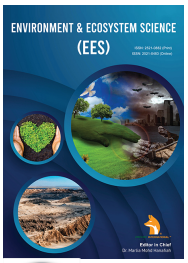
ZIBELINE INTERNATIONAL™ PUBLISHING

ISSN: 2521-0882 (Print)
ISSN: 2521-0483 (Online)
CODEN: EESND2

Environment & Ecosystem Science (EES)

DOI: http://doi.org/10.26480/ees.02.2021.94.100



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RESEARCH ARTICLE

FIRE CHARACTERISTICS OF ZAGROS FOREST ECOSYSTEM, KERMANSHAH PROVINCE, WESTERN IRAN

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ARTICLE DETAILS

Article History:

Received 17 May 2021
Accepted 20 June 2021
Available online 15 July 2021

ABSTRACT

Fires are an integral part of many terrestrial biomes and a major source of disturbance in nature. The purpose of this study is to assess the causes and characteristics of fires in the Zagros ecosystem in ten consecutive years from 2011 to 2020. To conduct this research, wholly fire events that occurred in natural areas in the Gilan-e Gharb basin during the fire season detailed in a decade. In practice, immediately after informed of the occurrence of fires in natural areas, research data recorded. Totally, 233 event fires have occurred in the ten years from 2011 to 2020. The fire affected approximately 11,420 hectares of natural areas. The highest frequency of monthly fires during the months of the fire season includes 53, 44, and 40 events, which concern August, July, and September, respectively. The frequency of fires in different components of natural resources shows that the highest and the least frequency includes non-wooded pastures (44.6±5.6) and mixed Forest-rangeland (14.25±4.11). The most causes of fire in natural areas include recreation and hunting (43.3±16.1). The maximum frequency of the fire area includes <100 hectares' classes (83.6±20.57). Most fires suppressed in a very short period (64.27±26.17). Daneh Khoshk, Nawdar, Poshteh, Peikoleh, Belaleh, Cheleh - Ghalajeh as well as Chikan regions include a high risk of fire. The issues connected to the fire are multidimensional. It deals with climatic and habitat factors, social issues, and the nature conservation culture institutionalization among the local people. To reduce the fire and the resulting damage, it is necessary to perform basic proceedings in whole fields.

KEYWORDS

Recreation, time of fire, area of fire, local conflicts and disputes.

1. INTRODUCTION

Fire is an integral fragment of many terrestrial ecosystems (TS) and one of the main causes of disturbance in natural areas (Pausas et al., 2008; Castro Santana, 2019). Humans have increasingly modified natural fire regimes over thousands of years so that in many parts of the world, anthropological fires are more common than natural fire. The fires and burned areas increased over the past decades (Piñol et al., 1998; Flannigan et al., 2009; Bowman et al., 2011). Although fire is an essential part of natural ecosystems, fire regimes in southern Europe are principally man-made, while they are occurring naturally in boreal forests (San-Miguel Ayanz and Camia, 2009). Traditional utilization of fire (TUF) in agriculture and animal husbandry is one of the fundamental causes of forest fires (Juárez-Orozco et al., 2017). Demographic changes associated with the abandonment of rural regions similarly increase the fire risk.

There a fuel accumulation through lack of forest management practices that lead to uncontrolled forest fires (Mantero et al., 2020). Although, in general, the rural population in southern Europe has decreased, the presence of a whacking population in the recreation and hunting areas during the holidays increases the ignition in summer. There are ignition growths increase with the development of urban areas towards natural biomes. Therefore, certain areas have emerged as urban intermediaries through the cities' development or the secondary house's construction in rural areas (RA). The difficult fire management in enormous intermediate terrain in southern Europe has been the cause of catastrophic fires, such as Portugal 2003 or Greece 2007 (Moreira et al., 2012).

One of the elementary components of fire dynamics is ground cover. This factor affects whole phases of fire, from ignition to fire behavior, and post-fire revival (Moreira et al., 2012). Forest stand Separate type is composed of various plants, whether herbaceous or wooden. The plants' flammability is determined via their physical and chemical properties (including leaves, needles, stems, thin pieces of wood) and their structural arrangement (Zylstra, 2011). Factors affecting fires (FAF) in each region depend on factors such as human, natural and seasonal. It causes forest fires because of negligence and fire misuse in agriculture, especially livestock and shepherds, and stakeholder's disputes. The vicinity of residential zones to forest areas likewise roads in the forest increases access to forests and besides the risk of fire (Zarekar et al., 2013).

The most important causes of forests and pastures fires have been reported as the development of agricultural lands and land grabbing,

Quick Response Code	Access this article online	
	Website: www. environecosystem.com	**DOI:** 10.26480/ees.02.2021.94.100

Cite the Article: Mohsen Javanmiri pour (2021). Fire Characteristics of Zagros Forest Ecosystem, Kermanshah Province, Western Iran. *Environment & Ecosystem Science, 5(2): 94-100.*

sabotage, hunters and passers-by negligence, inattention of farmers in burning crop residues in contiguous forests and pastures, throwing cigarettes in adjacent routes to forests (McKenzie et al., 2011). The forests of the Golestan province findings showed that most of the fires occurred in dense forest stands, in mid-canopy cover forests, and shrub areas. The fire majority calculation in altitudes classes showed that approximately 90% of fires occurred at 700 - 1500 m altitudes. (Janbaz Ghobadi, 2019). Findings showed that vegetation with 58.36% density, 38.38% slope have the utmost impact on fire expansion, and other parameters exist in the next priorities.

Further, the correlation coefficients sightings showed that the highest correlation with the fire hazard map consists of vegetation, ground surface temperature (GST), slope direction, and slope indices with 29.20%, 29.11%, 21.93%, and 19.75%, respectively. Furthermore, the fire potential map evaluation with 50% risk exhibited that around 17% a high potential (HP), and more than 50% very high risk of fire. The relationship between human causes and fire risk study revealed that proximity to the road factor personate a major function in igniting. The roads and residential areas contain at least 32% and, at most 68% correlation with fire risk, respectively. (Emami and Sharyair, 2019). The fire regime characteristics concerning local and large-scale physiography in pine forests in the United States were studied (Meunier et al., 2019). Frequent fires (average fire return includes 8 years) and widespread annual fires have identified in various areas.

There is no obvious difference in fire return intervals or origin and physiographic effects (topography and water characteristics). The significant variation in the fire origin on a local scale measured by increasing water properties and topographic roughness, which lead to shorter return intervals. It scrutinizes a comparison of spatial variability in forest fires between cold and subtropical ecosystems in China (Su et al., 2019). In general, forest fires change from cold to subtropical. There are significant spatial differences in fire factors between cold and subtropical forest ecosystems (P <0.05 Forest fires in cold ecosystems are caused by meteorological, topographic, and human elements that have specific spatial variations. In contrast, there were locally inhabited forest fires in the subtropical forest ecosystem. Environmental stimuli contribute to the severity of the fires that affect the pine forest of the Mediterranean ecosystem.

The results exhibited that the fire severity was more affected by whether the vegetation was alive or dead formerly the fire. However, the effect of the live plants before the fire was strappingly dependent on the relationships between the vertical structure (VS) of the vegetation, the date of the fire, and the weather conditions. There, paradigms that employ physical variables display a significant relationship with fire intensity (FI). However, the results suggest that the physical properties likely influenced by the combustible biomass structural properties (García-Llamas et al., 2019). A group researcher analyzes the fire severity potential in the Mediterranean pine ecosystem (Mitsopulus et al., 2020). The results of the stochastic forest classification algorithm showed that high-intensity potential and classification between fire severity levels primarily depend on topographic variables and fuel properties. There numerous studies conducted on the forest fire issue.

Most of them have focused on the effects of fire on changing the diversity and abundance of species, changing the structure of burnt stands, changing the quantitative and qualitative characteristics of soil, zoning, and the possibility of predicting it. There are some inadequacies in the study of fires in natural areas on frequency, recurrence, duration of firefighting, and causes over time and in different years, which the present study tries to address as much as possible. Therefore, this study's purpose examines the causes and characteristics of fires caused in the sub-Mediterranean deciduous Zagros ecosystem in western Iran in ten consecutive years. The innovation of this research comprises considering the effective factors in creating and spreading fires via direct measurement in diverse climatic conditions. Further, another innovative aspect of this research includes the selection of a ten-year statistical period and the selection of different regions with different climatic and altitude conditions within a geographical region that has not been studied at this level so far. This diversity of climates can support the extension of the results of this study to other parts of the world.

2. Material and Methods

2.1 Study area

Gilan-e Gharb similarly romanized as Gīlān-e Gharb is the capital city of Gilan-e Gharb County, Kermanshah Province, Iran. The latitude of this basin includes from 3730000 to 3810000 and the longitude from 554000 to 662000 based on the World Geodetic System 1984.

The study area is located in the west and south of Kermanshah province in western Iran. The mentioned region leads from the north to Sarpol-e Zahab and Dalahu, from the northeast, east, and south to Islamabad-e Gharb and Ilam province, and from the south and southwest to Iraq and to the west Naftshahr and Qasr-e Shirin. The minimum and maximum altitudes 140 and 2315 meters above sea level related to the border point with Iraq and the Kachel mountaintop, respectively. To the east and north, the altitude increases and the air cools, while to the south and west, the altitude decreases and the air warms.

Gilan-e Gharb has the typical continentally influenced Mediterranean climate of western Iran. However, in recent years dust storms have contaminated the air, triggering respiratory diseases, including asthma. Persian oak is the main tree in the forest of the Gilan-e-Gharb basin. Other important tree species and shrubs of this region consist of Wild pistachio (*Pistacia atlantica*), Khinjuk (*Pistacia khinjuk*), Fig sp., Maple (*Acer monspessulanum*), common almond (*Prunus dulcis*), mountain almond (*Prunus scoparia*), Tangres almond (Prunus lycioides) , Mountain Almond (*Amygdalus scoparia*), Wild cherry (*Prunus microcarpa*), Hawthorn (*Crataegus* sp.), Ash tree (*Fraxinus rotundifolia*), Wild pear (*Pyrus glabra*), Nettle tree (*Celtis australis*), Oleander (*Nerium oleander*), Euphrate poplar (*Populus euphratica*), Blackberry (*Paliurus spina-christi*), Desert thorn (*Lycium shawii*) and Daphne (Daphne mezereum). Dominant rangeland plants in this area include prickly thrift (Acantholimon sp.), Acanthophyllum, *Onobrychis sativa*, water foxtail (Alopecurus sp.), Thyme, Clover (Trifolium sp.), Licorice (*Glycyrrhiza glabra*), and Geramineae species (Bagheri et al., 2020). Wildlife in this area include wild goats, rams, deer, wolves, foxes, rabbits, hedgehogs, hyenas, brown bears, boars, jackals, snakes and other reptiles.

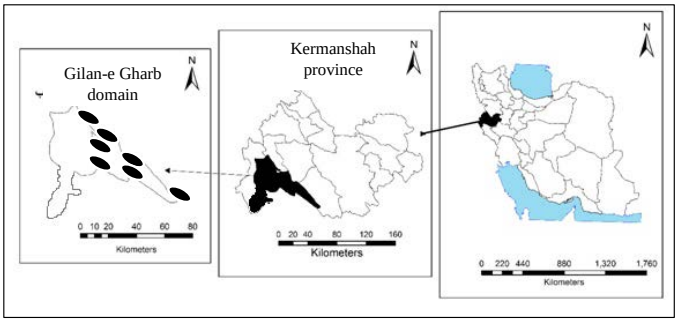

Figure 1: The study area in Iran and Kermanshah province

2.2 Research method

To conduct this research, wholly wildfires events that occurred in the Gilan-e Gharb basin recorded during the fire season from early June to mid-November in 2011 to 2020 years. This area includes appropriate forest and rangeland (75,000 hectares of forest and 130,000 hectares of rangeland) as well as great climatic variety so that in the mentioned region dry, medium semi-dry and slightly semi-dry climates are significant. The contemporary situation provides the fire's cause analysis through different conditions. Another reason to select this area is the fires frequency. The number of 7, 3, 4, 3, 26, 37, 27, 12, 64 and 50 fire events are related to the years 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 and 2020, respectively. The natural areas type affected by the fire classified as non-wooden rangeland, wooded rangeland, forest, mixed forest- rangeland.

The reason for this type of classification is the existence of non-wooden rangeland in dry areas and the existence of wooden rangelands in medium semi-dry and slightly semi-dry regions. Data sampling conducted, directly and with the participating forces in the firefighting operation in the field. To conduct the study, the researchers immediately arrived at the fire-location and proceeded to record the data after receiving the news of a fire in natural areas. The collected data in this study include the area common name, affected source type by the fire (forest, non-wooded rangeland, wooded rangeland, and …), the fire date, the fire month, the fire begin and end time, the fire duration, the fire area and the geographical location of the region. The fire cause is another piece of recorded data in current study. The fire cause was determined via the documents left at the fire spot, the fire history in the past years, the local people observations who were the first eyewitnesses of the fire, and the area land-use.

For example, the fire cause in recreation and hunting areas is different from the fire origin in rangelands. Manual GPS employed and a special option served to compute the area by walking on the burned area borders to record the area location and the burned region area determination. The recruited GPS type in this study was the Garmin GPSmap 62 s. The burned zones area considered as small, intermediate, large, and very large include > 20, 100-20, 500-100, and <500 ha, respectively. The required time to extinguish the fire in less than 1, 1-2, 2-3, 3-4, 4-6, 6-8, 8-10, 10-14, and more than 14 hours in Low, very low, low, below average, average, above average, approximately high, high, and very high categories, respectively (Bermudez et al., 2009). Environmental criteria such as physiographic, climatic, and human characteristics considered to hazardous map fire areas by Arc GIS software.

Various data hired to prepare the fire risk map, including fire information and a digital elevation model. Regional data including meteorological information, residential areas, rivers, and roads are other requisite information for this purpose. Meteorological data including temperature, wind, humidity, and rainfall obtained from synoptic stations in the area. Information on residential areas, rivers, and roads received from the Natural Resources Office of the Gilan-e Gharb city. The climate type was determined through experimental methods, plant species including herbaceous and woody as well as meteorological data of adjacent areas (Qasr-e Shirin, Sar pol-e Zahab and Islamabad-e Gharb) through the lack of synoptic stations in entirely parts of the region (Based on the Amberger classification); (Ganjalikhani et al., 2015).

3. Results

In total, 233 fires occurred in the ten years from 2011 to 2020. The lowest number of fires involves 3 incidents in 2012 and 2014. The highest number of fires includes 64 incidents in 2019 (Figure 1).

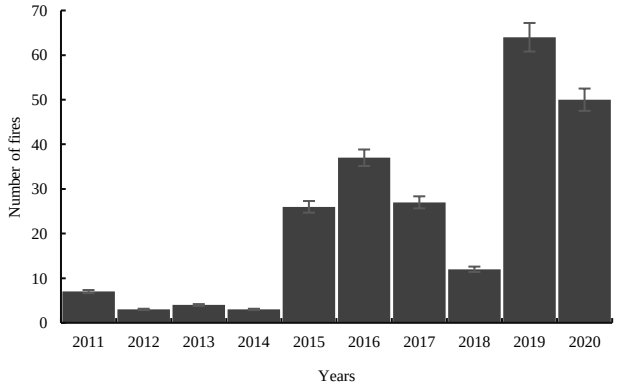

Figure 1: Number of fires recorded from 2011 to 2020

There approximately 11420 hectares of natural areas affected by fire between 2011 and 2020. The minimum-burned area includes 25 hectares that occurred in 2012. Most of the burned natural areas comprises 3992 hectares, which includes 2020 (Figure 3).

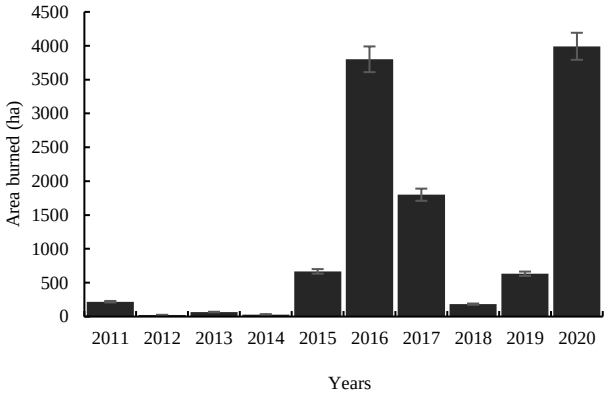

Figure 3: The area of fires occurred from 2011 to 2020

The highest number of fires, the uppermost occurrence of fires on Nawdar, Ghalajeh-Cheleh, and Poshteh-Melineh areas, with 28, 27 and 26 fires, respectively, throughout 2011-2020 (Figure 4).

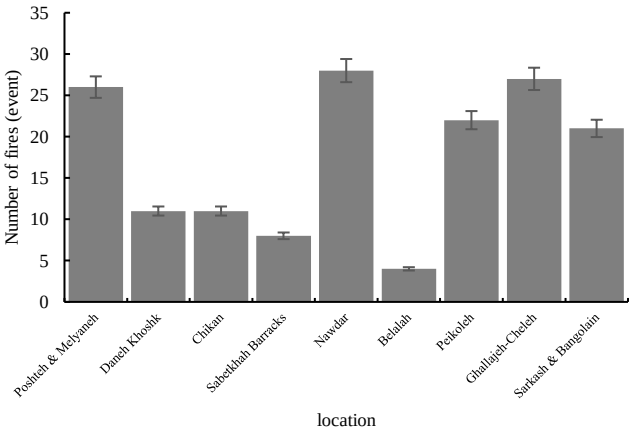

Figure 4: Indicative areas for the frequency of fires from 2011 to 2020

The highest monthly fires frequency during the fire season months includes 53, 44, and 40 events, which concern August, July, and September, respectively. The lowest monthly fires rate includes 1 and 3 events, which happen in May and December, respectively (Figure 5).

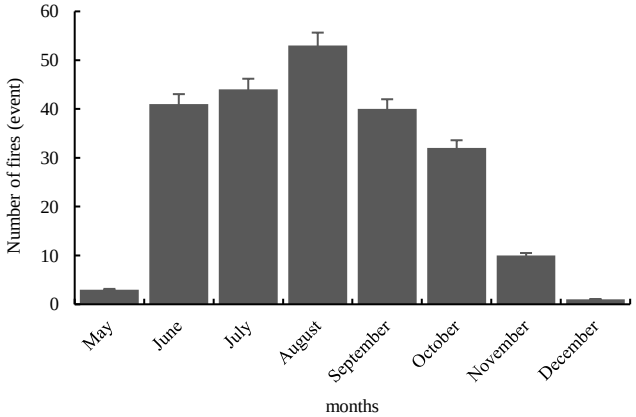

Figure 5: The fires Frequency in the dry months from 2011 to 2020

The fires regularity in different components of natural resources presents that the highest and the least incidence includes non-wooded pastures (44.6±5.6) and mixed Forest-rangeland (14.25±4.11). The highest fires incidence in non-wooded pastures was in 2014, which includes almost 55%. In addition, the highest fire regularity on mixed forest-rangeland occurred in 2013, which includes virtually 20% (Table 1).

Table 1: Frequency of fires in various sources from 2011 to 2020											
Resource	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Ave
Forest	20	15	25	18	24	30	27	24	11	50	24.4±10.65
Non wooden-rangeland	50	45	40	55	48	40	38	44.5	47.8	38	44.6±5.6
wooden -rangeland	15	12	15	20	10	20	20	16	26.5	2	15.6±6.7
Forest-rangeland	15	18	20	7	18	10	15	15.5	14.0625	10	14.25±4.11

The most fire reason in natural areas include recreation and hunting (43.3±16.1). The highest recreation and hunting rate existed in 2019, which consists of almost 72%. The least impact (2.9 ± 1.9) on natural resource fires is from the spreading municipal waste incineration fires from 2011 to 2020 (Table 2).

Table 2: Various human factors of fire from 2011 to 2020											
Human factor	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Ave
Farm postures	8	33	25	0	4	5	5	3	4.6	12	9.96±10.67
Municipal waste	2	0	0	0	4	5	4	3	1.6	4	2.3±1.9
Maneuver	1	0	0	0	4	8	5	5	7.8	4	3.4±3.1
Recreation and hunting	35	33	25	67	50	40	35	50	71.88	26	43.3±16.1
Disputes and quarrels	45	33	25	33	30	35	40	25	9.4	50	32.5±11.4
Unknown	9	0	25	0	8	7	11	14	4.7	4	8.27±7.37

The maximum fire frequency area includes <100 hectares classes (83.6±20.57) while the lowest fire incidence extent comprises >1000 hectares category (1.2±1.98) from 2011 to 2020 (Table 3).

Table 3: Fires area in different categories from 2011 to 2020											
fire area (ha)	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**Ave**
<100	100	100	100	100	60	65	65	50	100	96	83.6±20.57
100-500	0	0	0	0	30	20	15	50	0	0	11.5±17.3
500-1000	0	0	0	0	10	10	15	0	0	0	3.5±5.8
>1000	0	0	0	0	0	5	3	0	0	4	1.2±1.98

Most fires suppressed in a very short period (64.27±26.17) whereas the lowest frequency of fires involves a very much period (1.9±3.9); (Table 4).

Table 4: Frequency of fires time in the years 2011 to 2020											
period (h)	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Ave
Very little	60	100	100	100	50	40	45	65	48.6	34.1	64.27±26.17
Little	30	0	0	0	30	30	30	30	36.5	24.4	21.09±14.8
medium	10	0	0	0	10	15	15	5	12.1	24.4	9.15±8.02
high	0	0	0	0	10	10	8	0	2.7	5	3.57±4.3
very much	0	0	0	0	0	5	2	0	0	12.2	1.9±3.9

Ten-year average shows that the highest fires abundance during the day and night embrace 25.45%, 24.65%, and 20.5% in the evening, noon, and afternoon, respectively (Table 5).

Table 5: Frequency of fire events during the day and night in the years 2011 to 2020							
Years	**Evening**	**Noon**	**Night**	**Afternoon**	**Morning**	**Midnight**	**Sunset**
2011	31.2	37.8	6	13	2	8	7
2012	33.3	-	-	33.3	-	33.3	-
2013	25	25	25	25	-	-	-
2014	-	33.3	33.3	33.3	-	-	-
2015	30.6	19	10	16	6	10	8.4
2016	27	33	14	9	5	8	4
2017	21	29	11	34	2	1	1
2018	24	16	8	29	5	15	3
2019	34.4	23.4	14	6.25	7.8	10.9	3.12
2020	28	30	4	6	10	12	10
Mean	25.45±9.4	24.65±10.4	12.5±9.4	20.5±11	3.78±3.3	9.8±9.3	3.65±3.5

On average, most fires occur in temperate and dry climates (43.6% and 39.6%, respectively) in a decade while the lowest fires include the slightly semi-dry climate (13.9%). The largest occurred fire in the dry climate include 2020 (68%) from 2011 to 2020. The highest token place fires in the medium semi-dry climate consist 2012 and 2014 (65%); (Figure 6).

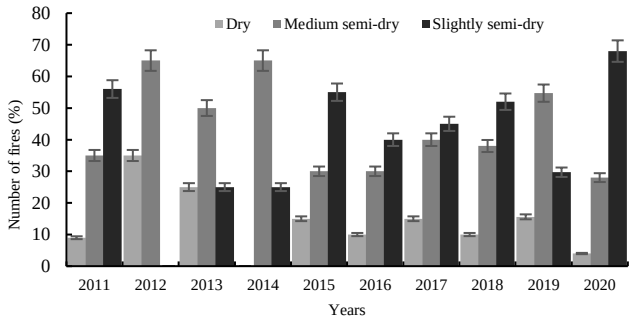

Figure 6: Frequency of fires in regional climates in the region in the studied years

Areas with high fire risk have been identified according to the number of repetitions, intensity and rate of fire in the area. Daneh Khoshk, Nawdar, Poshteh, Peikoleh, Belaleh, Cheleh, and Ghalajeh as well as Chikan are among the parts with a high risk of fire (Figure 7).

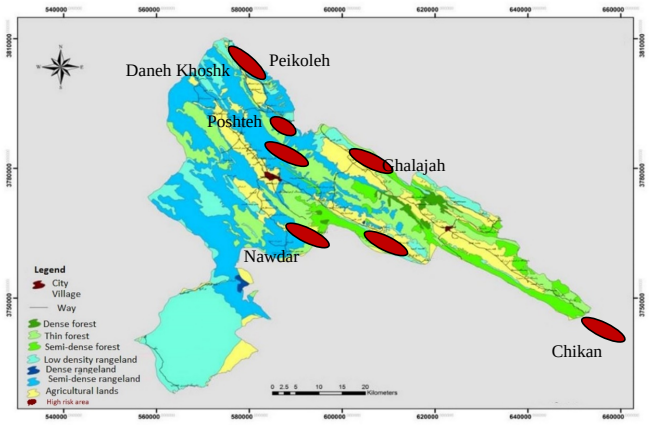

Figure 7: High risk areas Map of fires in forests and pastures of Gilan-e Gharb basin

The significant test results indicate that the difference between the area and time means is not significant (p= 0.05). In addition, the significant test results disclose that the difference between the sources and human factors type means is significant (p= 0.05); (Table 6).

Table 6: Significant test results include area, time, resources and type of human factors

Area	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	84.400	12	7.033	.773	.672
Within Groups	245.600	27	9.096		
Total	330.000	39			
Time					
Between Groups	209.733	23	9.119	1.213	.351
Within Groups	120.267	16	7.517		
Total	330.000	39			
Source					
Between Groups	262.939	19	13.839	2.776	.006
Within Groups	149.561	30	4.985		
Total	412.500	49			
Human factors					
Between Groups	376.763	26	14.491	4.044	.000
Within Groups	118.237	33	3.583		
Total	495.000	59			

4. Discussion

The forests, non-wooded rangelands, wooded rangelands, and mixed forest and rangeland fires Comparison provide a specific pattern from 2011 to 2020. According to the model obtained until 2014, the was annual fire was roughly 4 events per year. The average annual fires include nearly 36 events per year from 2015 to 2020. There are various reasons for this sharp increase. In the past, the deliberately burning natural areas intentions included hunting wildlife, destroying hunting habitats, ethnic and tribal disputes, and similar issues. Currently, most fires are rooted in local community demands. If the fires are comprehensively and analytically analyzed, it will be clear that tourists carry out most of them and profiteers who intend to develop their agricultural lands. Climatic factors such as drought, low humidity, and drought, decrease in relative humidity, increase in average annual temperature and hot winds seem to have a significant effect on the ignition and provide favorable conditions for the fire's development.

Eskandari (2015) has reported that the increase in mean annual temperature and decrease in mean annual humidity is the most essential climatic factors affecting the forest fire rate. High temperatures in hot seasons and consequently drought, along with high drought fuel rates have been the main causes of forest and pasture fires (Yousefi and Jalilvand, 2010). The dried Iranian oak trees through oak decay disease in forest stands are examples of increased concern about forest fires in the region. These trees perform as a crisis basis during fires, and the reasons for the increase in forest burn area because of these fragments, particularly in sloping areas, which cause the fire to re-emerge after it is contained. These findings confirmed by Bradstock and Kenny (2003). The burned area comparison through fire in <100 ha areas in a few hours to control the fire had the highest regularity. Most reasons for fire control in small areas and in a short time encircle timely report of the fire, most reasons for fire control in small areas and in a short time encircle timely report of the fire.

The natural resources, and non-governmental organizations celerity to control the fire rapidly, an ample number of troops participating in firefighting operations, recruitment of a semi-mechanized device called a blower to suppress the fire, the ability to access the fire site via the existing road network or proximity to communication roads, the involvement of local and indigenous people in fire mechanism, natural barriers existence to the spread of fire in the area, the low density of pastures through livestock grazing and lack of severe wind. In contrast, the most significant reasons for the collapse to control the fire are involved the impassability and very steep area, Topography and geographical shape of the area affected by the fire, war-torn region, and unexploded ordnance found despite more than three decades of Iran-Iraq war, forest and rangeland density cover, the lack of cell phone service, severe winds, underprivileged provision, and firefighter's logistics.

In Zare Kar et al. (2013) and Emami & Shahriari (2019) studies communication routes have been reported as a factor in increasing the fire rate. The results showed that among the human factors involved in causing fires in the ten years under study, most fires counted in recreation and hunting, local disputes, and conflicts, respectively (Table 2). The result obtained with Ebrahimi et al. (2018) on the human agencies increasing role in the fire occurrence is consistent. Human fires allocated into intentional and unintentional categories (Miraki et al., 2013). Deliberate fires are created with the increasing agricultural lands are caused by psychological complexes and personal animosities, coal production, tribal disputes, and some customs aims. Versus, inadvertent fires caused by tourists, shepherds, hunters, burning crop residues in fields near forests and pastures, throwing cigarette filters at vehicles that traveling on forest roads.

The Covid-19 virus prevalence and the sharp decline in recreational rates through contracting fear of the disease appear to have been effective in reducing the recreational fires frequency. Because recreation factor was effective in causing 26% of fires in the region and was not the foremost factor in 2020 whereas, meanly, it accounted for about 45% of fires

through recreation in previous years (2011-2011). Nawdar, Cheleh-Ghalajeh, and Poshteh-Melieh ney extents with 28, 27, and 26 events, respectively, have the highest frequency of fires among the burned zones in 2020-2011. Repeated fires in an area over time indicate that the fire was intentional in that particular area. One of the most essential reasons for its creation is the differences between local communities in benefiting from the pastures and forest products, tribal disputes, and so on. In creating these fires, it is always tried to observe the surprise principle and the pastures are set on fire when there is the least opportunity to put out the fire.

Another principle is to be aware of the occurrence of a fire when a long time has passed since it started and the fire has become very outsized. Furthermore, in intentional fires, most days taken that include severe winds, which significantly affect the time of fire during the day and night. In general, almost 11,420 hectares affected by fire during the decade under study. The prime fire areas include about 3995 hectares, 3800 hectares, and 1800 hectares in 2020, 2016, and 2017, respectively. The period, duration, intensity, extent, and spread of fire in diverse temporal and spatial conditions consist of various aspects. Instantly, the fire period length in the dry zone is longer than medium semi-dry and slightly semi-dry regions. These parameters are mainly controlled by the climate type, the litter accumulation amount, and fuel flammability, soil moisture, wet and dry years, moreover the regional topography.

The obtained results are consistent with Meunier et al. (2019) and Mitsopulus et al. (2020). Besides, the intervals between fires increase with increasing altitude. At higher altitudes in arid regions, the average of intervals is about 35 years. These intervals are more frequent in the northern mountains and wetlands, in a sample, extending to 500-600 years in the redwood forests. These intervals reduced to 5-23 years in the southern and arid regions (McKenzie et al., 2012). However, the fire risk in local and regional ambiance consists of the climate, physiography, vegetation, and human activities effects. The human factors are the initiators and climatic factors intensify it. The obtained results are consistent with the Meunier et al. (2019) results. The highest fire rate (almost 34%) occurred in the evening in 2019, while the maximum fire abundance (approximately 30%) concerns noon in 2020. Similarly, the most fire affluence during the day in a long time includes evening, noon, and afternoon, respectively.

It attributed to the availability of desirable fire conditions in such cases. Because heat, oxygen, and combustible materials provide the ideal conditions for fires by maximizing temperature and wind speed. The combination of weather conditions with many physiological characteristics of the fuel is a factor that fundamentally affects fire behavior. Drought is extremely associated with the flammability and combustion of combustible material (García-Llamas et al., 2019), and wind plays a significant function in spreading the flame front (Flannigane et al., 2012). The proposed classification by Su et al (2019) in describing the main meteorological factors in the fire spreading avowed as meteorological variables classified into two groups. The group that affects the likelihood of fire combustion, because they have the greatest impact on fuel humidity.

Thus, these variables have an effective influence on the spread of the event, and they have a significant effect on igniting a fire possibility. These variables include sunlight, rainfall, relative humidity, and lightning. Variables that affect the expansion ratio. Because they affect the required flow for combustion and heat transfer processes. Therefore, the dominant influence of these variables is on fire behavior. This group contain wind and atmospheric reliability. The results are consistent with the Emami & Shahriari (2019) results. Comparison of fire trends in various months in the years 2020-2011 showed that the highest rates of fires exist in August, July, June, and September (53, 44, 41, and 40 events, respectively) while the least fire rates are in May and December (3 and 1 events, respectively). Ten-year comparative results corroborate a definite paradigm and show that most fires can occur during the fire season in August. Because the conditions for creating fire are regularly remarkable at this time.

In general, irrigated farmers always demolish their residual fodder to prepare the ground for a second crop in warmer areas in the early months of the fire season. The most common method of destroying farmland pasture includes burning it exclusively. In some cases, the farmers' negligence causes spread the fire to nearby natural areas and cause fires in them. The cause of fires is mostly personal, tribal, and ethnic dissimilarities between local communities in the middle months of the fire season. The major conditions for grazing livestock are available in August, July, June, and September. The desired conditions for setting fire to the opposite side pasture are August, July, June, and September. Further, recreation and nature tourism are the main cause of fires in the last months of the fire season and autumn early.

5. Conclusion

The issues connected to the fire are multidimensional. It deals with climatic and habitat factors, social issues, and the nature conservation culture institutionalization among the local people. To reduce the fire and the resulting damage, it is necessary to perform basic proceedings in whole fields. Relevant implementing organizations should be equipped with up-to-date and appropriate firefighting facilities as pioneers of nature protection. There is also possible to adopt effective plans in this field by educating local communities and creating a conservation culture of nature, as well as enforcing strict laws for criminals. It is conceivable to employ local observers and establish a firefighting base to increase the acceleration control the fire in areas with a high risk of fire. Therefore, the study of ecological factors in this region shows that these factors alone do not cause fires, but the presence of these ecological factors creates the conditions for fires. Finally, it can be stated that the most important factor in the occurrence of fire is the human factor and vegetation and moisture of combustible materials are the most important ecological factors affecting the development of forest fires.

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