THE WEATHER CONDITIONS OF RECENT YEARS AND ITS IMPACT ON THE FOREST FIRES IN HUNGARY

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ABSTRACT

The natural disasters are gaining greater emphasis in our lives. The climate change has already been accepted as a fact by all literature in the branch of the science. Climate change affects all over on Earth and it has many consequences. One of that is the constant raise of the average temperature, and this greatly increases the risk of the forest and vegetation fires. In order to do researches on forest fires it is essential for analyzing the climate and weather data. The paper shows the most important data in connection with the weather conditions and the forest fires from the last six years in Hungary.

Key words:
Forest fires, weather conditions, drought, precipitation, data

1 INTODUCTION

If we want to do researches in connection with forest and vegetation fires it is essential to analyze the climate of the country. An effective firefighting intervention is greatly influenced by the weather conditions. In dry climate periods the vegetation can easily to ignite. When it is also a presence of variable breezes and winds, it can make the intervention more difficult. In many cases this has led to wide forest fires. [1, 2, 3] In connection with the topic the weather data between 2011 and 2016 were analyzed. For this, we can find the most important information on the website of the Hungarian Meteorology Service (OMSZ). [4]

Based on the data from OMSZ it can be stated that the weather of Hungary was variable in the last six years. One of the main reasons for the variability is that Hungary is affected by the wet ocean and the dry continental climate with extreme temperatures. It results drought in summer and wet weather in winter. In this paper I will examine the weather data of the last six years and the impact of this on the forest fires.

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2 WEATHER DATA 2011-2016 IN HUNGARY

In order to make consequences I made a research from the weather conditions from the last six years.

2011: The months of 2011 were warmer than in the previous years, only the frozen February and the wintry November were exceptions. The biggest positive difference was in September as the prolonged summer caused the month to reach an average temperature of 3.5 ° C higher than in previous years. But there was a significant rise in the temperature in April and August as well (+2 ° C). The most important weather factor for forest fires is the amount of precipitation. In connection with the year 2011, meteorological data show an extremely dry year. Not only the year, but with the exception of two months (July and December), every month showed a precipitation deficit. The November was particularly rainless, when only 0.4 mm precipitation fell. The autumn was therefore extremely dry, so much so that its rainfall was the second lowest, since the beginning of the measurements. [4] Due to the lack of the precipitation, in 2011 the number of the forest and vegetation fires were much higher than in the last 2-3 years in Hungary.

2012: After the record dry year of 2011 it came another dry year again in 2012 in Hungary. As in the previous year, a significant part of 2012 was characterized by drought. Two months, March and August also proved to be a record dry, with severe frosts in February, and in summer, with four heat waves. The year was characterized by a significant lack of rainfall as well.
Two extremity can be highlighted: The precipitation levels in March and August were far below the normal value, and extremely few rain fell across the country over the two months. In August, the drought has broken more than 100 years of record. This has also had a major influence on forest fires as the weather has hit the worst fire season of the past decade. More precipitation fell only in October and December. [4]

2013: In previous years, record-breaking dry years followed each other, sometimes it was often associated with high temperatures. The beginning of the year was characterized by significant rainfall surpluses, and the constant recurrent rainfall resulted in an average annual rainfall somewhat the higher than normal. Thanks to this, in 2013, much less forest and vegetation fire occurred than in the previous two years. All in all, the year 2013 was very varied, which was characterized both by the precipitation in the beginning of the year and by the summer drought. In autumn the rain period came back but only in a small quantity. [4]

2014: The year 2014 was remarkable in the weather of Hungary. The average temperature of around 12 ° C proved to be the warmest year of the past 100 years, ahead of the hottest year of 2007. It is interesting, that the high average temperature was not measured in the summer months -but could be measured in other seasons - therefore the dry and hot summer periods were not present like in the previous years. So the statistics showed less forest fires again. 2014 can be named to the rainy years. It was unusual that the most precipitation fell in the summer period, in contrast with the

previous years. After the wet summer, Hungary had a wet autumn as well. In this year the most of the precipitation fell in the southwestern part of the country. Overall, although there were forest fires, their number did not exceed the ten-year average. [4]

2015: 2015 was the third warmest year. The summer months were again characterized by drought, which came to Hungary in the form of several long-lasting heat waves. Only in August falls a small amount of rain. Most of the year was warmer than the average. Based on statistical data, 2015 is considered to be average in terms of the rainfall. After the dry spring and summer period, came a rainy autumn and winter. [4] Although the weather was drier than in 2014, the country did not have a higher number of forest fires.

2016: On Earth, the year of 2016 was a record hot year, although it did not exceed in Hungary the record of 2014. The most of the months were warmer than usual. Especially the late winter and the early days of autumn proved to be mild. The country had larger quantity of rain this year. In particular, in February and in July, there was a record precipitation, but overall several months were rainier than the average. [4] This year the number of the forest fires was much below than the 5 year average mainly due to the rainy days of February and March.

3 STATISTIC ON FOREST FIRES IN HUNGARY

After the examination of the weather data, it is important to make consequences from the statistic on the forest and vegetation fires.

3.1 FIRE SEASON

During the investigation of the number of the fires, it can be clearly demonstrated that during a year two highly flammable periods can be separated. As the graph shows, the number of the outdoor fires are beginning to rise from the middle of February. Most of the fires are generated in March. Depending on the weather, the flammable period will be extended to April, just as was in 2011 and 2012. This is due to the fact that vegetation has not yet grown out, because of the weather of spring. However from the previous year a larger amount of dried herbaceous vegetation or foliage is found in the area that can easily and quickly to dry out. Thin, few centimeters thick plant parts dry out even in cold, precipitation without a few days (in droughty springs even in a few hours) and can easily to burn. The second flammable period can generate during the droughty summer months in July and August. Almost 70% of the fires generate in these two highly flammable periods. [5]

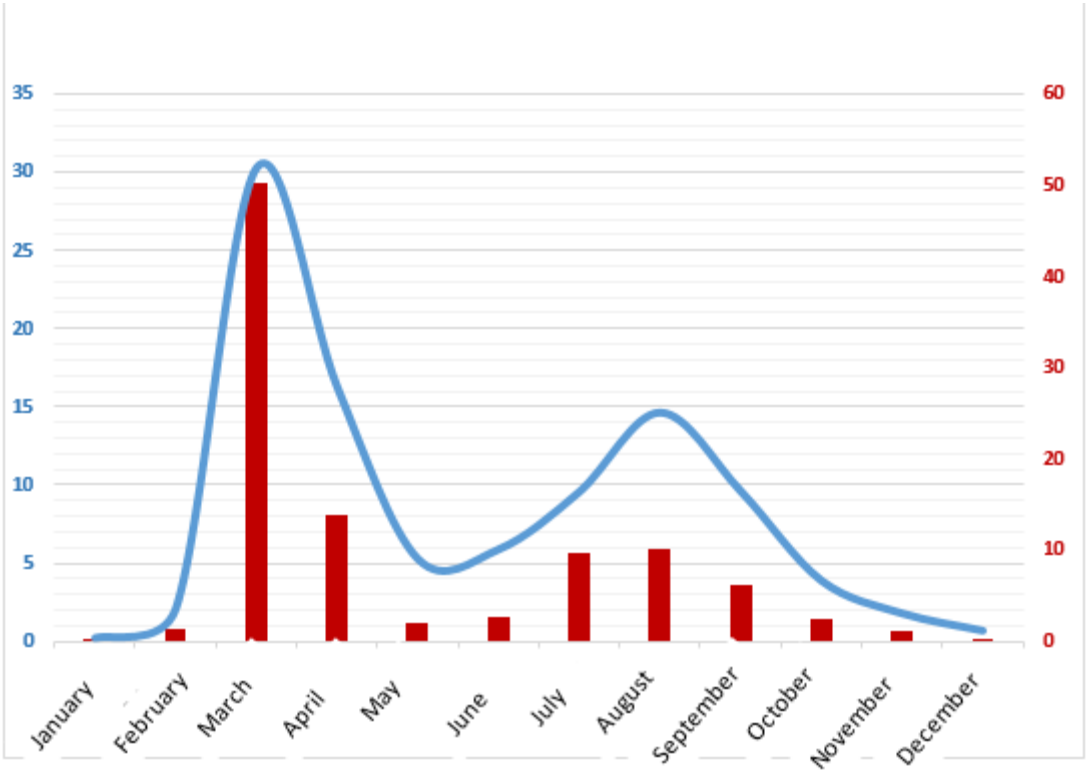

Figure 1: The number of free fires between 2011 and 2016 and the average burned area monthly. Made by: Péter Debreceni Source: [5]

The trend in the figure also confirms that the light combustible lawn biomass (vegetation fires) because of the weather conditions can be generated at any time of the fire season. It gives frequently interventions to the fire services. During the spring period, large fires do not generate, but between middle of February and late April the number of fires increases significantly. After the snowy days in the snow-free years the temperature begins to rise and the flammable light biomass can be burned in a few days.

In the recent years, in the increased risk of fire, a large number of foliage fire generated in the pine forests of the Great Plain and in the woody and of the northern part of Hungary. (2012. Bugac, vegetation fire, 1200 hectares; 2015. Kiskunhalas, Rekettye, 400 hectares; 2015. Hortobágy, 400 hectares).

3.2 FOREST FIRE STATISTICS FROM THE LAST 6 YEARS

Table 1 shows all the vegetation fires, the forest fires and the burnt forest areas between 2011 and 2016. At the time the paper was written, the final data for 2017 were not yet available, therefore, only the data between 2011 and 2016 was analysed.

Table 1: Number of the forest and vegetation fires between 2011 and 2016 in Hungary. Made by: Peter Debreceni. Source: [5]

Number of the forest and vegetation fires between 2011 and 2016 in Hungary			
Year	**Nr. of the vegetation fires (+ forest fires)**	**Nr. of the forest fires (Nr.)**	**burnt areas (ha)**
2011	8 436	2 021	8 055
2012	21 581	2 657	14 115
2013	4 602	761	1 955
2014	5 783	1 042	4 454
2015	5 297	1 069	4 730
2016	2 677	452	974

Based on the statistics of the last 6 years, it can be stated that the number of the forest fires were very variable. In 2012 was extremely high, and in 2016 there were exceptionally few forest and vegetation fires. The main reason for this is the weather for the given year. I made an average calculation from the fire statistics data from the last 6 years, it can be stated, that the number of the forest and vegetation fires are more than 8000 cases/year (8062), the number of forest fires are 1333 cases/ year. The burnt areas are approximately 6000 hectares/ year (5713). In connection with the statistical data it is important to mention, that the 99% of the forest and vegetation fires are caused by human negligence. [6]

3.3 CLASSIFICATION OF BURNT AREA IN SIZE GROUPS

One indicator of the severity of a fire is the size of the burnt areas during the fire. Examining the extent of the affected area by a fire, we have divided the fire into five categories in line with international statistics. **Small** fire is a fire reaching less than one hectare. **Medium-sized** fires include from 1 to 50 hectares of fires, and the fires of more than 50 hectares are considered a **large** fire. For medium and large fires, several firefighting units may be alerted taking into account the risk factors. Regarding all the fires, the area which was affected by forest fires in the examined period, averaged more than 4 hectares of the burnt areas. Based on statistics, it can be stated that the proportion of the forest fires under one hectare exceeds 60%, and for vegetation fires this proportion reaches 75% of all fires. For fires where the burnt area does not reach 1000 m^2, the proportion of fires involved is even more prominent (50% and 36%). By default the fire spread can be stated “consistent” if in all directions, this corresponds to a circle of 18 meters of radius. It means that the firefighters have to fight against fires, which can be prevent with the compliance of the fire regulations. In addition, it is also important that land owners and farmers do not have the necessary license and appropriate knowledge in connection with the forest fires. They make the ignition not in a regular framework. [5]

3.4 THE NUMBER OF THE FIRES DURING A WEEK

It is worth considering to analyze the number of the forest and vegetation fires in another aspect. The weekly aggregation can be used to determine the shorter or longer periods during the year when a flammable period is expected. Figure 2 illustrates well that the number of the fires in the examined period begins to increase in the 9th week (last week of February) and in the 18th-19th week (early May) is reduced to 50 fires per week. During the summer, the number of fires rises steeply during the sunny and hot months of July and August. [5]

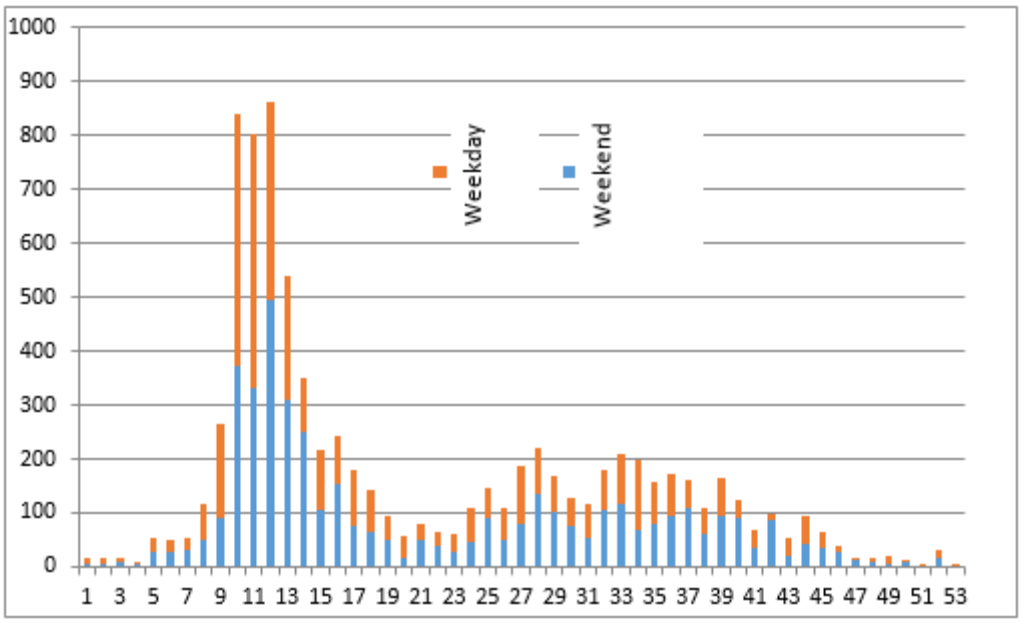

Figure 2: The average number of the outdoor fires on weekdays and weekends between 2011and 2016. (Made by: Péter Debreceni Source: [5]

According to an annual statistic, nearly the half of the forest fires (47%) are generated on weekends or on holidays. The number of the fires under 1 hectare are also generated on weekends. It shows the fact that, besides agricultural activity, we have to make investigations for the fire behaviors of the hobby garden owners, because they causes many forest fires, because of their negligence. This is particularly true during the spring holidays (national holidays, Easter) when there are several public holidays, long weekends in certain years. During the period under the review, except for the extreme rainy weather in 2013 of March, it can be stated that in March, the 45% of the fires was on weekends and on a holidays. This statistic leads to the human negligence as well. Forest fires are more common, and the size of the affected areas are higher on weekends and holidays than on workdays. [7] The human negligence is not only a problem at the forest fires, but also during at other types of the firefighting, [8, 9] all over the world. [10, 11]

4 CONCLUSION

This paper shows the weather of Hungary for the last 6 years associated with the forest fire statistics of the country. As a result of this article, it can be stated that the primary cause of the forest fires are the weather conditions of the area. According to the paper, it can be stated that in Hungary the large number of forest fires occurred in those years when the weather conditions of the country allowed this opportunity. This is especially true for the fire seasons of the early spring and the dry summer months. In connection with the forest fires it is very important to deal with the problem of the human negligence. By reducing this problem, almost all the forest and vegetation fires could be prevented. The disaster management has to find a solution for this problem.

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