 10 % error margin. In the distribution of determined sample volume to layers, the $n_h = \left(\frac{N_h}{N} \right)$ Formula has been used (Yamane,1967). By entering the data in the formula, the number of individuals by whom the questionnaire would be conducted has been determined as 85 for the villages of Mustafakemalpaşa plain and it has been

determined as 87 for the villages of Karacabey plain. The responses taken from 172 individuals regarding the effects of land consolidation on rural environment has been resolved on SPSS (Statistical Package for the Social Sciences) for Windows program pack. In data analysis, matched t test method and statistical techniques has been used in order to reveal the differences in between two regions for which the number-percentage distribution, arithmetical average (\bar{X}) and questionnaire have been applied. It has been required from the farmers to answer the questions as yes(1) and no(0).

3. Results and Discussion

While agriculture was the main means of living of 96.5 % of the respondents, 3.5 % was subsisting on retirement pension and by salary from other professional groups. 9.9 % of the respondents were of age 30 and under (young farmers), 74.4 % were in between ages 30-60 (middle aged) and 15.7 % were of age 60 and over (old farmers).

When the educational status is examined, 87.86 % of the population at the study area is only literate, 12.1 % is illiterate, 51.6 % is elementary school graduate and 14 % is graduate of an higher level as per the data of the year 2000 obtained from State Statistics Institute.

Considering the average land sizes per facility of farmers living the examined villages, it has been found that it was 38.10 da at Karacabey which has passed on to land consolidation and that it was 35.33 da at Mustafakemalpaşa which has not passed on to land consolidation. These values are lower than 59.00 da which is the average of Turkey (Anonymous, 2001).

While the average parcel number per facility of farmers living at Mustafakemalpaşa which has not passed on to land consolidation was 5.54, this number was 2.78 at Karacabey which has passed on to land consolidation (Table 1).

Table 1. T test results regarding of the average number of parcels, *t*(*t-value*), *df*(*degree of freedom*), *p*(*significance*)

Study area	N	Average	Standard Deviation	t	df	p
MKP	85	5.54	4.96	4.713	114.007	.000
Karacabey	87	2.78	2.15			

Following the t test made in order to compare the parcel numbers owned by the farmers living at examined villages, it has been found that the difference in subject was statistically significant. The fragmented structure of agricultural lands prevents these lands from being used effectively.

Small sized agricultural lands are not being rational in respect of usage of input and mechanization. Also time loss is excessive at fragmented lands due to the distance in between parcels.

When the land leveling operations are carried out along with land consolidation, it is being implemented in conformity with irrigation

network, in straight forms, at the level of blocks and without considering the borders of parcels in between them. And thus the plant isles, river branches, border shrubs and trees are being damaged. As the land leveling operations carried out at small areas and by the farmers without the consolidation operations were being performed at parcel level, the shrubs and trees at borders were not being disturbed.

Within the scope of survey, following the t test performed in order to compare the damage against shrubs and trees by the land leveling operations, it is found that cutting of border shrubs and trees during land leveling implemented along with land consolidation operations at Karacabey were higher than cutting of border shrubs and trees during land leveling implemented during irrigation system and by the farmers at Mustafakemalpaşa (Table 2).

Table 2. T test results regarding the effect of land leveling against cutting of border shrubs and trees, *t(t-value)*, *df(degree of freedom)*, *p(significance)*

Study area	N	Average	Standard Deviation	t	df	p
MKP	83	.29	.46	-12.573	106.854	.000
Karacabey	87	.97	.18			

One of the purposes of land consolidation is to obtain straight parcels which can use mechanization at optimal level. As trees within the borders of this parcel obstruct the operational conditions, the farmers require cutting of these trees during leveling operations. Moreover the farmers within the area of survey have generally taken over the lands from their grandfathers and have sentimental connections with their lands. The delivery of trees which have been preserved and used for a long time to other farmers following consolidation is disturbing the former owner of the land. Thus the trees are being cut before the transfer of lands to new owners. When it is asked to the farmers of Karacabey how the

cutting of trees could be prevented; 14.85 % has specified that the amount of trees should be paid, 25.74 % has specified that the land on which the tree is located should be returned back to the former owner, 32.675 has specified that the owner shall be convinced and 26.74 % has specified that it could not be prevented.

T test has been applied in order to compare the positive effect of roads within the fields constructed along with land consolidation and irrigation on the protection of environment at project areas. According to this, the positive effect on environmental protection of roads at Karacabey is higher than the positive effect of roads at Mustafakemalpaşa (Table 3).

Table 3. T test regarding the effect of constructed roads on environmental protection, *t(t-value)*, *df(degree of freedom)*, *p(significance)*

Study area	N	Average	Standard Deviation	t	df	p
MKP	83	.41	.49	-2.481	168	.014
Karacabey	87	.60	.49			

Because through the constructed roads reaching the preserved natural assets and assessing them is getting easy. Along with land

consolidation, the connection to surrounding provinces and counties is getting easy as the result of construction or reorganization of roads, the prospective planning of individuals for production is getting widespread, mutual communication is improving and thus awareness of environmental

protection is increasing. Moreover new plants can be planted by the construction of roads to locations which did not previously have roads or which were hard to reach, and the preservation and maintenance of existing plants is getting easy.

Tourism can be defined as accommodation of people as temporarily or permanently provided that it does not turn into settlement for financial gain and as sharing of economical, social, cultural assets at natural and artificial environments within the country and abroad by the purpose of holiday, recreation, health, cultures, sports, hunting, recognizing other societies etc (Anonymous, 2004). In this context, following the statistical analysis made in order to compare the effect of constructed and renewed roads at Mustafakemalpaşa and Karacabey on the visit of foreigners to the region, no significant difference has been determined in between the responses of farmers living at Mustafakemalpaşa and

Karacabey. At the area of survey the roads have no effect on the visit to region as attractive environments for foreigners are not being generated.

In order to reveal the difference created by land consolidation at villages of Mustafakemalpaşa and Karacabey plains where the survey is conducted, environmental changes arising along with the facilities has been determined at both areas where irrigation facilities have been installed. In order to make a comparison, 5 criteria have been considered and t test have been applied for each criterion. These criteria are effect of irrigation facilities on stream beds (SB_EF), their effect on wild plants and animals (WPA_EF), their effect on shrubs-river branches-puddles (SRBP_EF), their effect on the protection of significant areas (SA_EF) and their effect on natural appearance (NA_EF). The results of each criterion have been provided in Table 4.

Table 4. T test results indicating the effect of irrigation facilities on the environment, *t*(*t-value*), *df*(*degree of freedom*), *p*(*significance*)

Criterion	Study area	N	Average	Standard Deviation	t	df	p
SB_EF	MKP	85	.27	.45	-7.444	169	.000
	Karacabey	87	.77	.42			
WPA_EF	MKP	85	.34	.48	-2.552	167.993	.012
	Karacabey	87	.53	.50			
SRBP_EF	MKP	85	.29	.46	-9.187	153.018	.000
	Karacabey	87	.86	.35			
SA_EF	MKP	85	.24	.43	-1.441	166.713	.151
	Karacabey	87	.34	.48			
NA_EF	MKP	85	.14	.35	-3.317	157.519	.001
	Karacabey	87	.36	.48			

As per the result of t test analysis performed by examining the answers of the owners of facilities at the area of survey for each criterion, it has been found that the effect of irrigation plants

at Karacabey plain –where land consolidation has been realized- on stream beds, wild plants and animals, shrubs-river branches-puddles, natural appearance was more significant than their effect at Mustafakemalpaşa plain –where land consolidation has not been realized. A specific

period shall pass in order to ensure the expected improvements at irrigation areas.

Mustafakemalpaşa plain irrigation project has been completed in 1967 and 39 years has passed until the date of survey. Within this period the areas which have been damaged during the installation of the facility have renewed itself in 40 years, and as the farmers to whom the questionnaire is conducted assess the current condition, the problems which have arose during the installation of irrigation facilities have been partially forgotten during this period. As the Karacabey plain irrigation project which is designed along with land consolidation studies has been completed in 2003, the destruction is very new and its renewal will take time. But along with the land consolidation operations, it is being dealt with property ownership in the implementation of irrigation plants. Thus the natural structure on the lands is being destructed and as the reorganization of the lands is being performed without considering the natural

environment, interference on natural assets is extensive. In case of the construction of only irrigation facilities as in the villages of Mustafakemalpaşa plain, it is not being dealt with property ownership and the facility is being installed as per the current parceling status. During the installation of facilities, parcel borders are being observed in case the technical conditions allow. Moreover as the areas of facility are expropriated, the areas covered by the facilities are being tried to be kept limited. And this decreased damage to nature.

2 criteria have been considered in order to determine the change of underground water at Mustafakemalpaşa and Karacabey plains. These criteria are the change in the amount of underground water in the village (AUW_CH) and change in the quality of underground water (QUA_CH). Results obtained by the comparison of each criterion for Mustafakemalpaşa and Karacabey plains have been provided in Table 5.

Table 5. T test results regarding the change of underground water, $t(t\text{-value})$, $df(\text{degree of freedom})$, $p(\text{significance})$

Criterion	Study area	N	Average	Standard Deviation	t	df	p
AUW_CH	MKP	85	.38	.49	4.911	130.165	.000
	Karacabey	87	.0814	.28			
QUA_CH	MKP	85	.49	.50	5.283	146.853	.000
	Karacabey	87	.14	.35			

As the result of t test performed in order to compare the decrease of underground water at examined villages, the change in underground water at villages of Mustafakemalpaşa and Karacabey has been found to be different. According to this, the decrease in the underground water at examined villages of Mustafakemalpaşa is higher than the decrease at the villages of Karacabey. In the survey, it has been found that the decrease of underground water at Mustafakemalpaşa was arising from the realization of irrigation by underground water due

to difficulties in irrigation network and its management.

And at Karacabey plain, which is designed by land consolidation, irrigation channel is being connected to each parcel. As the farmers obtain the irrigation water directly from the channels and as they do not use the underground water, it has been observed that an increase has occurred in the underground water. And as a result water table is elevating.

When the contamination of underground water at examined villages is required to be compared, the results are statistically different. Underground water contamination at villages of

Mustafakemalpaşa is more than the underground water contamination at villages of Karacabey. Excessive contaminants at Mustafakemalpaşa plain, provision of wastes to drainage ditches, usage of both water table and drainage water for irrigation have caused the contamination of agricultural lands. Against this, the rareness of contaminant rate at Karacabey plain, controlled provision of irrigation water, extensive usage of drop and sprinkler irrigation methods decreases the excessive water usage and also by the non usage of drainage water for irrigation the contamination at agricultural lands decreases.

4. Conclusions

Considering the soil and water sources of Turkey, it is being known that only 50 % of the irrigable lands have reached irrigation and only 11 % of these lands have been subjected to land consolidation. At areas where land consolidation have been performed, it is being observed that the natural assets have been largely destructed and that the operation was only considered as the amelioration of the operational conditions and income level of the farmer. This condition is being confirmed by the result of survey. This was also in the same manner in European countries until 1970s. After that time, the environmental awareness which became widespread in Europe has indicated that land consolidation was not just for the benefit of the farmers but also for the benefit of society and environment and that it could be organized considering such factors. And today, in accordance with this perspective, many different examples of land consolidation which supports environmental protection are being observed. By this comprehension, it is being known that land consolidation creates a significant opportunity in the improvement of nature and environment.

As land consolidation has been realized at a small scale in Turkey, it can create significant advantage for the protection of environment. As it is being considered to open a 4mil. ha area in Turkey for irrigation in the near future, improvement and better protection of the nature and environment can be realized by also

considering the benefits of land consolidation. In this respect it is beneficial to make legal regulations for irrigation and land consolidation and to develop methods for realization of projects that consider the protection of environment through land consolidation.

Within the scope of land consolidation, while protection of nature and environment is being related to legal frame, the coordinated operation of relevant institutions shall be ensured. Within the frame of land consolidation, various natural assets, trees and shrubs may be preserved at their current locations, some others may be moved to other sites and areas which are no more being used for agriculture and which bring marginal income may be planted. Trees shall be considered as fixed facilities and the parceling shall be performed as per that.

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