FOREST FIRES IN IZMIR REGIONAL DIRECTORATE OF FORESTRY

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Abstract. One of the major problems in many countries is the forest fires. Forest fires are the source of the most of the problems of fire protection organization in every year. Why does Turkey still have too many forest fires? And how do we eliminate forest fires? We are trying to approach this problem under our country conditions, and explain that how we are able to eliminate the forest fires in Izmir Forest Directorate. Forest fires stands out especially in the provinces of forests under the influence of the Mediterranean climate in Turkey. However, the forest directorate that are at risk in terms of both burning areas and fire numbers in these provinces are Mugla, Antalya and Izmir. For this reason, this study was carried out in Izmir Regional Directorate of Forestry between the years 2006-2015, one of the regional directorates that are always at risk.

Keywords: *Izmir, forest fire, forest directorate, burnt area, forest conservation*

Introduction

Forest fires are one of the important factors that jeopardize the continuity of forests in various parts of the world, especially in developed countries. Forest fires do not only damage timber and other forest products, they also harm ecosystem services, such as conserving the top soil etc. They destroy the habitats of forest biota and bring death to all sort of creatures. Even if the burned land is restored and reforested, forest fire change environmental conditions in forest (Mol et al., 1997). According to the recent fire statistics (from 1988 to 2016) in Turkey, the annual average number of forest fire is 2114 and that of burned forested area is 10615 ha (Goltas et al., 2017a).

Today, the importance of forest fires has increased due to global warming. Especially in the European continent, countries in the Mediterranean climate zone with low humidity and high temperature values are under the threat of forest fires with global warming. This situation is a top problem in terms of the sustainability of forests. Because of heat waves and drought, risk of forest fire, fire intensity, number of fire, fire frequency and burning area is expected to increase (Goltas et al., 2017b).

A large proportion of Turkey lies within the Mediterranean climate zone, which is characterized by hot and arid summer seasons, followed by warm and mild winters. Similar to many countries in the Mediterranean basin, Turkey is a country, which is prone to forest fires, which are frequently encountered phenomena due to climatic conditions (Mol and Kucukosmanoglu, 1998). In Turkey, about 35% of total forested areas are sensitive to forest fires at first-degree, 23% at second-degree, and 22% at third-degree (Bilgili and Kucuk, 2001).

Therefore they should be considered as usual events. Unfortunately, forest fires are rarely a result of natural causes such as the lightning. Forest fires are mostly human

induced events (Demir et al., 2009). Manager of the fire fighting team should comprehend the behavior of fire and customize a tailor made fire fighting strategy (Ayberk, et al., 2010).

The aim of this study is to make a detailed assessment of forest fires in general Turkey and in particular İzmir benefiting from fire reports, fire statistics, forest inventories and management plans. Results of the study will contribute to fire protection and fire suppression activity in both Turkey and Izmir Forest Directorate.

Materials and methods

The forest fires statistics occurred in Turkey between the years of 2006-2015 were evaluated in various aspects. In this study; Causes of forest fires, distribution in the field (hectare), the numerical distribution to the regional directories and the number of forest fires and total burned area in İzmir Regional Directorate of Forestry has investigated. Among the State forest Enterprises of regional Directorates; Bayındır, Bergama, İzmir, Menderes, Akhisar, Demirci, Gördes and Manisa are particularly considered. The main data of these directorates are sorted by years and calculated one by one in order to create systematic schemes. Moreover to reveal accurate investigation over these numbers, their 10 years total and 10 years average values are conceived and examined. For the investigation of forest fires in 10-year period; forest inventory and forest management plans obtained from İzmir Regional Directorate of Forestry in Izmir region has taken into consideration. In this way, the fire sensitivity of the Izmir Regional Directorate of Forestry has been tried to determine.

Study area

Surrounded by the Mediterranean, the Black Sea, the Sea of Marmara and the Aegean Sea; Turkey has 97% of its land area in Asia and 3% in Europe. It also has 8333 km of coastline and related to its geographical position, properties such as climate, relief and location have caused the formation of different geographical regions within the boundaries of the country (Demir et al., 2009).

Izmir regional directorate of forestry, which includes a large part of the Aegean region, is located within the territorial boundaries of Izmir and Manisa provinces. It is surrounded by Balıkesir in the north, Denizli and Kutahya in the east, Muğla Forest Regional Directorates in the south and Aegean Sea in the west. The geographical location of the Izmir Forest Directorate is located between the northern longitude of $39^{\circ}35'38''$ – $37^{\circ}52'30''$ and eastern latitudes of $26^{\circ}11'42''$ – $28^{\circ}52'28''$ (Fig. 1).

Under the influence of the Mediterranean climate, the plant species determined by this climate are located in İzmir. For many years, a wide variety of plant species have been destroyed due to grazing, breeding, smuggling, fire and insect damages. Especially in these areas where main tree species were damaged, drought resistant forest species were included. Main forest species are *Pinus brutia* and *Pinus nigra* in Izmir. Additionally there are many other tree species like *Pinus pinea*, *Quercus* sp., *Castanea* sp., *Juglans* sp., *Fagus* sp. in Izmir forests. General area of Izmir Forest Directorate is 2,509,336 ha and 39% of this area is forest lands. This value is calculated by creating relevant pie-chart, that presents damaged forests (22%), efficient forests (17%) and non-forest area (61%). 417,910 ha efficient forests, 557,095 ha damaged forest in Izmir Forest Directorate (Uzmez, 2011) (Fig. 2).

Figure 1. The location of the study area in Turkey

Figure 2. Forest status in İzmir Forest Directorate

Results

Different factors influencing forest fire danger

Many factors such as weather conditions, forest vegetation and fire season influence the forest fire danger (Noble et al., 1980). For instance, some weather conditions such as high air temperature, low relative humidity and dry winds reduce the moisture contents of flammable materials. In Mediterranean region the wind of South, South East and South West are oceanic origin, and so they bring more humidity. As a result, the fire danger is less. But the wind of North, North East and North West origin, bring dry air masses, because they are Central Anatolian origin. So, this situation created severe fire seasons (Mol and Kucukosmanoglu, 1998).

Forest vegetation also has a great influence on the damage of the forest fires. Most of the forest fires in Turkey occur in pine forest (49%) At the same time it is difficult to

prepare a fire season list for different parts of Turkey, because of various climatic conditions and forest fuels. But we frequently notice almost two characteristic types of fire season. Short fire season, this is well illustrated in Black-Sea and Marmara regions. In Black-Sea region July-August, and in Marmara region June-August are the peak points. Long fire season, Mediterranean and Aegean regions are typical examples. It continues about 5-8 months, but some part of these regions has year-long fire season (Demir et al., 2009).

Forest fire statistics in Turkey

The major destructive factor in Turkish forests is forest fires. Large or small, high severity or low severity they have had a profound influences on forests and wildlands. Especially the Mediterranean area has very suitable combustion and spreading factors. Forest fires cause great damage especially in Mediterranean, Aegean and Marmara regions. Forest fires not only cause the destruction of forest resources, but also destroy the balance of the ecological system. The coastal band, which starts from Hatay in particular from the Mediterranean and the Aegean coastal regions to Istanbul, constitutes the most risky area in terms of fires. In this region, the first sensitive area of fire is 7,182,051 ha, the second sensitive area to the fire is 5,091,788 ha. According to this, 12 million ha of the forests corresponding to approximately 60% of our forests are located in areas sensitive to fire (Uzmez, 2011) (Fig. 3).

Figure 3. Sensitive regions of Turkey against to forest fire

Considering the causes of forest fires, which emerged in Turkey between the years 2006-2015, their numbers and area distributions are shown in *Table 1*. With the examination of *Table 1*, it is possible the state that among the period of 2006-2015; the year 2013 reached the highest level in terms of the number of forest fires (16.1%), yet the year 2008 reached highest value relating to amount of burnt area (33.4%). The reason of why the year 2013 has the highest number of fire, is explained by the social events such as communal violence occurred in Turkey during 2013. It is also emerged that, with respect to amount of burnt area, the year 2008 has the highest value. This situation can be explained with the fact that the temperatures of 2008 were 0.5-2.4 °C

higher than the average seasonal normals (1971-2000) as shown in *Figure 4*. This also causes the increase in number and burnt areas by means of forest fire. Moreover, it is obvious that our findings are supported by Kucuk and Saglam (2004).

Figure 4. Average monthly temperatures of 1971-2000 and 2008 (MGM, 2017)

In Turkey, the main causes of the forest fires are human being (99%) and lightning (1%) (Mol and Kucukosmanoglu, 1998). According to Demir et al. (2009), forest fires have many causes in Turkey, such as; human activities (smoking, negligence, carelessness, accidents, deliberate fire setting etc.), shortage of basic equipment for fire fighting, climate and weather variation (lightning etc.) and unknown reasons.

Among the causes of forest fires, four main subjects; Intentional, Negligence-Accident, Natural (Lightning) and Unknown are particularly chosen and their values by years calculated in detail. In *Table 1*, it is important to point out that during the year 2008; number value of Intentional is 18.1%, field value of Negligence-Accident is 43.7% and field value of Natural (Lightning) is 29.8%. Furthermore, during the year 2013; it is possible to find out that by 24.4% in terms of number value and by 30.7% in terms of field value, Unknown has reached its highest values. During the examination period (2006-2015), within the range of these causes, in respect to number value Intentional and in accordance to its field value, Negligence-Accident comes forward.

For this reason, regarding the protection of forests from fires; more emphasis should be put on to the issues of public awareness and education. These findings and suggestions of ours are also validated by related work of Ryan (2012).

Detailed examination through *Table 2* makes possible to reveal total forest fires within the mentioned years, in terms of number and area. For the year 2008, number value of fires generated from Intentional causes calculated as 1.6% and for the year 2007 field value is found as 1.9%. In addition to this, it is revealed through *Table 2* that in 2013 number value of Negligence-Accident obtained as 6.1% and in 2008 field value as 29.5%. In 2007, number value of Natural (Lightning) is obtained as 1.7% and in 2008 field value as 0.8%. Finally, in 2013 with respect to number value of Unknown as 7.8% and field value as 6.5%; all of these mentioned years have reached their highest rates

within *Table 2*. It seems clear that, likewise in *Table 1*, the year 2008 and the year 2013 comes forward in also *Table 2*. On the other hand, within mentioned decade when the total causes of forest fires are examined; it is seen that the Negligence-Accident has the first place concerning both number value (46.1%) and area value (67.6%). This finding shows that, fires are mostly caused by negligence and accident, rather than natural or unknown ones among the reasons of forest fires. For this reason, in order to protect forests from fire before the fire starts, precautions such as; fire safety roads, firebreaks, transportation roads, silvicultural measures, arrangement of flammable materials etc. are should be given priority and they should be practiced accurately.

In our work, *Tables 3 and 4* show the field distribution of forest fires with respect to regional forest directorates. *Table 3* reveals the field distribution, while *Table 4* shows the numerical distribution.

As it is understood by generating and analyzing *Tables 3 and 4*, related to the regional forest directorates and field distribution of forest fires in terms of number and field (hectare) between the years 2006 and 2015 it is seen that numerical findings of Izmir, Antalya and Mugla reach the highest rates. Therefore it is possible to state that forest fires are mainly concentrated upon these three regions in Turkey. As being sensitive to forest fires; this is one of the reasons why Izmir is selected as our study subject.

It is also seen that our findings regarding to these observations are supported by the research that carried out by Mol and Kucukosmanoglu (1997) and Kucuk and Unal (2011).

Forest fire statistics in İzmir

In Izmir there are many factors that destroy the forests. Among these destruction factors besides grazing, smuggling, insect damages and breeding, fire is the most dangerous one which especially harms plant species. All these mentioned factors are effective in Izmir Regional Directorate of Forestry that located in the west of Turkey as our study area.

Akyuz and Kucukosmanoglu (1997) especially draw attention to the fact that fire is the most important reason leading to destruction of forest resources in Izmir.

Izmir Regional Directorate of Forestry has the total area of 248986 ha. Approximately 968078 ha that constitutes the 39% of this area is covered with forests (GDF, 2016). Bayındır, Bergama, Izmir, Menderes, Akhisar, Demirci, Gördes, and Manisa are the names of the eight enterprises that Izmir Regional Directorate of Forestry contains. Between the years 2006-2015, number distribution of forest fires with respect to these State Forest Enterprises are stated and analyzed in *Table 5*. Within this 10 years period, calculations carried out in *Table 5* expose that total fire number is 2333 and average fire number is 233. Also it is indicated in *Table 6* that amount of burnt area is 7963 ha and the average amount of burnt area is calculated as 796 ha during this 10 years. As can be understood through the detailed investigation of *Tables 5 and 6*, Izmir Forest Enterprise steps forward with highest values in respect to area and number, concerning the forest fires. This situation reveals similar results that forest fires reach the highest values of both number and field value, as we obtained from the examination of Izmir Regional Directorate of Forestry (*Tables 3 and 4*). These relevant findings indicate that Izmir Region has a sensitive status concerning the forest fires. Therefore; during the fire seasons, it is a necessity to take all the required precautions against fires in Izmir.

Table 1. Forest fires in Turkey between 2006 and 2015

Year	Numbers of forest fires		Amount of burnt area		Causes of forest fires															
					Intentional				Negligence-accident				Natural (lightning)				Unknown			
	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)
2006	2227	9.6	7762	8.7	166	8	206	2.7	1315	12.2	5873	9.8	330	10.9	543	23.2	416	5.6	1139	6
2007	2829	12.1	11664	13.1	292	14	1705	22.3	1642	15.3	7994	13.3	407	13.4	243	10.4	488	6.5	1722	9.1
2008	2135	9.2	29749	33.4	377	18.1	797	10.4	1018	9.5	26283	43.7	330	10.9	699	29.8	410	5.5	1970	10.4
2009	1793	7.7	4679	5.3	231	11.1	792	10.3	884	8.2	3082	5.1	333	11	105	4.5	345	4.6	700	3.7
2010	1861	8.0	3317	3.7	146	7	526	6.9	861	8	1851	3.1	281	9.3	69	2.9	573	7.7	871	4.6
2011	1954	8.4	3612	4.1	153	7.3	283	3.7	1067	9.9	2368	3.9	130	4.3	39	1.7	604	8.1	922	4.9
2012	2450	10.5	10454	11.7	197	9.4	1615	21.1	936	8.7	5780	9.6	373	12.3	334	14.3	944	12.7	2725	14.4
2013	3755	16.1	11456	12.9	260	12.5	1478	19.3	1419	13.2	4051	6.7	258	8.5	138	5.9	1818	24.4	5789	30.7
2014	2149	9.2	3117	3.5	127	6.1	85	1.1	801	7.5	1682	2.8	328	10.8	77	3.3	893	12	1273	6.7
2015	2150	9.2	3219	3.6	138	6.6	167	2.2	794	7.4	1198	2	257	8.5	95	4.1	961	12.9	1759	9.3
Total	23303	100	89029	100	2087	100	7654	100	10737	100	60162	100	3027	100	2342	100	7452	100	18870	100

Table 2. Evaluation of the total forest fires in terms of number and area between the years 2006 and 2015

Year	Numbers of forest fires	Amount of burnt area	Causes of forest fires															
			Intentional				Negligence-accident				Natural (lightning)				Unknown			
	Number	Field (ha)	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)	Number	Number %	Field (ha)	Field (%)
2006	2227	7762	166	0.7	206	0.2	1315	5.6	5873	6.6	330	1.4	543	0.6	416	1.8	1139	1.3
2007	2829	11664	292	1.3	1705	1.9	1642	7	7994	9	407	1.7	243	0.3	488	2.1	1722	1.9
2008	2135	29749	377	1.6	797	0.9	1018	4.4	26283	29.5	330	1.4	699	0.8	410	1.8	1970	2.2
2009	1793	4679	231	1	792	0.9	884	3.8	3082	3.5	333	1.4	105	0.1	345	1.5	700	0.8
2010	1861	3317	146	0.6	526	0.6	861	3.7	1851	2.1	281	1.2	69	0.1	573	2.5	871	1
2011	1954	3612	153	0.7	283	0.3	1067	4.6	2368	2.7	130	0.6	39	0.1	604	2.6	922	1
2012	2450	10454	197	0.8	1615	1.8	936	4	5780	6.5	373	1.6	334	0.4	944	4.1	2725	3.1
2013	3755	11456	260	1.1	1478	1.7	1419	6.1	4051	4.6	258	1.1	138	0.2	1818	7.8	5789	6.5
2014	2149	3117	127	0.5	85	0.1	801	3.4	1682	1.9	328	1.4	77	0.1	893	3.8	1273	1.4
2015	2150	3219	138	0.6	167	0.2	794	3.4	1198	1.3	257	1.1	95	0.1	961	4.1	1759	2
Total	23303	89029	2087	9	7654	8.6	10737	46.1	60162	67.6	3027	13	2342	2.6	7452	32	18870	21.2

Table 3. *The distribution of the field (ha) to the regional directorates of forest fires between 2006 and 2015*

Regional directorates of forestry	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)	Field (ha)	Field (%)
Adana	443	5.7	704	6	415	1.4	183	3.9	237	7.1	222	6.1	916	8.8	875	7.6	145	4.6	402	12.5
Amasya	93	1.2	413	3.5	46	0.2	85	1.8	306	9.2	158	4.4	139	1.3	280	2.4	201	6.4	119	3.7
Ankara	314	4	80	0.7	63	0.2	65	1.4	43	1.3	165	4.6	158	1.5	177	1.5	36	1.2	15	0.5
Antalya	515	6.6	2093	17.9	17026	57.2	469	10	503	15.2	92	2.5	653	6.2	1312	11.5	234	7.5	197	6.1
Artvin	7	0.1	6	0.1	34	0.1	-	0	42	1.3	20	0.6	7	0.1	20	0.2	9	0.3	5	0.2
Balıkesir	302	3.9	543	4.7	1974	6.6	328	7	64	1.9	421	11.7	658	6.3	2350	20.5	33	1.1	39	1.2
Bolu	284	3.7	80	0.7	29	0.1	12	0.3	85	2.6	83	2.3	65	0.6	77	0.7	14	0.4	51	1.6
Bursa	159	2	386	3.3	54	0.2	452	9.7	108	3.3	121	3.4	343	3.3	532	4.6	40	1.3	263	8.2
Denizli	61	0.8	369	3.2	71	0.2	88	1.9	91	2.7	116	3.2	235	2.2	122	1.1	80	2.6	34	1.1
Elazığ	104	1.3	338	2.9	859	2.9	210	4.5	235	7.1	73	2	20	0.2	53	0.5	63	2	71	2.2
Erzurum	65	0.8	28	0.2	14	0	-	0	-	0	40	1.1	66	0.6	55	0.5	9	0.3	83	2.6
Eskişehir	66	0.9	107	0.9	24	0.1	70	1.5	46	1.4	54	1.5	105	1	155	1.4	22	0.7	5	0.2
Giresun	10	0.1	33	0.3	51	0.2	11	0.2	106	3.2	27	0.7	32	0.3	91	0.8	89	2.9	74	2.3
Isparta	49	0.6	55	0.5	61	0.2	38	0.8	130	3.9	127	3.5	297	2.8	97	0.8	61	2	54	1.7
İstanbul	67	0.9	263	2.3	96	0.3	90	1.9	8	0.2	67	1.9	107	1	77	0.7	18	0.6	41	1.3
İzmir	579	7.5	963	8.3	1790	6	1603	34.3	502	15.1	733	20.3	474	4.5	862	7.5	270	8.7	153	4.8
K. Maraş	45	0.6	949	8.1	710	2.4	78	1.7	162	4.9	204	5.7	3669	35.1	1579	13.8	160	5.1	184	5.7
Kastamonu	166	2.1	311	2.7	83	0.3	26	0.6	48	1.4	40	1.1	205	2	77	0.7	46	1.5	30	0.9
Kayseri	-	0	-	0	-	0	-	0	-	0	161	4.5	51	0.5	203	1.8	69	2.2	41	1.3
Konya	132	1.7	42	0.4	17	0.1	88	1.9	106	3.2	78	2.2	85	0.8	182	1.6	49	1.6	64	2
Kütahya	574	7.4	581	5	15	0.1	25	0.5	11	0.3	14	0.4	183	1.8	72	0.6	52	1.7	6	0.2
Mersin	29	0.4	1053	9	5080	17.1	80	1.7	105	3.2	114	3.2	505	4.8	509	4.4	79	2.5	282	8.8
Muğla	3416	44	1531	13.1	665	2.2	260	5.6	160	4.8	165	4.6	242	2.3	972	8.5	724	23.2	184	5.7
Sakarya	170	2.2	321	2.8	192	0.6	358	7.7	87	2.6	106	2.9	99	0.9	117	1	28	0.9	34	1.1
Şanlıurfa	-	0	-	0	-	0	-	0	-	0	45	1.2	89	0.9	387	3.4	302	9.7	536	16.7
Trabzon	10	0.1	40	0.3	324	1.1	46	1	61	1.8	73	2	39	0.4	166	1.4	268	8.6	141	4.4
Zonguldak	101	1.3	373	3.2	56	0.2	14	0.3	71	2.1	91	2.5	1013	9.7	57	0.5	19	0.6	111	3.4
Total	7761	100	11662	100	29749	100	4679	100	3317	100	3610	100	10455	100	11456	100	3120	100	3219	100

Table 4. Numerical distribution (number) to the regional directorates of forest fires between 2006 and 2015

Regional directorates of forestry	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Adana	105	4.7	123	4.3	107	5	83	4.6	84	4.5	88	4.5	101	4.1	173	4.6	81	3.8	176	8.2
Amasya	116	5.2	165	5.8	63	3	74	4.1	104	5.6	93	4.8	95	3.9	144	3.8	84	3.9	60	2.8
Ankara	76	3.4	95	3.4	38	1.8	84	4.7	57	3.1	73	3.7	113	4.6	233	6.2	46	2.1	43	2
Antalya	240	10.8	265	9.4	212	9.9	144	8	125	6.7	152	7.8	214	8.7	321	8.5	169	7.9	189	8.8
Artvin	5	0.2	8	0.3	8	0.4	-	0	17	0.9	5	0.3	3	0.1	7	0.2	6	0.3	5	0.2
Balıkesir	105	4.7	122	4.3	80	3.7	90	5	57	3.1	79	4	73	3	96	2.6	72	3.4	68	3.2
Bolu	57	2.6	61	2.2	45	2.1	18	1	30	1.6	32	1.6	40	1.6	57	1.5	26	1.2	24	1.1
Bursa	82	3.7	94	3.3	97	4.5	105	5.9	53	2.8	72	3.7	81	3.3	118	3.1	64	3	43	2
Denizli	128	5.7	154	5.4	90	4.2	79	4.4	72	3.9	76	3.9	68	2.8	146	3.9	47	2.2	41	1.9
Elazığ	27	1.2	56	2	77	3.6	45	2.5	47	2.5	14	0.7	4	0.2	72	1.9	79	3.7	84	3.9
Erzurum	26	1.2	8	0.3	8	0.4	2	0.1	1	0.1	7	0.4	16	0.7	21	0.6	5	0.2	17	0.8
Eskişehir	43	1.9	59	2.1	42	2	51	2.8	44	2.4	32	1.6	38	1.6	79	2.1	21	1	12	0.6
Giresun	11	0.5	19	0.7	27	1.3	9	0.5	60	3.2	16	0.8	30	1.2	40	1.1	46	2.1	43	2
Isparta	47	2.1	53	1.9	69	3.2	76	4.2	78	4.2	56	2.9	105	4.3	120	3.2	70	3.3	74	3.4
İstanbul	151	6.8	186	6.6	136	6.4	115	6.4	42	2.3	172	8.8	228	9.3	271	7.2	108	5	153	7.1
İzmir	179	8	256	9	151	7.1	183	10.2	216	11.6	197	10.1	269	11	344	9.2	284	13.2	265	12.3
K. Maraş	71	3.2	100	3.5	64	3	79	4.4	119	6.4	78	4	132	5.4	262	7	155	7.2	170	7.9
Kastamonu	97	4.4	169	6	67	3.1	39	2.2	48	2.6	63	3.2	120	4.9	146	3.9	88	4.1	57	2.7
Kayseri	-	0	-	0	-	0	-	0	-	0	54	2.8	16	0.7	69	1.8	27	1.3	26	1.2
Konya	42	1.9	37	1.3	30	1.4	36	2	51	2.7	32	1.6	50	2	91	2.4	31	1.4	29	1.3
Kütahya	46	2.1	63	2.2	48	2.2	55	3.1	34	1.8	41	2.1	54	2.2	90	2.4	55	2.6	33	1.5
Mersin	50	2.2	128	4.5	93	4.4	60	3.3	90	4.8	98	5	75	3.1	155	4.1	91	4.2	80	3.7
Muğla	326	14.6	415	14.7	348	16.3	252	14.1	309	16.6	267	13.7	383	15.6	395	10.5	320	14.9	254	11.8
Sakarya	57	2.6	80	2.8	98	4.6	74	4.1	54	2.9	58	3	56	2.3	78	2.1	33	1.5	46	2.1
Şanlıurfa	-	0	-	0	-	0	-	0	-	0	21	1.1	23	0.9	101	2.7	66	3.1	89	4.1
Trabzon	3	0.1	5	0.2	26	1.2	9	0.5	25	1.3	21	1.1	6	0.2	41	1.1	29	1.3	22	1
Zonguldak	137	6.2	108	3.8	111	5.2	30	1.7	44	2.4	57	2.9	57	2.3	85	2.3	46	2.1	47	2.2
Total	2227	100	2829	100	2135	100	1792	100	1861	100	1954	100	2450	100	3755	100	2149	100	2150	100

Table 5. Distribution of forest fire numbers to the State Forest Enterprises in the İzmir Regional Directorates between 2006 and 2015

State Forest Enterprise	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		10 years total		10-year average	
	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%	Number	%
Bayındır	24	13.4	26	10.2	15	9.9	30	16.4	13	6.2	25	13	29	10.9	24	7	18	6.3	28	10.6	232	9.9	23	9.9
Bergama	19	10.6	17	6.6	23	15.1	21	11.5	19	9	26	13.5	44	16.5	45	13	19	6.7	44	16.6	277	11.9	28	12
İzmir	53	29.6	56	21.9	33	21.7	48	26.2	71	33.8	71	36.8	54	20.3	85	24.6	85	29.9	73	27.5	629	27	63	27
Menderes		0.0		0		0		0		0		0	32	12	53	15.4	37	13	32	12.1	154	6.6	39	16.7
Akhisar	31	17.3	55	21.5	42	27.6	28	15.3	46	21.9	32	16.6	49	18.4	67	19.4	43	15.1	53	20	446	19.1	45	19.3
Demirci	12	6.7	30	11.7	8	5.3	17	9.3	16	7.6	7	3.6	15	5.6	19	5.5	22	7.7	6	2.3	152	6.5	15	6.4
Gördes	13	7.3	19	7.4	4	2.6	1	0.5	11	5.2	2	1	10	3.8	5	1.4	17	6	7	2.6	89	3.8	9	3.9
Manisa	27	15.1	53	20.7	27	17.8	38	20.8	34	16.2	30	15.5	33	12.4	47	13.6	43	15.1	22	8.3	354	15.2	35	15
Total	179	100	256	100	152	100	183	100	210	100	193	100	266	100	345	100	284	100	265	100	2333	100	233	100

Table 6. Amount of burnt area (ha) to the State Forest Enterprises in the İzmir Regional Directorates between 2006-2015

State Forest Enterprise	2006		2007		2008		2009		2010		2011		2012		2013		2014		2015		10 years total		10-year average	
	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%	Field (ha)	%
Bayındır	418	72.3	28	2.9	63	3.5	48	3	6	1.2	22	3	19	3.8	8	0.9	22	8.1	8	5.3	642	8.1	64	8
Bergama	30	5.25	130	13.5	23	1.3	12	0.7	398	80.4	148	20.3	76	15.4	22	2.6	4	1.5	15	9.9	859	10.8	86	10.8
İzmir	71	12.3	468	48.6	1513	84.5	1457	89.7	40	8.1	439	6.3	100	20.2	215	24.9	64	23.6	39	25.7	4407	55.3	441	55.4
Menderes	-	0	-	0	-	0	-	0	-	0	-	0	94	19	57	6.6	26	9.6	11	7.2	188	2.4	47	5.9
Akhisar	23	4	36	3.7	94	5.2	21	1.3	13	2.6	65	8.9	37	7.5	58	6.7	111	41	62	40.8	520	6.5	52	6.5
Demirci	18	3.1	15	1.6	31	1.7	23	1.4	17	3.4	14	1.9	40	8.1	25	2.9	20	7.4	1	0.7	205	2.6	21	2.6
Gördes	5	0.9	13	1.3	50	2.8	3	0.2	6	1.2	1	0.1	4	0.8	3	0.3	7	2.6	1	0.7	93	1.2	9	1.1
Manisa	13	2.2	273	28.3	17	0.9	60	3.7	15	3	39	5.4	125	25.3	472	54.8	18	6.6	15	9.9	1048	13.2	105	13.2
Total	578	100	963	100	1791	100	1625	100	495	100	728	100	495	100	862	100	271	100	152	100	7963	100	796	100

Turkish Forest Organization and present activities against fires

Ministry of Agriculture and Forestry of Turkey and the Turkish General Directorate of Forestry have the main responsibility over the fire prevention and forest protection. All the organizational framework is set up in accordance with the Turkish Constitution (Dated 07.11.1982, Nr.2709, Section 169) and Turkish Forest Law (Dated 08.09.1956, Nr.6831, Section 68-76) besides relevant rules and regulations. The General Directorate of Forestry contains primary departments of fire control and forest protection.

General Directorate of the Turkish Forestry has three main sections which are: Forest Protection, Control of Forest Pests and Prevention and Control of Forest Fires. Especially, the section of Prevention and Control of Forest Fires is charged to prevent forest fires by means of the Regional forest directorates, forest enterprises and forest rangers. Fire suppression activities are realized by different kind of tools, equipment, man and machine powers and also sometimes by aerial supports which can be summarized as: fire attack crews, fire personnel, fire boss, fire lookouts, power chain saws, bulldozers, tractors, lorries, water trucks, pick-ups, off-road cars, water reservoirs, UHF and FM communication radios, telescopes, different masks, fire resistant clothes, chemical retardants, planes and helicopters. Furthermore; meteorological data is taken from the weather stations. Meantime various firebreaks, fuelbreaks, fire lookout roads and telephone lines are also constructed (Mol and Kucukosmanoglu, 1998).

Discussion and conclusion

Forest fires are one of the major problems in many countries. As we know, in context of location and climate properties; during fire seasons the environmental effects of drought, low rates of relative humidity and wind occur in Mediterranean, Aegean and Marmara Regions of Turkey. Due to these reasons; as being located at Aegean Region, Izmir Regional Directorate of Forestry is also at remarkable risk. However regarding the forest protection and fire prevention, there is no doubt that much development has been achieved in Turkey. Within the results of our study, fires are mostly caused by negligence and accident, rather than natural or unknown ones among the reasons of forest fires. During the examination period (2006-2015), within the range of these causes, in respect to number value Intentional and in accordance to its field value, Negligence-Accident comes forward.

For this reason, regarding the protection of forests from fires; more emphasis should be put on to the issues of public awareness and education. Between the years 2006 and 2015, it is seen that numerical findings of Izmir, Antalya and Muğla reach the highest rates. Therefore it is possible to state that forest fires are mainly concentrated upon these three regions in Turkey. Izmir Forest Enterprise steps forward with highest values in respect to area and number, concerning with forest fires.

There are 603 forest villages in İzmir. It is emphasized that the socio-economic level of the people which are living in or near the forest, is highly below the standard of living. According to statistical data, 343.513 forest villagers live there (GDF, 2016). The average income of forest villagers is \$250 per month, mainly from forestry work and farming. Forest villagers regularly clear fields from forest land for subsistence farming. So, these villagers would like to use the forest without limitation for their survival. This brought out the forest-human activities relationship. Furthermore, this helps to explain why the three causes of forest fires are negligence, carelessness and accidents, unknown reasons, and deliberate fire setting.

Demir et al. (2019) stated that however, with the fast-growing economy in Turkey, the present situation of forest fire protection is becoming severe. The main causes are that technical forest fire protection work has failed to keep up with social development and that regulation and management systems for forest fire protection are falling behind the present state of social development. Therefore, more effective regulations and rules should be set up soon, and a strategy should be developed in Turkey to carry out timely forest fire research work so as to cope with the new challenges of forest fire hazards in the future.

Boazountas et al. (2005) stated that most of the Mediterranean region suffers from extensive forest fires, and in some cases socioeconomic factors are key determinants in wildfire causality classification. Determinants are those components within the forestry environment that help explain the intensity and spread of wildfires. The module developed here incorporates five factors representing forestry profitability, demographic pressure, social tension, forestry culture, and organizational thinking. These factors are sufficient to explain the increase or decrease of fire risk. These factors can be modelled by considering variables which describe the behaviour of the socioeconomic fire risk (local permanent population, tourists, domestic animals, houses, type and height of vegetation) and constructing transformation functions that will determine the final value of fire risk.

Ayberk et al. (2010) has similar results as our research and stated that fire is a natural element and plays an important role in the natural dynamics of the forest ecosystems. However, fire can be a very destructive force. According to the establishment of new and modern fire prevention and suppression techniques, the number of fires and burning area will be getting decreased. Adverse burning conditions will occur in the future as they have been in the past. The important measures to be taken are firstly to keep away the fire from the forests and secondly to suppress the fire immediately and effectively as it is still at the beginning stage. The sooner a fire is detected and reported, the larger the initial attack force and the quicker it arrives at the fire, the more likely the fire will be contained at a small size. This could be realized by effective protective measures and well-trained fire fighting teams using appropriate high technology and equipment.

Therefore, all relevant findings in our study indicate that Izmir Region has a sensitive status concerning the forest fires. Therefore; during the fire seasons in Izmir, it is a necessity to take all the required measures against fires. Also, fire suppression activities in Izmir should be carried out by different kind of tools, equipment, man and machine powers and aerial supports such as fire attack crews, fire personnel, off-road cars, water reservoirs, UHF and FM communication radios, fire resistant clothes, planes and helicopters, etc. Due to the fact that Izmir Regional Directorate of Forestry where the forest fires are frequently occurred has a long fire season (5-8 months), flammable material reduction and road cleaning works in forests should be performed. Izmir Regional Directorate of Forestry is one of the most dangerous forest region directorate compared to other directorates in terms of both number of fires and burnt area. For this reason, in context of forest fires all essential precautions should be taken and applied carefully.

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