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Current analysis of orcharding in the Isparta Province (Turkey)

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Abstract. In this study, orcharding activity in the Isparta Province, Turkey, is analysed. Until a few years ago, the economy of Isparta was associated with hand carpet weaving, rose-growing and rose-oil extraction. However, over the last few years orcharding has attracted attention as the most important economic activity in Isparta. This is especially visible in the districts of Eğirdir, Gelendost, Senirkent and Yalvaç where many kinds of fruits, specifically apples and cherries, are grown for the market. Physical geography features of Isparta have an important potential for developing orcharding. Suitable climatic conditions, fertile soils and fresh water resources, both surface and underground, are distinctive elements of this potential. In addition, irrigation projects, modern agricultural techniques, quality and resistible fruit types, appropriate fertilisation, pruning and disinfecting are human activities effecting the development of orcharding. Moreover, establishing modern and high capacity cold stores nearby the areas where fruits are grown is regarded an important factor increasing the value of Isparta fruits on the national and international markets. Thus, developing commercial orcharding in Isparta is gaining importance as a profitable activity as well as an opportunity for rural population for employment in fruit picking, storing, packaging and transporting. The emphasis of this study is put on current development of orcharding, distribution of apple, cherry, grape and other fruits production, reasons for this distribution and problems associated with orcharding in Isparta. Besides formal data collection, the findings obtained during field studies in Boğazova as well as on the Uluborlu-Senirkent and Gelendost Plains enable the authors to conclude that orcharding has become the most important rural activity in the region.

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Contents:

1. Introduction

In this study, development of orcharding in the Isparta Province, Turkey, is investigated on the basis of the data from the Turkish Statistical Institute and the Isparta Provincial Directorate of Food, Agriculture and Livestock. The purpose of the study is to detect the development of orcharding by years, districts and crops; the main areas, or districts, where orcharding is common; the relationship between distribution of population and orcharding; as well as the major problems in orcharding in the Isparta Province. In order to reach this purpose distribution of the most common fruits grown in the Isparta Province, i.e. apple, cherry and grape, by years and the number of harvested fruit trees were evaluated and mapped. Moreover, graphs were made to show production of these fruits between 1991 and 2010. In addition to the above fruits, pear, peach, quince, strawberry, apricot, pomegranate and sour cherry, which show lower production than apple, cherry, and grape, were combined and evaluated together as 'other fruits'. Maps in the study were prepared using the Geographic Information System mapping program. Besides the formal data, the findings from the field studies in Boğazova, Uluborlu-Senirkent and the Gelendost Plain, where orcharding is the most important activity, were evaluated to focus on the problems of orchard cultivation.

In the Isparta Province agriculture is gaining importance due to fertile soils, favourable climatic conditions and ever-developing irrigation programmes, In Isparta dry farmland covered much wider area in the past. After 1970, however, irrigation projects were introduced by the State Irrigation Organisation and the water of Lakes Eğirdir and Kovada was brought to agricultural areas via canals. Thanks to them, dry farming areas were opened to irrigation and became valuable farmland where orcharding cultivation has been applied. The major areas of Isparta where orchard cultivation is common are the Boğazova, Uluborlu-Senirkent, Gelendost, Kumdanli, Isparta and Şarkikaraağaç Plains. Commonly grown fruits are apple, cherry, grape, peach, plum, apricot, pomegranate, quince, pear, strawberry and sour cherry.

Development of quality apple cultivation as well as storing apples in cold stores for a long time increase the value of this fruit on national and international markets. Thanks to high market prices of fruits grown in Isparta, the size of the areas taken by orchards as well as the number of people making a living on growing fruit are growing. Moreover, new sectors connected with orcharding develop, such as fruit juice factories, cold stores, packaging units and transportation services.

As mentioned above, growing popularity of orcharding positively affects the economic structure in the Isparta Province. This, together with other economic activities connected with orcharding, may reduce high rural unemployment and rural-urban migration in Isparta. If employment and the added value resulting from orchard-based agricultural activities are considered, it is visible that orcharding exerts an important influence on rural development. Thus, orcharding, especially apple cultivation, in Isparta is becoming the most profitable occupation for rural areas in the region. The apple grown

in Isparta has a common mass-consumer on national and international markets and it is recognised as 'the apple of Isparta.'

2. Location and geographical features of the study area

The study area is the Isparta Province. Its surface area is 8,933 sq. km. The province is located in the border zone of the Göller Subregion in the Antalya Region, south-west Turkey. Isparta borders the Afyon Province to the north and west, the Konya Province to the north-east, east and south-east, the Antalya Province to the south, and the Burdur Province to the south-west and west (Fig. 1). The mathematical location of the study area is between 30° 20' and 31° 33' E, and 37° 18' and 38° 30' N. The Isparta Province includes 174 villages and 38 towns administrated by 13 districts.

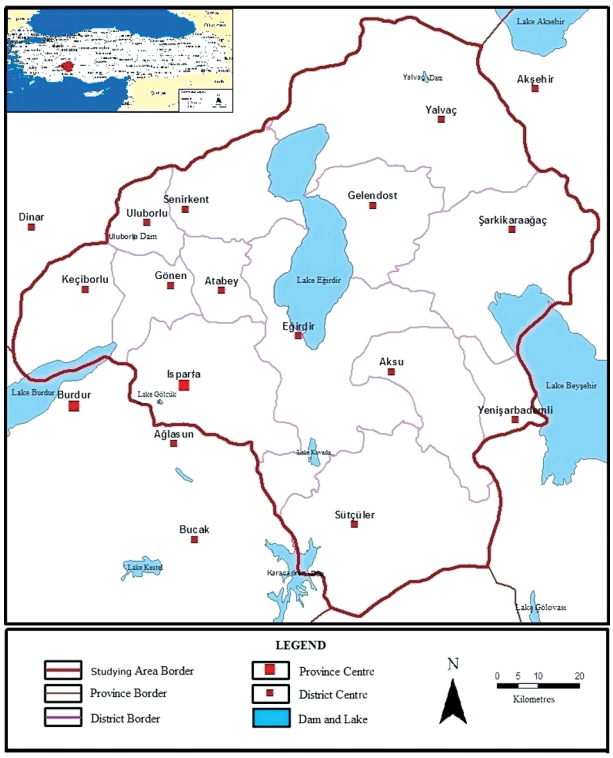

Fig. 1. Location of the study area

Source: Okudum, 2012

The study area is covered with mountain (68.4%), plains (16.8%) and plateaus (14.8%) (Almanac of Isparta, 1996). The major mountains in Isparta are the Sultan, Karakuş, Dedegol, Davraz, Barla and Akdağ. The major plains are the Boğazova, Uluborlu-Senirkent, Kumdanli and Şarkikaraağaç where orcharding is intensively applied (Fig. 2).

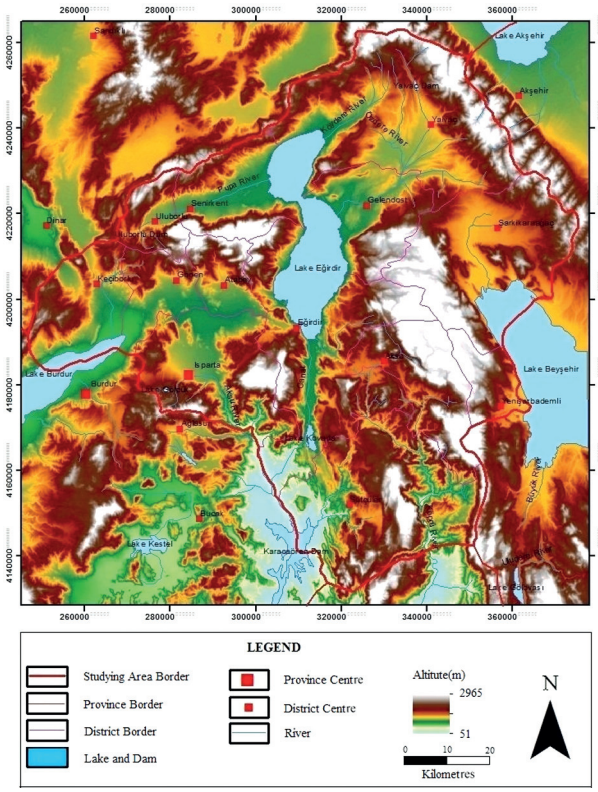

Fig. 2. Physical map of the Isparta Province

Source: Okudum, 2012

The study area is located in the transition region between the Mediterranean and Central Anatolian climates. Due to this, the features of both climates are significantly felt in the Isparta Province. However, high temperatures and precipitation characteristic for the Mediterranean coastline and relatively lower temperatures and precipitation characteristic for the Central Anatolia climate are not completely effective in the study area. In the lower-lying area in the south of the Isparta Province, the Mediterranean climate is effective, while in the north of the Isparta Province the Central Anatolian climate is effective. During winter season, the latter area is colder and has lower participation than the coastal area. Located in the Göller Sub-region the study area is rich in water resources. The major lakes include Lake Eğirdir, Kovada, Beyşehir and Burdur. Moreover, there are dams for both irrigation and other purposes. The major dams are Uluborlu, Yalvaç, Sorgun

and Karacaören. The Akçay and Köprüçay Rivers, which are major rivers in the study area, are drained to the Mediterranean Sea. Other rivers do not generally have much water. The rivers draining to Lake Eğirdir are the Pupa, Kocadere, Köydere and Özdere. The major rivers draining to Lake Beyşehir are the Eğri and Hizar. The Keçiborlu River is another one coming from the north of the Keçiborlu District and draining to Lake Burdur.

3. General characteristics of agricultural activities in the Isparta Province

Due to insufficient irrigation options, dry farming had been applied in fertile areas of the Isparta Province until the 1970s. Later on, thanks to the irrigation projects organised by the Public Waterworks Administration, these areas became very important farmland where orcharding is applied. The process was especially fostered with the opening of the canal between Lake Eğirdir and Kovada, which enabled the Boğazova Plain to be used for irrigated farming as well. In addition to irrigation, application of pesticides and fertilisers became more common in farming. The application of such modern agricultural techniques effected the development of all agricultural activities, especially orcharding. According to the data of the Isparta Provincial Directorate of Food, Agriculture and Livestock, the total agricultural area of Isparta is 2,057,821 hectares, out of which 63% is harvested land, 18% is orcharding land, 17% is fallow land and 2% is vegetable land.

Irrigated farming can be applied in 30% of agricultural land, while dry farming in 70%. In terms of the distribution of agricultural land by districts in the Isparta Province, the one with the highest proportion of agricultural lands is Yalvaç (27%), followed by Yalvaç Şarkikaraağaç (15%), Gelendost (12%), Eğirdir (8%) and Senirkent (7%). The district with the lowest proportion of agricultural land is Yenişarbademli (0.3%) (Fig. 3). It is well visible that in Isparta, agricultural land and agricultural activities are concentrated on the plain. Orcharding lands are irrigated lands, especially concentrated in the surroundings of Lake Eğirdir.

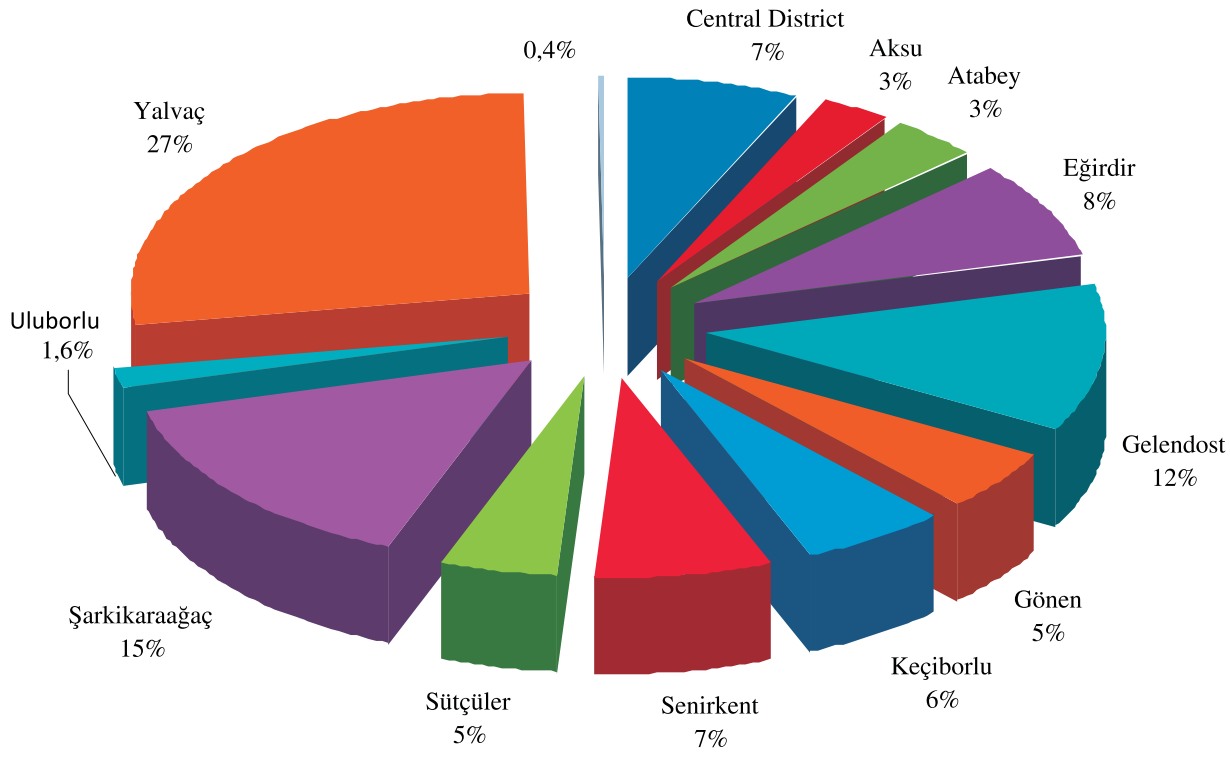

Fig. 3. Distribution of total agricultural lands in the Isparta Province by districts in 2010 (%)

Source: Turkish Statistical Institute

4. Development of orcharding in Isparta

With the completion of irrigation projects orcharding in Isparta gained importance. Besides irrigation, application of pesticides and fertilisers in Isparta influenced the development of modern agriculture (Temurçin, 2004). In this process, more profitable apple cultivars such as *golden*, *starking* and *granny smith* began to be grown, instead of less profitable apple varieties. Also irrigated agriculture gained much more importance via irrigation projects taking place in the Uluborlu-Senirkent Plain after the 1970s. Specifically, with the construction of the Uluborlu Dam in 1984, irrigation opportunities increased. Thanks to them, several kinds of fruits, especially apple and cherry, began to be grown on this plain as well. The moment the Uluborlu-Senirkent and Gelendost Plains were opened to irrigated agriculture, commercial orcharding began to spread. With the irrigation projects cropping up all over the province, orcharding activities, such as apple, cherry and sour cherry growing, got importance in some agricultural areas such as the Kumdanli, Şarkikaraağaç and Isparta Plains. This development accelerated the construction of cold stores as well. Modern storing facilities make commercial orcharding more profitable. These two elements, which affect each other, got an important developing acceleration. In 2010, total orcharding area in the study area was 368,555 hectares. Irrigated agriculture is applied in the 78% of this area, while dry farming in 22%. In terms of the distribution of orcharding area by districts in the Isparta Province, the one with the largest orcharding area is Senirkent (22%), followed by Yalvaç (17%), Gelendost (16%), Eğirdir (14%), Uluborlu (8%) and the Isparta Central District (7%). The district with the least value in those terms is Sütçüler (1%) (Fig. 4). In every district in the study area, irrigated orcharding is applied and it remains the most important occupation in the Isparta Province. While apple growing is more common in the Senirkent, Gelendost and Eğirdir Districts, cherry growing is more common in the Uluborlu District than in the others. Moreover, viticulture, almond growing and olive tree growing are applied in the dry farming lands where orcharding is applied. Olive tree growing is located only in the Sütçüler and Keçiborlu Districts and applied in smaller area than other fruits.

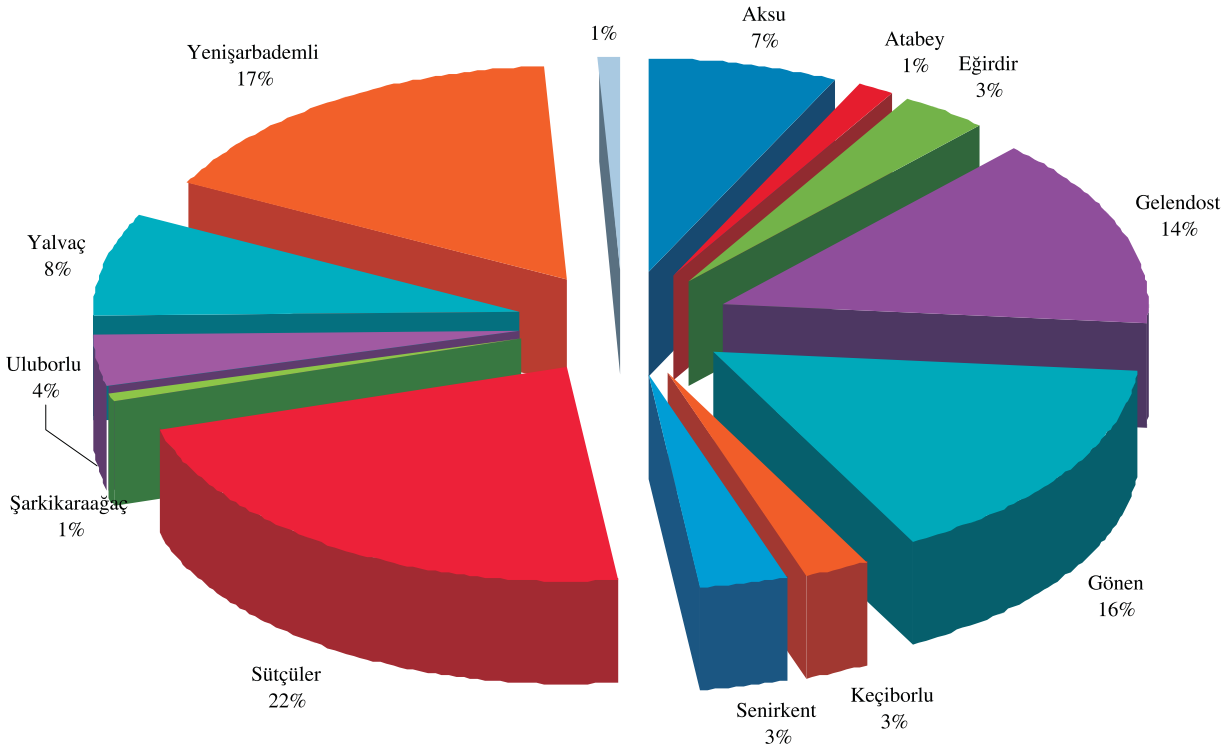

Fig. 4. Distribution of orcharding lands in the Isparta Province by districts in 2010 (%)

Source: Turkish Statistical Institute

Some apple, cherry, grape, peach, apricot and sour cherry grown in Isparta are exported and marketed in other provinces during harvest time, while some are stored in cold stores and supplied to local markets. Some of these fruits are used as fruit juices and dried fruits. This especially refers to the fruits of less value on the markets as they are tiny, spotty or rotten. Fruits such as apple, sour cherry, apricot, peach and grape are processed as fruit juice in two factories in the Eğirdir and Atabey Districts.

The apple grown in the Eğirdir, Gelendost and Senirkent Districts is globally famous. These apples are marketed to a number of national and international centres. As all of the interviewed cold store owners indicate, apples grown in Isparta are marketed to big urban centres such as Istanbul, Ankara, Konya and Adana in Turkey. International markets are generally Middle East countries, such as Egypt, Syria, Iraq, Jordan, Saudi Arabia, Georgia and Iran. A significant amount of cherry grown in Isparta is marketed to international markets, especially the European Union countries by keeping them in cold stores only for a short time. After storing, some of these crops are marketed to national and international markets in the post-harvest period. However, cherry cannot be stored in cold stores as long as apple. While cherry grown in Isparta can generally be preserved in a cold store for 3 weeks, apple can be preserved for up to 9 months (Trivedi, 2006).

Distribution and situation of orcharding by years and districts are investigated through the production of fruits commonly grown in the Isparta provinces and the number of fruit trees. This data is provided by the Turkish Statistical Institute. According to it, major fruits grown in Isparta are apple, cherry, plum, grape, peach, sour cherry, pomegranate, apricot, pear and quince. The fruits of the most commercial value and highest production are apple, cherry and grape. The production value of other fruits is very low. Because of this, while apple, cherry and grape are evaluated separately, the fruits such as peach, quince, plum, pear, pomegranate and apricot are evaluated together as 'other fruits' in this study (Okudum, 2012).

4.1. Apple

For years, the fruit commonly grown in Isparta has been apple. Geographic potential of Isparta is very suitable for growing this fruit. Additionally, technical developments in human activities such as irrigation, fertilisation, pesticide application and pruning are effective methods for the development of apple growing. The Boğazova, Gelendost and Uluborlu-Senirkent Plains gained importance as the areas where apple is grown.

According to the data, in 2010, total apple production in the Isparta Province was 549,371 tons. The district with the largest apple production in the Isparta Province was Gelendost with 193,243 tons (35.2%), followed by Eğirdir with 154,084 tons (28%). The district with the lowest apple production was Yenişarbademli with 2,420 tons (0.4%) (Fig. 5).

In 2010, the number of harvested trees in the Isparta Province was 4,004,050. The district with the highest number of harvested apple trees was Eğirdir with 1,051,500 trees (26%), followed by Gelendost with 1,003,500 trees (25%). The district with the lowest number of harvested apple trees was Sütçüler with 25,905 trees (1%). The distribution of apple production and the number of harvested apple trees by districts in Isparta are mapped on the basis of the data of the Turkish Statistical Institute (Fig. 5).

As Figure 3 indicates, apple production is correlated to the number of harvested apple trees. As shown in the map, Eğirdir, Gelendost, Yalvaç, Senirkent and Uluborlu, located in the vicinity of Lake Eğirdir where irrigation is developed, are major districts where apple production and the number of harvested apple trees are highest. Sütçüler and Yeni°arbademli are the districts with the lowest apple production and the number of harvested apple trees.

As the table showing the apple production indicates, in 1991 the total amount of apple production in the Isparta Province was 234,783 tons (Tab. 1), while in 2010 it was 549,371 tons. Thus, the apple production nearly doubled between 1991 and 2010. These values, however, did not increase regularly in those years. In some years fluctuations took place. Between 1991 and 1997 apple production increased steadily and reached 558,872 tons. Between 1997 and 2007, relative fluctuations took places. However, in 2007, compared with the earlier year, a nearly 60% loss in the production was recorded (production down to 192,806 tons). The reason for this loss was a drought which occurred during the flowering season. In 2008, however, the apple production increased again and reached 534,464 tons. In 2009,

the production value reached the highest level exceeding 600,000 tons. Eğirdir and Gelendost are two districts with the highest apple production in the Isparta Province, followed by Yalvaç.

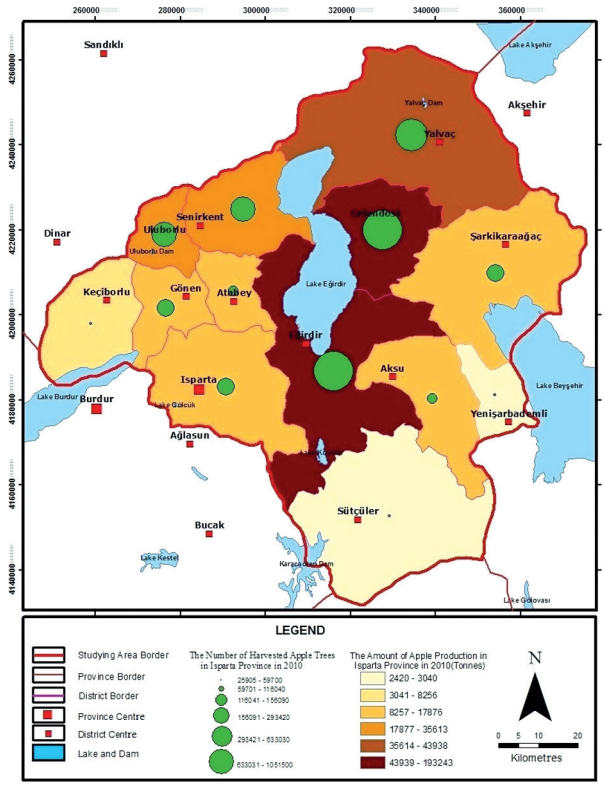

Fig. 5. Distribution of apple production and number of harvested apple trees in the Isparta Province by districts in 2010 (tonnes)

Source: Okudum, 2012

Eğirdir and Gelendost are also the districts where cold stores, especially for apple storing, are concentrated. Increasing apple production required the construction of cold stores in these districts. The growing number of modern high capacity cold stores also meant apple production was profitable and so it increased further.

4.2. Cherry

Besides apple, the fruit commonly grown in the study area is cherry. This fruit is especially commonly grown in the Uluborlu-Senirkent Plain. Cherry growing is commercially applied like apple growing. An important amount of cherry grown in Isparta is exported. After storing for a while, a small amount of cherries is marketed to national and international markets. Cherries of commercially bad quality (tiny, crushed, etc.) are processed in the juice factory.

In 2010, cherry production in the Isparta Province was 21,885 tons. The district with the highest cherry production was Uluborlu with 6,300 tons (28.8%), followed by Gelendost with 4,150 tons (19%) and Senirkent with 2,977 tons (13.6%). The district with the lowest cherry production was Aksu with 101 tons (0.5%) (Fig. 6).

In 2010, the number of harvested cherry trees was 573,100. According to the pie graph showing the number of harvested cherry trees, the district at the top in those terms was Uluborlu with 180,000 harvested trees (31.4%), followed by Gelendost with 103,000 (18%), Senirkent with 66,150 (11.5%) and Atabey with 43,000 (7.5%). The district at the end of the list was Aksu with 2,520 harvested trees (0.4%). The number of harvested cherry trees and cherry production are parallel (Fig. 6).

Table 1. Distribution of apple production in the Isparta Province by districts in 1991-2010 (tonnes)

Districts	Central District	Aksu	.Atabey	Eğirdir	Gelendost	Gönen	Keçiborlu	Senirkent	Sütçüler	Ş. Karaağaç	Uluborlu	Yalvaç	Y. Bademli	Total
1991	19,960	10,422	1,032	95,466	43,711	*	6,900	11,454	3,372	7,558	987	33,921	*	234,783
1992	14,467	12,055	1,504	99,004	53,142	7,718	6,793	7,061	2,913	6,746	14,593	26,008	1,014	253,018
1993	13,970	13,620	1,339	81,875	59,450	5,025	9,539	9,040	3,390	7,835	20,090	30,470	1,507	257,150
1994	17,967	11,350	1,403	112,000	44,000	4,000	9,006	11,625	2,676	8,100	15,015	30,511	1,600	269,253
1995	16,500	11,000	2,439	94,679	44,550	5,005	9,945	12,375	2,459	10,000	19,000	30,787	1,600	260,339
1996	18,933	9,778	11,496	135,000	100,650	5,390	13,090	12,487	3,416	7,562	22,000	43,426	1,000	384,228
1997	36,850	13,640	23,471	198,050	142,049	6,243	13,200	34,318	4,615	8,195	26,560	50,081	1,600	558,872
1998	21,573	9,528	24,010	196,800	112,200	20,729	7,835	33,107	3,417	4,967	22,960	50,027	1,666	508,819
1999	15,645	11,310	24,010	183,680	149,350	8,404	9,448	47,183	3,107	6,189	22,149	32,340	1,666	514,481
2000	22,200	12,600	26,600	164,000	101,000	5,312	11,000	58,000	3,000	9,000	29,000	41,000	1,904	484,616
2001	20,560	11,310	24,010	159,430	153,440	16,000	9,766	62,325	3,000	6,490	14,500	35,000	1,904	517,735
2002	24,417	11,310	24,009	133,226	165,279	13,655	9,353	58,724	3,230	8,840	16,651	39,100	1,008	508,802
2003	23,586	11,310	21,400	141,219	132,250	16,179	9,353	56,391	3,180	8,126	21,212	38,323	2,188	484,717
2004	23,921	11,310	21,390	165,219	150,400	16,334	9,098	67,991	3,090	8,515	25,844	43,337	2,188	548,637
2005	23,822	15,321	20,394	123,114	152,506	15,387	9,290	64,991	2,885	10,923	24,975	40,978	2,510	507,096
2006	22,619	15,365	17,415	161,336	127,400	15,255	8,990	51,187	2,802	10,921	26,359	34,618	2,509	496,776
2007	7,991	6,142	7,999	49,206	74,838	4,118	3,524	15,516	996	4,489	6,456	9,868	1,663	192,806
2008	15,956	16,361	14,425	179,635	140,043	15,233	9,215	52,361	2,948	12,266	27,474	44,503	4,044	534,464
2009	17,374	17,361	16,272	193,257	192,630	15,709	8,256	54,281	3,343	14,154	27,746	47,495	2,960	610,838
2010	17,241	17,876	15,535	154,084	193,243	15,761	8,256	35,613	3,040	14,654	27,710	43,938	2,420	549,371
% (2010)	3.1	3.3	2.8	28	35.2	2.9	1.5	6.5	0.6	2.7	5	8	0.4	100

Explanation: * lack of data

Source: Turkish Statistical Institute

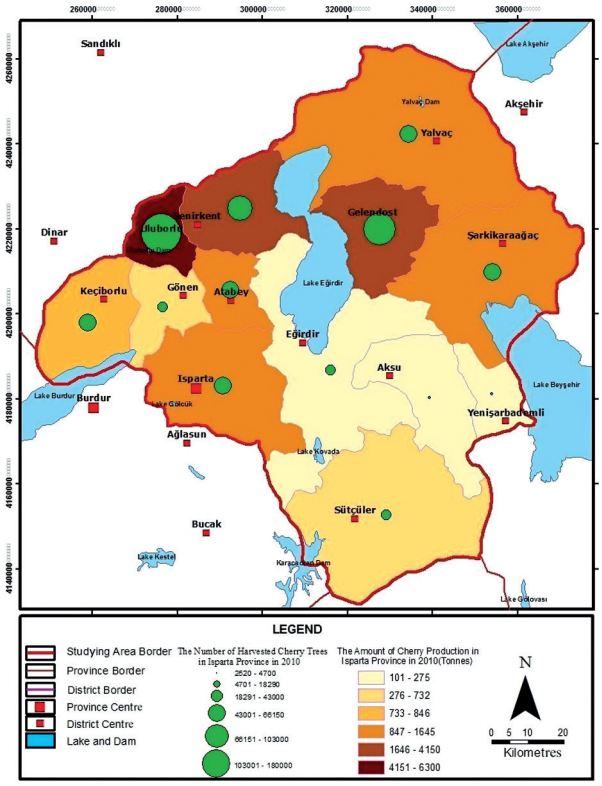

Fig. 6. Distribution of cherry production and number of harvested cherry trees in the Isparta Province by districts in 2010

Source: Okudum, 2012

Table 2. Distribution of cherry production in the Isparta Province by districts in 1991-2010 (tonnes)

Districts	Central District	Aksu	Atabey	Eğirdir	Gelendost	Gönen	Keçiborlu	Senirkent	Sütçüler	Şarkikaraağaç	Uluborlu	Yalvaç	Yenişarbademli	Total
1991	1,423	40	164	160	300	*	260	164	128	249	1,495	831	*	5,214
1992	1,353	39	196	133	294	206	277	177	130	190	1,457	827	35	5,314
1993	1,670	38	202	120	305	145	350	205	126	155	1,950	920	34	6,220
1994	1,328	9	312	135	342	200	94	480	225	200	1,800	990	48	6,163
1995	1,250	10	382	118	75	150	442	680	305	223	3,000	1,020	48	7,703
1996	1,000	13	1,000	148	537	180	1,100	950	420	238	3,000	1,038	36	9,660
1997	1,104	22	799	148	684	162	1,016	1,290	282	240	3,700	1,098	250	10,795
1998	570	23	625	243	724	308	718	1,230	731	264	1,035	655	275	7,401
1999	1,207	23	1,250	245	1,005	357	860	2,089	738	338	5,922	848	350	15,232
2000	1,104	23	1,250	198	540	20	663	793	737	538	2,270	848	350	9,334
2001	1,255	26	1,250	247	2,260	280	657	1,825	737	694	5,000	850	350	15,431
2002	721	29	1,325	247	2,370	281	310	1,546	508	700	1,800	848	100	10,785
2003	1,124	29	1,525	247	2,430	298	500	2,844	635	707	6,080	875	125	17,419
2004	1,132	29	1,950	248	2,420	302	500	3,798	635	706	3,060	756	125	15,661
2005	1,179	29	2,070	421	900	435	429	3,798	635	841	3,050	759	210	14,756
2006	1,033	29	1,868	421	1,260	435	429	2,515	723	840	3,136	1,084	210	13,983
2007	1,460	28	1,013	417	1,115	339	547	3,521	701	815	5,035	1,392	204	16,587
2008	663	41	840	291	1,215	514	846	3,889	723	1,197	5,370	1,055	210	16,854
2009	1,055	41	924	336	1,225	644	846	3,889	723	1,420	8,190	1,124	188	20,605
2010	1,274	101	1,290	275	4,150	732	846	2,977	687	1,420	6,300	1,645	188	21,885
% (2010)	5.8	0.5	5.9	1.3	19	3.3	3.9	13.6	3.1	6.5	28.8	7.5	0.9	100

Explanation: * lack of data

Source: Turkish Statistical Institute

Total cherry production, which was 5,214 tons in 1991, increased four times in fluctuations up to 2010, when it reached 21,885 tons. This is the highest value in the years given in the table (Tab. 2). In the Uluborlu District in some years this value exceeds 6,000 tons, in some others it reduced to less than 2,000 tons. According to the table, the highest cherry production was 8,190 tons in 2009, but in 2010 this value was reduced to 6,300 tons. Another district of cherry production is Gelendost. While in 1991 the cherry production in that region was 300 tons, it went up to 1,000 tons by 2001, and exceeded 2,000 tons in 2001. Next, the cherry production was growing until 2004 but later, between 2005 and 2009, it decreased to nearly 1,000 tons. In 2010 this value abruptly increased to over 4,000 tons. In Senirkent, where cherry production also fluctuated from year to year, it was 164 tons in 1991. Production reached the highest level with 3,889 tons in 2008 and 2009. In 2010 this value dropped to 2,977 tons. Between 1991 and 2010 cherry production in other districts, was generally lower than 1,000 tons. Cherry production in Aksu, which generally shows the lowest values, exceeded 100 tons in 2010 first time – it was 101 tons.

4.3. Grape

Another crop commonly grown in the Isparta Province is grape. In 2010, total grape production in the study area was 54,906 tons. The district with the highest grape production was Yalvaç with 24,116 tons (43.9%), followed by Senirkent with 19,442 tons (35.4%), the Isparta Central District with 4,055 tons (7.4%) and Şarkikaraağaç with 3,140 tons (5.7%). The district with the lowest grape production was Yenişarbademli with 30 tons (0.1%) (Fig. 7).

In 2010, the number of harvested grape trees in the Isparta Province was 75,136. The district with the largest number of these trees was Yalvaç with 23,430 (31.2%), followed by Senirkent with 22,187 (29.5%) and the Isparta Central District with 13,850 (18.4%). The districts showing the lowest number of harvested grape trees in the Isparta Province were Aksu and Yenişarbademli with 100 (0.1%) (Fig. 7).

As indicated by the map showing distribution of grape production and the number of harvested grape trees by districts in the Isparta Province, grape production is also significant in the districts where the number of harvested grape trees is high. Two districts with the largest grape production and the highest number of harvested grape trees are Yalvaç and Senirkent, followed by the Isparta Central District and Şarkikaraağaç. However, the number of harvested grape trees in Keçiborlu is larger than in Şarkikaraağaç. This situation shows that yield per tree in Keçiborlu is lower than in Şarkikaraağaç. The districts with both the lowest grape production and the lowest number of harvested grape trees are Aksu, Yenişarbademli and Sütçüler.

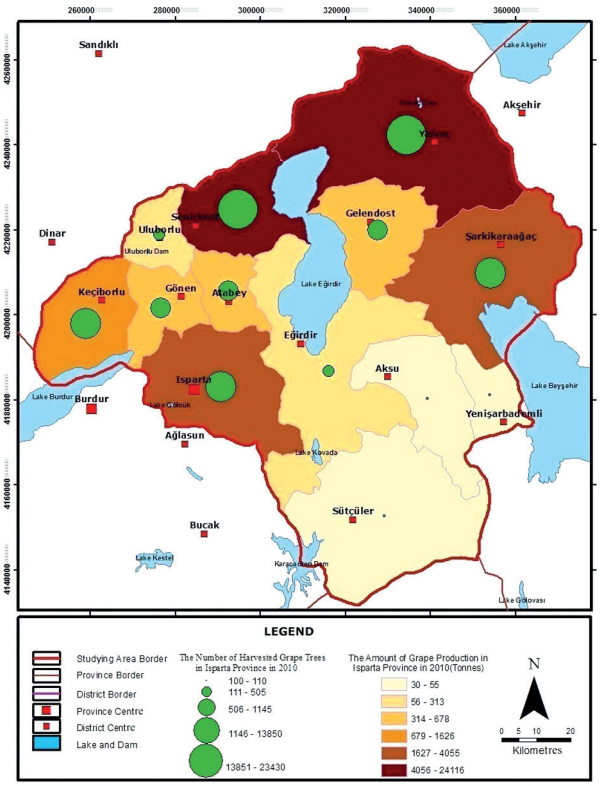

Fig. 7. Distribution of grape production and number of harvested grape trees in the Isparta Province by districts in 2010

Source: Okudum, 2012

As the table on grape production by districts shows, grape production grew from 36,645 tons in 1991 to 54,906 tons in 2010 (approx. 50% increase) (Tab. 3). Grape production by years shows that the lowest value of approx. 2,500 tons was in 1992. Grape production of Yalvaç, which in 2010 was highest in the Isparta Province, was only 19,012 tons in 1991. The highest grape production in the Isparta Province exceeded 25,000 tons in 1994. In the fol-

lowing years, grape production there fluctuated and exceeded 24,000 tons in 2010. Grape production of Senirkent was 2,457 tons in 1999, and fluctuated from year to years. The highest production of 19,442 tons was in 2010. The other districts with the highest grape production were Şarkikaraağaç, the Isparta Central District and Keçiborlu. The size of production of these districts was between 1,600 and 4,100 tons in 2010. Grape production of all the remaining districts was lower than 1,000 tons.

Table 3. Distribution of grape production in the Isparta Province by districts in 1991-2010 (tonnes)

Districts	Aksu	Atabey	Eğirdir	Gelendost	Gönen	Keçiborlu	Central District	Senirkent	Sütçüler	Şarkikaraağaç	Uluborlu	Yalvaç	Yenişarbademli	Total
1991	234	1,316	1,267	1,365	*	2,047	5,391	2,457	483	2,590	483	19,012	*	36,645
1992	250	1,150	1,301	1,293	715	2,125	2,867	1,260	450	1,597	495	12,154	135	25,792
1993	245	1,080	1,276	687	98	2,120	4,216	1,649	491	1,568	536	24,295	251	38,512
1994	400	1,127	910	700	110	2,400	5,984	4,410	648	1,460	455	25,125	320	44,049
1995	400	1,050	1,040	980	160	2,400	6,100	4,410	600	1,460	450	25,064	300	44,414
1996	160	1,425	1,040	840	160	2,928	7,200	4,160	600	1,350	100	20,700	300	40,963
1997	160	14,250	1,100	665	381	1,013	6,800	7,287	126	1,350	100	12,100	42	45,374
1998	120	390	160	700	613	945	3,300	7,301	80	675	150	21,375	42	35,851
1999	5,365	120	1,170	184	700	875	1,026	8,344	80	1,199	150	19,125	42	38,380
2000	120	1,170	184	700	810	1,000	5,431	10,630	80	839	150	19,125	42	40,281
2001	120	1,170	192	700	820	980	5,300	11,825	80	862	150	19,125	42	41,366
2002	120	1,170	192	550	883	1,225	5,250	16,351	100	1,232	150	16,800	40	44,063
2003	138	1,050	192	700	990	1,225	5,265	17,080	100	1,232	150	19,125	40	47,287
2004	138	1,050	129	700	1,007	1,225	5,285	14,426	100	1,232	150	20,250	90	45,782
2005	112	1,050	129	700	548	1,225	5,286	16,426	98	1,375	150	20,250	90	47,439
2006	112	500	129	700	540	1,005	5,228	16,388	102	1,325	150	15,750	90	42,019
2007	22	409	143	623	525	624	3,770	15,986	80	1,218	150	10,012	80	33,642
2008	55	672	174	600	599	1,475	4,248	14,773	164	3,194	321	11,060	150	37,485
2009	55	672	200	614	609	1,328	3,726	15,319	160	3,240	300	15,988	20	42,231
2010	55	678	180	618	609	1,626	4,055	19,442	44	3,140	313	24,116	30	54,906
% (2010)	0.1	1.2	0.3	1.1	1.1	3	7.4	35.4	0.1	5.7	0.6	43.9	0.1	100

Explanation: * lack of data

Source: Turkish Statistical Institute

4.4. Other fruits

In addition to apple, cherry and grape, other fruits are grown in the Isparta Province. They include pear, quince, plum, peach, pomegranate, apricot and sour cherry. In 2010 the most common among them was apricot with 11,405 tons (29%), followed by sour cherry with 8,734 tons (22%), peach with 7,617 tons (19%), quince with 2,954 tons (7%) and pomegranate with 410 tons (1%).

In terms of the total number of harvested 'other fruits' trees, the range of the number of harvested trees is same as the size of production. The percentage values of production and the number of harvested trees, as shown in Table 4, are almost similar. In 2010 the crop of the highest number of harvested 'other fruits' trees was apricot with 256,072 tons (12%), followed by sour cherry with 214,935 tons (23%), peach with 179,025 tons (19%), plum with 113,320 tons (12%), pear with 91,350 (10%), quince with 70,965 tons (8%) and pomegranate with 9,310 tons (1%) (Tab. 4).

Table 4. Distribution of other fruits production and number of harvested trees in the Isparta Province by districts in 2010

Fruits	A	%	B	%
Pear	3,728	9	91,350	10
Quince	2,954	7	70,965	8
Plum	5,128	13	113,320	12
Apricot	11,405	29	256,072	27
Pomegranate	410	1	9,310	1
Peach	7,617	19	179,025	19
Sour cherry	8,734	22	214,935	23
Total	39,976	100	934,977	100

Explanation: A – production (tonnes); B – number of harvested trees

Source: Turkish Statistical Institute

In 2010, the total production of these crops was 39,976 tons. In terms of distribution of production by districts, the highest value was in Yalvaç with 12,140 tons (30.4%), followed by Gelendost with 5,437 tons (13.6%) and Uluborlu with 4,386 tons (11%). The district with the lowest production was Yenişarbademli with 152 tons (0.4%) (Fig. 8).

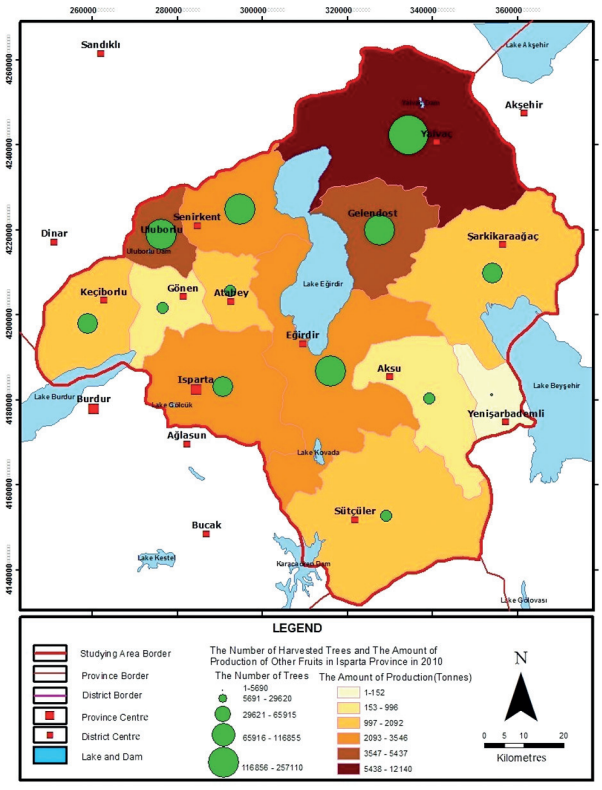

Fig. 8. Distribution of other fruits total production and total number of harvested trees in the Isparta Province by districts in 2010
Source: Okudum, 2012

In 2010, the total number of harvested trees of these fruit was 934,977. In terms of the distribution of the harvested trees by districts, the map indicates that the values are parallel to the production values. The district with the highest number of harvested 'other fruits' trees was Yalvaç with 257,110 (27.5%), followed by Senirkent with 116,855 (12.5%), and Gelendost with 103,250 (11%). The district with the lowest number of harvested trees was Yenişarbademli with 5,690 (0.6%).

5. Effect of orcharding on population and settlement in the Isparta Province

As the population distribution data indicate, population density is growing, as well as the administrative, industrial and agricultural activities in the Isparta Province and Isparta itself (Fig. 7). This is due to the fact that Isparta is an economical, administrative and commercial centre of the province. It also offers education, health and security opportunities. In addition, the effect of orcharding growth in the Eğirdir, Gelendost, Uluborlu and Senirkent Districts influences population density and settlement pattern in the administrative centres of these districts. Moreover, towns and villages administrated by these districts are also densely populated areas. As a result, the areas which have applied orcharding differ from other areas in terms of population sizes and settlement patterns. According to the population distribution of Isparta in 2010, the majority of population is concentrated along the rivers valleys, in the plateau areas as well as on the Isparta, Senirkent, Boğazova, Gelendost, Yalvaç and Yılanlı Plains (Fig. 9). The areas where agricultural activities, especially orcharding, are intensively applied have favourable climatic and hydrographic conditions as well as soil and topographic features. On the other hand, mountainous areas are sparsely populated, such as the Sütçüler, Aksu, Yenişarbademli Districts and their surroundings.

As it was emphasised in the previous sections of the paper, the areas where orcharding is concentrated are those where storing facilities have been built. Such areas include the Boğazova, Uluborlu, Senirkent, Gelendost Plains and their surroundings which offer fertile and irrigable agricultural lands. The information collected during the field studies shows

that in 2010 the number of cold stores in the Isparta Province was 71. The district with the largest number of cold stores in the Isparta Province is Eğirdir with 32 facilities, followed by Gelendost with 19, Senirkent with 6, the Isparta Central District with 5, Atabey and Uluborlu with 2 each, and Keçiborlu, Aksu, Gönen, Yalvaç and Şarkikaraağaç with 1 facility each. The districts with no cold stores are Sütcüler and Yenişarbademli (Okudum, 2012). Generally, these fertile agricultural lands attract a number of farm workers from the neighbouring districts and towns. Some workers, however, come from distant parts of Turkey, such as South Anatolia, especially the Adana, Mersin and Hatay Provinces.

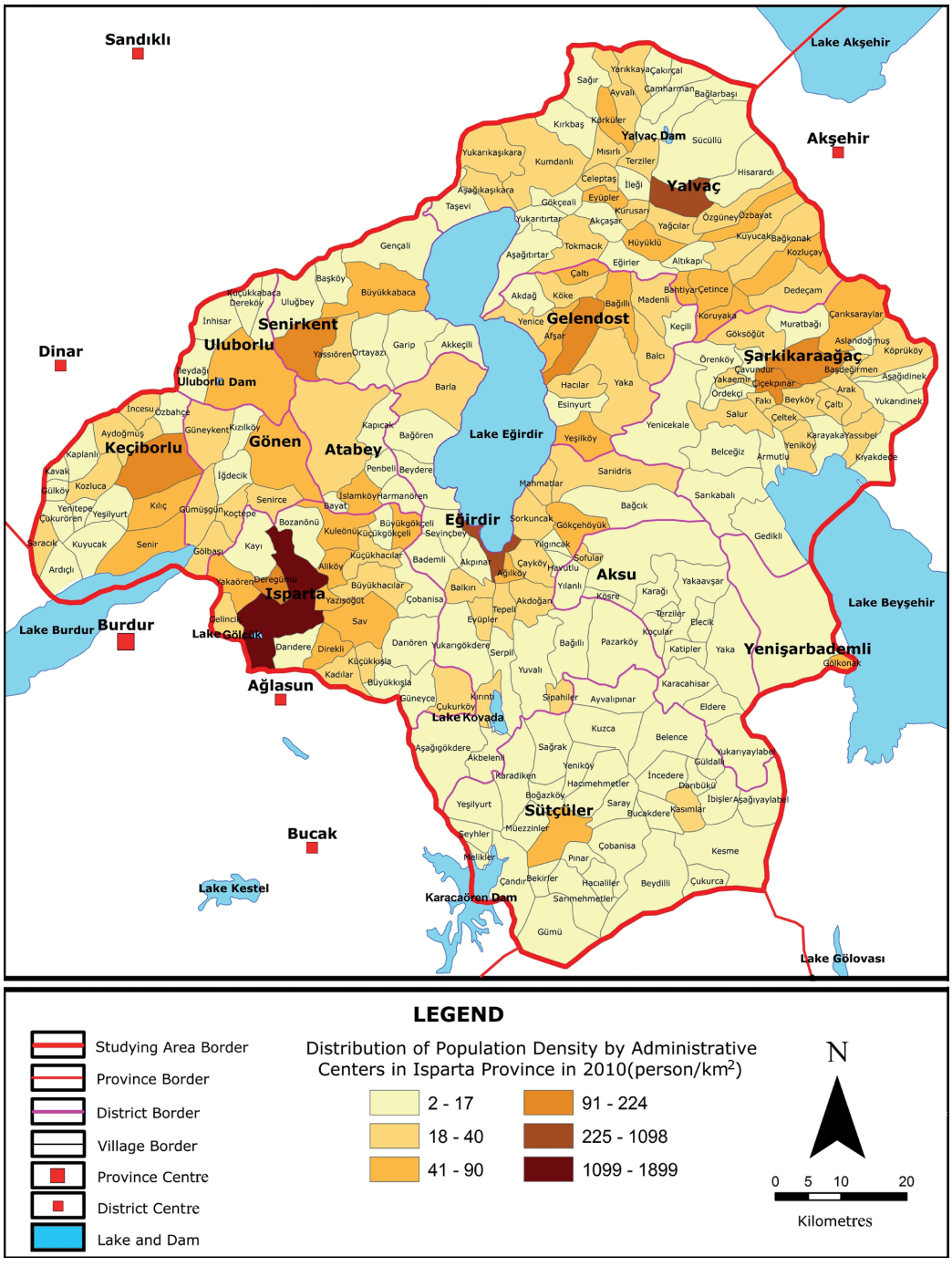

Fig. 9. Population density in the Isparta Province by administrative centers in 2010 (persons/km²)

Source: Okudum, 2012

6. Problems of orcharding in the Isparta Province

Orcharding in the Isparta Province is growing which contributes to rural development. Until recently, Isparta was famous for rose-picking and handmade carpet weaving, but these activities lost importance and orcharding became the most important activity. For orcharding to be healthy and continuous, the geographical potential of Isparta needs to be used properly so as not to overuse the natural resources. However, the interviews and observations made during the field surveys revealed a number of problems. Some of them are:

- *opening fertile agricultural areas to settlement:* building housing estates, industrial facilities and cold stores on fertile plains in the Boğazova Provinces as well as the Uluborlu-Senirkent and Gelendost Plains. Making no agricultural use of these very fertile areas is a big loss to the local economy;
- *not being able to export fruits or importing fruits:* in the years when widely grown products, such as apple and cherry, cannot be exported, they cannot be utilised well enough on the domestic market. Producers either sell them for a cheaper price or put them in cold stores and wait for prices to increase. In case the prices do not increase, the cost of the stored products increases and this causes another loss. Also importing cheaper fruit from other countries means locally-grown fruit is sold for lower prices on the domestic markets or used in for producing juice. This kind of lameness, experienced from time to time, shows that marketing problems have not been solved yet;
- *storing products from other provinces in Isparta:* bringing apples from different provinces to be stored in Isparta and marketing them as the 'Isparta apple' affects the brand name of the apples grown in the province. This affects negatively the brand name of the 'Isparta apple';
- *inadequate fresh water resources:* the underwater resources, the water of the Eğirdir, Kovada, Burdur, Beyşehir, Yalvaç and Uluborlu dams used for irrigation in agricultural areas, do not meet the irrigation demands of orcharding lands when the weather conditions are unfavourable (drought). Techniques for using water resources more carefully should become widespread and awareness about using water should be raised;
- *inappropriate agricultural measures:* excessive use of pesticides and fertilisers pollutes the soil and lowers its fertility; pollutants also get to the groundwater sources and even Lake Eğirdir, which is one of the most important fresh water resources of Turkey. If necessary precautions are not introduced, agriculture is going to be affected soon (Zengin, 2001; Anaç ve Çolak-Esetlili, 2012; Karaca, Turgay, 2012). It is very important to maintain sustainability on the valuable agricultural lands of Isparta. Otherwise short-term profit may endanger the productivity of the region in the long run. It is very important, thus, to prevent pollution, desertification and loss of soil fertility;
- *storing cost:* a high cost of storing is one of important issues concerning producers. In times of marketing problems, it evokes additional stress on producers and brings losses;
- *drought, ground frost, hail:* to get the intended yield from orcharding, each fruit needs its optimum climate conditions. The two especially fragile periods of time are inflorescence and maturation. Cherry and apple production strongly depend on weather conditions. Spring hail significantly decreases the yield. Hail during the apple maturation period causes spots on the product which decreases its quality. Apple production in 2007 in the province decreased by 60% with respect to the former year and reached 192,806 tonnes. In 2008, however, it reached the level of 2006 again, i.e. approx. 500,000 tonnes. These are tough times for both storing and orcharding.

Other climatic factors that affect fruit production and thus producers include events during the inflorescence period, such as drought or ground frost, as well as excessive rainfall and consecutive failure in pollination. Although it is not possible to prevent these nature-related problems, the harm can be minimised by using technology.

7. Results and suggestions

The Isparta Province has exceptional geographical conditions where nationally and globally known ap-

ple and cherry cultivation is applied. In addition to economical contribution to Isparta, orcharding creates employment in a number of sectors ranging from storing to fruit juice factories. Also these activities contribute to rural development and reduce uncontrolled rural-urban migration.

Widespread irrigation opportunities have affected the development of orcharding in Isparta. With the start of irrigation on the farming in Boğazova, Gelendost, Uluborlu and Senirkent Plains, orcharding gained commercial significance in the Isparta Province. The information gained from the stakeholders during field study shows that although orcharding was applied in the past, it was not as organised, profitable and common as it is now. Construction of new canals, transition to commercial orcharding, selection of quality fruit spices, as well as good position of the Isparta fruits on national and international markets influenced the growth of production of some fruits such as apple, cherry and grape.

Growing importance of orcharding in Isparta gave rise to various sectors of economy, such as fruit juice factories, cold stores, packaging units and transportation activities. Irrigation projects need to meet the needs of all the provinces from the Gelendost Plain to Keçiborlu and Şarkikaraağaç Plains. Orcharding is not very well developed in the Aksu, Sütçüler and Yenişarbademli Districts. In these districts rose growing, greenhouse farming, forestry or livestock rearing can be promoted. This creates a movement in terms of development and diversification of agricultural activities. Solving problems such as storing, marketing, water and soil pollution due to excessive fertilisation and using agricultural areas for other aims will develop orcharding in Isparta. Besides, water and soil resources need to be used with care. Agricultural areas should not be used for settlement. Anxiety of traders and producers about cost of storing and exporting crops must be eased.

Isparta is one of the provinces in Turkey which has suitable climatic conditions and land features for quality orcharding. Providing economic and sub-structural support contributes to the development of Isparta and Turkey. As emphasised in the study, employment opportunities created by orcharding make it very important for rural area. Orcharding in Isparta has a determinative effect on the socio-economic development of rural structure.

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