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CLIMATIC AND ANTHROPOGENIC IMPACTS ON FOREST FIRES IN CONDITIONS OF EXTREME FIRE DANGER ON SANDY SOILS

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Abstract: Forests on sandy soils are particularly vulnerable to fire. The study area in this research was Deliblatska peščara (the Deliblato Sands), one of the most endangered areas in Serbia. The linear trends, the polynomial trends and the Pearson correlation coefficient (*r*) were applied. Statistically significant decrease in the number of forest fires was found, while the increasing trends of the burned area and burned forest area were not significant. There was also an increase in the air temperature during the same period. In a study of the connection between forest fires and the Atlantic Multidecadal Oscillation (AMO), significant values of *r* were statistically observed only for the annual number of fires. The highest values were recorded for June (–0.373) and July (–0.375), and for summer $r = -0.374$ (statistically significant at $p \leq .01$). As for the AMO in the main fire season (February–August), $r = -0.331$ (statistically significant at $p \leq .01$). In settlements in Deliblatska peščara area, there were trends of the decreasing number of inhabitants, agricultural population, and agricultural households in the investigated period. These trends contribute to the reduction of fire risk. The *r* value between the dynamics of the number of fires and the population is .50 (statistically significant at $p \leq .01$). The reduced agricultural activity contributes to the reduction of fire risk, while increased tourist presence is a risk factor.

Keywords: forest fires; air temperature; Atlantic Multidecadal Oscillation; population; Deliblatska peščara

1. Introduction

Significant natural hazards in the territory of Serbia are seismic hazards, landslides, excessive erosion, floods, torrential floods, rockfalls, droughts, and forest fires (Dragicević et al., 2013). Concerning forest fires, Deliblatska peščara is the most vulnerable area in Serbia (Dragicevic et al., 2011). The problem of forest fires represents the most significant threat to Deliblatska peščara ecosystems (Milenković et al., 2011). In the period 1948–2017, 267 fires were recorded in the investigated area, while the total burned area was close to 12,000 ha, of which more than half was under forest (Vojvodinašume, n.d.). Natural factors for the occurrence and dynamics of forest fires in this area are fossil aeolian relief, the absence of watercourses and

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water accumulation, sandy soil, the presence of different conifer species, climatic characteristics, and the influence of solar activity (Milenković, 2011). Besides natural conditions conducive to the emergence and spread of forest fires, the area of Deliblatska peščara is under anthropogenic influence. At the end of the 18th century, the anthropogenic effect resulted in the destruction of vegetation and the intensification of aeolian erosion. After that, in the period from 1818 to the first decade of the 20th century, the vegetation cover was successfully implemented, primarily because of the planned afforestation. The anthropogenic impact was also intensive during the second half of the 20th century, when mass afforestation with conifers was carried out, primarily with Austrian pine (*Pinus nigra* Arn.) and Scots pine (*Pinus sylvestris* L.), species very susceptible to fires (Ducić et al., 2008). Austrian pine reaches the highest fire sensitivity in the 60–80 years old stands (Csontos & Cseresnyés, 2015).

The first papers on forest fires in Deliblatska peščara were published in the mid-1970s and dealt primarily with the causes and conditions of fires, as well as with basic data on fires (Sekulić & Šljivovački, 1975; Živojinović, 1975). They were followed by papers that addressed, among other things, the possibility of applying fire protection measures (Kolić et al., 1994; Milenković & Munćan, 2004; Munćan et al., 2004; Vasić & Radenković, 1994; Živojinović, 1986; Živojinović & Sekulić, 1980). Gomes et al. (2009) and Milenković et al. (2011) analyzed the largest fires in the history of Deliblatska peščara and believe that they were caused by solar activity.

This paper analyzes some of the climatic impacts on forest fires. In addition to the analysis of air temperature and precipitation, research is also focused on defining teleconnection—the impact of distant (in thousands of km) climate events on the climate of a region. The Atlantic Multidecadal Oscillation (AMO) which show variability in the northern part of the Atlantic Ocean was chosen. It is primarily expressed by sea surface temperature. A statistically significant link between the positive (warm) phase of AMO and the number of fires was established for the United States for the period 1983–2013 (Milenković & Barović, 2015).

The relationship between AMO and wildfires has also been determined for certain parts of the United States: the west (Kitzberger et al., 2007; Sibold & Veblen, 2006), the south midwest (Collins et al., 2006), southwestern South Dakota, and northeast Wyoming (Brown, 2006), West Colorado (Schoennagel et al., 2007) and North Colorado (Sherriff & Veblen, 2008). Also, Beverly et al. (2011) found that there was a positive correlation between AMO and very large fires (≥10,000 ha) in Canada in 1975–2007. AMO has also been found to act together with other teleconnections, and the positive correlation with fires is explained by the link between AMO and drought. The same link has been established for South America, Bolivia part (Roman-Cuesta et al., 2014). However, Skinner et al. (2006) point out a strong significant negative correlation between the size of the fire and AMO in Canada, the western Northwest Territories and provinces of the Canadian prairies, across northern Ontario to Quebec. Taking into account the results of the aforementioned research, but also the fact that studies of this kind are rarely made for Europe, we have tried to explore the connection between AMO and the forest fires in Deliblatska peščara, one of the most endangered areas in Serbia.

Therefore, the main objectives of this study were to determine the relationship between forest fires in Deliblatska peščara and local climatic conditions, as well as the impact of AMO and the local population in their genesis and geospatial distribution. The results obtained will contribute to a better understanding of the causes of forest fires in this endangered area, but will also provide a basis for long-term fire hazard forecasting and the implementation of protection and mitigation measures.

2. Material and methods

2.1. Study area

Deliblatska peščara (the Deliblato Sands) is located in the northeast of Serbia (Figure 1). According to its location, it is also called Banatska peščara (the Banat Sands; Milojević, 1949; Vasović, 1994). The outermost southeastern part extends to the left bank of the Danube, while the northwestern part descends towards the Tamiš plain. Broadly speaking, the length of Deliblatska peščara is about 60 km and its maximum width is about 25 km in the southeast and about 20 km in the northwest (Milojević, 1949).

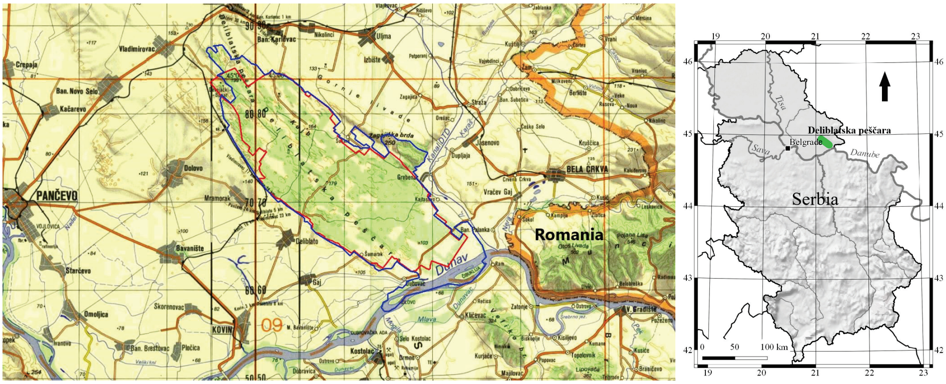

Figure 1. Management Unit "Deliblatski pesak" (red border line) and Special Nature Reserve (SNR) "Deliblatska peščara" (blue border line).

Note. Topographic map of Serbia 1:300,000 (sheet Belgrade and sheet Vršac), by *Vojnogeografski institut "General Stevan Bošković"* [Military Geographical Institute "General Stevan Bošković"], 1985; Borders were drawn based on Spatial Plan of the Special purpose area SNR "Deliblatska peščara", by *Pokrajinski sekretarijat za urbanizam i zaštitu životne sredine,* 2006 (The additional content on the map was created by Dragoljub Štrbac).

The area of the Spatial Plan of the Special purpose area SNR "Deliblatska peščara" covers 34,829.32 ha (Pokrajinski sekretarijat za urbanizam i zaštitu životne sredine, 2006). The largest part of this reserve consists of forest areas managed by the Vojvodinašume, Public Company from Novi Sad. Within this area, the management unit "Deliblatski pesak", with an area of 28,464.19 ha, was set aside. Besides, some smaller parts of the Management Unit were outside the boundaries of the reserve. As the available information on forest fires relates to this area, Management Unit "Deliblatski pesak" is the study area under research.

The area of Deliblatska peščara is characterized by the dunes, which represent relatively young eolian sandy formations formed after the Atlantic Holocene climatic phase. The main role in their creation was played by the southeastern wind (Menković, 2013).

The south-eastern part of Deliblatska peščara is called Niski pesak (the Low Sand). It is the lowest part where the altitude is up to 100 m a.s.l., mostly 70–80 m a.s.l. The dunes are low with gentle slopes and wide valleys. The middle part is known as Srednji pesak (the Middle Sand). The altitude is from about 100 m to 189 m a.s.l. and the peaks of the dunes average 150 m a.s.l. The dunes are long and have steep slopes and narrow intercostal recesses. The north-western part is Visoki pesak (the High Sand), above 150 m above sea level. The dunes are rounded off by gentler slopes and wide valleys.

The area of Deliblatska peščara is characterized by a moderate continental climate. The main problem in climate research of the area is a lack of data. Data from the Šušara and Flamunda meteorological stations are incomplete, and the stations themselves have been canceled decades ago (Flamunda was abolished in 1979).

Therefore, the data of climate elements for the standard period 1931–1960 were used (Kolić, 1969). The author has determined that the coldest month is January in the area of Deliblatska peščara and the surrounding area, and July is the warmest. The average January temperature in Deliblatska peščara is below –1 °C, while the surrounding area is between 0.3 °C and 1.0 °C. In July, the average temperature is below 22.0 °C, and in almost all sites in the surrounding area is above 22.0 °C. The average annual air temperature at stations in Deliblatska peščara area is up to 11.0 °C, while at stations near 11.0 °C. Ducić and Milovanović (2004) also found that Deliblatska peščara area is slightly cooler than the surrounding area, both in terms of temperature elements and in duration. The authors explain this phenomenon by slightly elevated altitude (138 m), the higher albedo of the sand itself, radiation of the sand and forest vegetation. As for precipitation, the month with the highest amounts is June, with the lowest being February. The average precipitation at the stations in Deliblatska peščara is higher than at stations in the surrounding area. The drought season in Deliblatska peščara lasts 73 to 76 days, which is shorter or even significantly shorter than in the surrounding area (Kolić, 1969).

A characteristic feature of the study area is the complete absence of surface water. Water retention in the surface layers of the soil is short-lived due to the significant permeability of the sandy soil.

Typical vegetation types in Deliblatska peščara are steppe and forest. The steppe type is characterized by the associations *Koelerieto-Festucetum Wagnerii*, *Chrysopogonetum pannonicum*, and *Festuceto-Potentilletum arenariae*, while the forest type has the character of forest-steppe with oaks and lime, association *Querceto-Tilietum tomentosae* (Stjepanović-Veseličić, 1953).

Within the forest type, Gajić et al. (1983) determined associations *Convallarieto-Quercetum roboris* Gajić and *Rhamneto-Quercetum virgilianae* Gajić. Košanin and Tomić (2002) divided forest type into three communities: *Polyquercetum pedunculiflorae* Jov. 1978, *Querco-Tilietum tomentosae* Stj.-Ves. 1953, and *Orno-Quercetum cerris-virgillianae* Jov. Et Vuk. 1977. However, autohtonous forests today account for less than 5% of Deliblatska peščara forests, since in the period 1818–2018 mass afforestation with different tree species was carried out. Thus, black locust (*Robinia pseudoacacia* L.; about 64%) and pines (Austrian pine – *Pinus nigra* Arn. and Scots pine – *Pinus sylvestris* L.; about 25%) are now the most represented in the area.

2.2. Data

The paper uses data on forest fires in the Management Unit "Deliblatski pesak" for the period 1948–2017. The source of data is Vojvodinašume (n.d.). The annual data include: total annual number of fires, total annual burned area, total annual burned forest area, and the intensity of the fire (the burning area divided by the number of fires).

Population data were taken from the Statistical Office of the Republic of Serbia ([SORS] 2014a, 2014b). The data included Comparative Population Survey 1948, 1953, 1961, 1971, 1981, 1991, 2002, and 2011 and Comparative overview of the number of households 1948–2011 and dwellings 1971–2011.

Due to incomplete meteorological data from Deliblatska peščara, temperature and precipitation calculations were made based on the closest meteorological station with a complete series (Vršac) for the period of observation of the dynamics of fire (1948–2017). The source of data was the Republic Hydrometeorological Service of Serbia (n.d.).

The AMO data were downloaded from National Oceanic & Atmospheric Administration – Earth System Research Laboratory (n.d.). The monthly, seasonal and annual AMO values were used in the research. One-year phase shift was also applied.

2.3. Methods

Pearson's correlation coefficient (*r*) was used in the research of the connection between the fire data and the AMO, the number of fires and the population. The Equation (1) for the moment of the Pearson product of the correlation coefficient *r* is:

$$r = \frac{\sum (x-\bar{x})(y-\bar{y})}{\sqrt{\sum (x-\bar{x})^2 \sum (y-\bar{y})^2}} \tag{1}$$

where, x and y are average values for array 1 and array 2.

Linear trends were used for the forest fire data. For linear trends the general form of the approximation equation is $y = ax + b$. Polynomial trends (sixth degree) were used for the number of fires and the number of inhabitants. For these trends the general formula is $y = ax^6 + bx^5 + cx^4 + dx^3 + ex^2 + fx + g$ (Microsoft, n.d.).

The statistical significance of the linear trend was determined for (n-2) and based on the coefficient of determination (R^2). For the testing of the significance *t*-test (Equation 2) was used:

$$t = R\sqrt{\frac{n-2}{1-R^2}} \tag{2}$$

where *n*—the length of the series. For the correlation calculation the Pearson correlation coefficient (*r*) based on the linear trend was used. Statistical significance was tested at $p \leq .05$ and $p \leq .01$.

3. Results and discussion

3.1. The forest fires in Deliblatska peščara

Reducing the number of wildfires occurs in many parts of the world (Doerr & Santín, 2016). Based on the conducted analyzes, a similar trend was found in Serbia, i.e., Deliblatska peščara, which represents the most endangered area. In Deliblatska peščara in the period 1948–2017 a trend of decreasing the annual number of forest fires was observed (Figure 2). In the last 10 years of data, in four cases (years), there were no reports of forest fires. The decrease in the number of forest fires in this area is statistically significant.

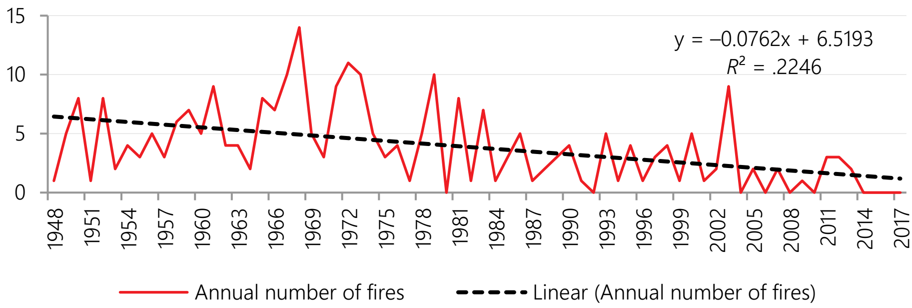

Figure 2. The total annual number of forest fires in Deliblatska peščara (1948–2017).
Note. Author's calculation based on *Forest Fire Documentation* [Unpublished raw data], by Vojvodinašume, n.d.

There was also a trend of increase in the total burned area (Figure 3), as well as in the total burned forest area. These trends are not statistically significant. Six years with extreme values have been recorded (1952, 1972, 1973, 1990, 1996, and 2007).

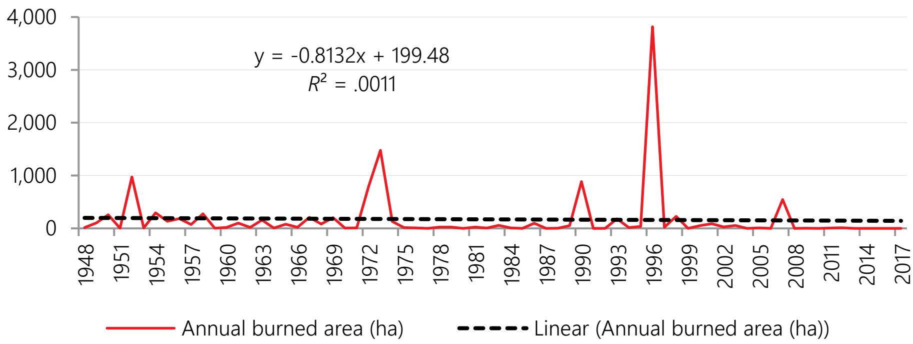

Figure 3. The total annual burned area in Deliblatska peščara (1948–2017).
Note. Author's calculation based on *Forest Fire Documentation* [Unpublished raw data], by Vojvodinašume, n.d.

The high values recorded in 1973, 1990, 1996, and 2007 are the result of four largest forest fires that have so far been recorded in Deliblatska peščara area. These four fires affected about half of the total burned area in the investigated period. In addition, forest area affected in these fires is about two-thirds of the total burned forest area. The trends of the rise of the total burned area and the total burned forest area are also a consequence of the aforementioned four fires.

3.2. Climatic influences on forest fires in Deliblatska peščara

Analyzing the data for Vršac station for the studied period (1948–2017), there was a statistically significant ($p \leq .01$) increase in mean annual air temperature, mean spring and summer air temperatures, as well as average temperature during the main fire season. For monthly values, the increase was statistically significant at $p \leq .01$ in July and August and at $p \leq .05$ in March, May, and June. A statistically insignificant decrease in surface air temperature was determined for September and December. Precipitation changes are statistically significant ($p \leq .05$) only in November. However, the fire season in Deliblatska peščara ends with September.

Thus, the increase in temperature was accompanied by a statistically significant decline in the number of forest fires, which is contrary to the expected one. The results related to the annual burned area were greatly influenced by the four largest forest fires (1973, 1990, 1996, and 2007). The increase in the total burned forest area in the studied period can be explained by the increase in area under forest plantations. This coincides with the period of mass increase in the plantations of individual conifer species, primarily Austrian pine and Scots pine. These species are known to be highly threatened by forest fires.

In the study of the link between fires and AMO, statistically significant values of *r* were recorded only for the annual number of fires. In the case of the burned areas (total area and area under forest), as well as the fire intensity, no statistically significant values were obtained. These results are expected given that AMO affects the genesis, but not the geospatial coverage, which is determined by the natural conditions in the field.

The highest *r* values in the annual number of fires and AMO monthly values were recorded for June (–0.373, Figure 4), July (–0.375), and August (–0.349), all statistically significant at $p \leq .01$. For AMO May *r* value is –0.294 (statistically significant at $p \leq .05$). Regarding seasonal values, for AMO summer $r = –0.374$, which is statistically significant at $p \leq .01$. These results are consistent with those obtained from the moving decadal values for the number of fires and AMO summer from 1948–1957 to 2000–2009 (Milenković et al., 2011). For the previous year's AMO values, the correlation is also negative. For the AMO summer of the previous year, $r = –0.343$ (statistically significant at $p \leq .01$).

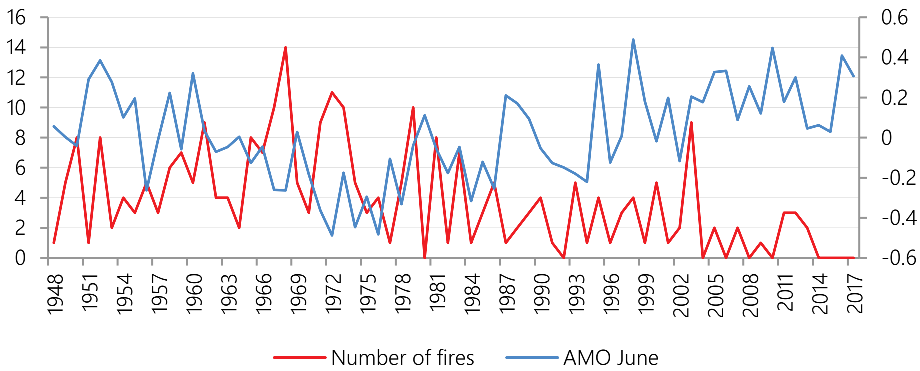

Figure 4. Correlation AMO June and the total annual number of forest fires in Deliblatska peščara (1948–2017), $r = –0.373$.
Note. Author's calculation based on *Forest Fire Documentation* [Unpublished raw data], by Vojvodinašume, n.d. and *Atlantic Multidecadal Oscillation Long Version* [Unpublished raw data], by National Oceanic & Atmospheric Administration – Earth System Research Laboratory, n.d.

In addition to annual, seasonal, and monthly AMO values, the research also included AMO values refering to the period defined as the fire season. Seasonal fire dynamics (data available for the period 1948–2006) were used to determine the fire season period. Based on these data, it was determined that 87.5% of all fires were in the February–August period. This period includes both the maximum numbers of fires during the year. The first is before the beginning of the vegetation period, when there is a large amount of dry fuel from the previous year in the field, and the other is during summer, especially in the second half, due to high temperatures and drought periods. The value of r for AMO in the main fire season and the number of forest fires is –0.331 (statistically significant at $p \leq .01$).

The results obtained could find application in the longer-term forecast of the number of fires in Deliblatska peščara, but the studies of other teleconnections are also necessary. As for the total burned area and the fire intensity, no association with AMO was found. For short-term forest fire forecasts, methods based on solar activity could be applied (Gomes & Radovanović, 2008; Radovanović & Gomes, 2008; Radovanović et al., 2015).

3.3. Population as a factor of risk for the outbreak of forest fires in Deliblatska peščara

The anthropogenic factor is widely recognized as the most important cause of forest fire (Balch et al., 2017; Ganteaume et al., 2013; Martínez et al., 2008; Parente et al., 2018; Šiljković & Mamut 2016). People cause fires inadvertently and intentionally (Vajda, 1971). In Deliblatska peščara, the main cause of fire is a human factor (64%), and the rest (36%) is unknown (Milenković et al., 2011). According to the data used, the most significant causes of fire in this area are passers-by, tourists, forest workers, as well as agricultural workers, especially in the surrounding areas (Milenković, 2011). Accordingly, the greater presence of people also imposes a higher risk of fire.

The demographic data include the settlements in Deliblatska peščara region. According to the 2011 census of population (SORS, 2014a), there were 34,195 inhabitants in 17 settlements. The average population size is 2,130 inhabitants, with five settlements with less than 1,000 inhabitants, and only two in the category of 5,001–10,000. The largest number of settlements (six) is in the category of 1,000–3,000 inhabitants, and four settlements have 3,000–5,000 inhabitants. The population density is 32 people/km^2, and the fragmentation of settlements and the small density of the settlement network are due to unfavorable natural conditions for accommodation. In addition to 17 settlements, in the wider area of Deliblatska peščara, there are also farmsteads, which are scattered by loess hills and beams. They are located in the vicinity of the settlements of the southern edge of SNR Deliblatska peščara. The largest number of inhabitants in the surveyed area was recorded in 1961. After that, the number has been decreasing. The agricultural population has been drastically reduced since 1953 (38,559) by 2002 (9,873), which is 74.4% (data on the agricultural population are not available at the settlement level for 1948; 2011 Census used different methods). The largest number of households was recorded in 1981 (SORS, 2014b). After 1981, the fall of the number was a result of the process of household stratification (Figure 5).

According to the presented data, the general demographic situation in the observed area is unfavorable. The basic population structures are such that they will not improve the demographic situation in the future. From a fire hazard perspective, however, these are favorable prospects.

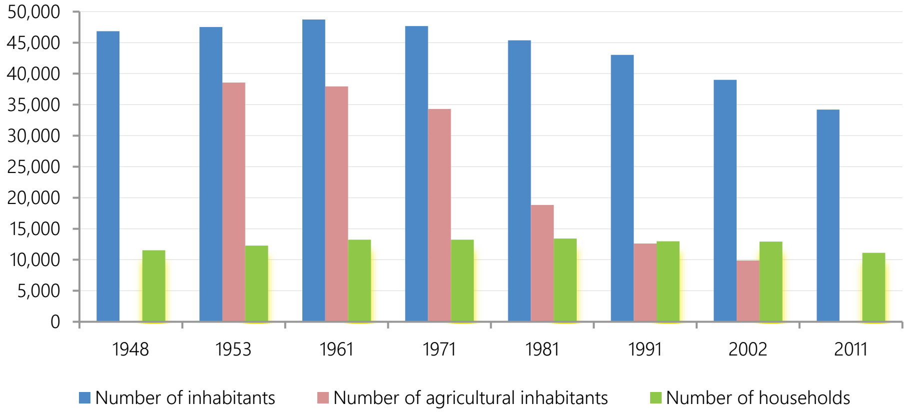

Figure 5. The number of inhabitants, agricultural inhabitants, and households in the settlements in Deliblatska peščara region.

Note. The data in the Figure are obtained from *2011 Census of Population, Households and Dwellings in the Republic of Serbia: Book 20. Comparative overview of the number of population in 1948, 1953, 1961, 1971, 1981, 1991, 2002 and 2011 – Data by settlements*, by SORS, 2014a (https://publikacije.stat.gov.rs/G2014/Pdf/G20144008.pdf). In the public domain; *2011 Census of Population, Households and Dwellings in the Republic of Serbia: Book 21. Comparative overview of the number of households in 1948-2011 and dwellings in 1971-2011 – Data by settlements*, by SORS, 2014b (https://publikacije.stat.gov.rs/G2014/PdfE/G20144009.pdf). In the public domain.

The risk of forest fires is increased in areas near forest roads. The system of unclassified roads in SNR Deliblatska peščara consists of access roads and forest roads. They mainly connect some important sites (forest houses, sightseeing spots, etc.) and are in function of fire protection and protection and maintenance of ecosystems. Their patency is limited because they are without a modern foundation. The asphalt roads cross Deliblatska peščara in central and southeastern parts. The traffic is going on these roads, which increases the risk of fires.

The tourist value of the natural potential of this area is significant. Dune forms of relief, specific climate, diversity of flora and fauna make this area extremely attractive to visitors of various professions. SNR Deliblatska peščara with its surroundings is very attractive and suitable for the development of ecological, hunting, fishing, nautical, and recreational tourism. Existing and potential tourist sites are located on the peripheral parts of SNR Deliblatska peščara (Obradović, 2009). The presence of tourists and picnickers is the greatest during summer when there is a period of increased risk of fire.

Hunting in Deliblatska peščara has a long tradition. This area is one of the most interesting breeding grounds and hunting grounds for deer in Serbia. Hunting tourism, if performed carefully and under surveillance, should not represent a high risk of fire.

Construction of industrial and other facilities whose operation and existence can cause adverse changes in the quality of soil, water, air, wildlife, and the beauty of the landscape are prohibited (Uredba o zaštiti Specijalnog rezervata prirode „Deliblatska peščara", 2002). Outside the protected areas, the industry is unevenly developed, with agriculture being the dominant activity in most settlements. The industry of this region is agriculture-related, but its capacity declined dramatically during the 1990s (Martinović & Ratkaj, 2015).

Agricultural production in protected areas, including SNR Deliblatska peščara, has limitations, which arise from the need to comply with the environmental protection regime in which it is taking place. In the practice so far, the possibilities of agriculture production within SNR Deliblatska peščara have not been used, which is positive from the aspect of the possibility of fire. Livestock production is steadily declining and livestock storage capacities are in poor condition. Reducing livestock production is in favor of reducing the risk of fire. On the other hand, it harmed the conservation and protection of nature, and in particular the conservation of pastures, which were turned into shrubs due to lack of grazing. Affirmation of the concept of integral and sustainable development is important for economic, demographic, social, and cultural revitalization of this area (Pokrajinski sekretarijat za urbanizam i zaštitu životne sredine, 2006). In this respect, the most important components are the production of biologically quality food, tourism development, and small economy. The application of this concept would also involve a greater presence of people, which could re-actualize the increase of fire danger in this area.

To quantify the dynamics of anthropogenic risk of forest fires in Deliblatska peščara, data on population dynamics in neighborhoods and the dynamics of the number of fires per year were observed. Annual population value is calculated as the average rate of change between two adjacent censuses. Both variables show a downward trend. Pearson's correlation coefficient between the dynamics of the number of fires and the number of inhabitants is .50 and is statistically significant at $p \leq .01$ (Figure 6).

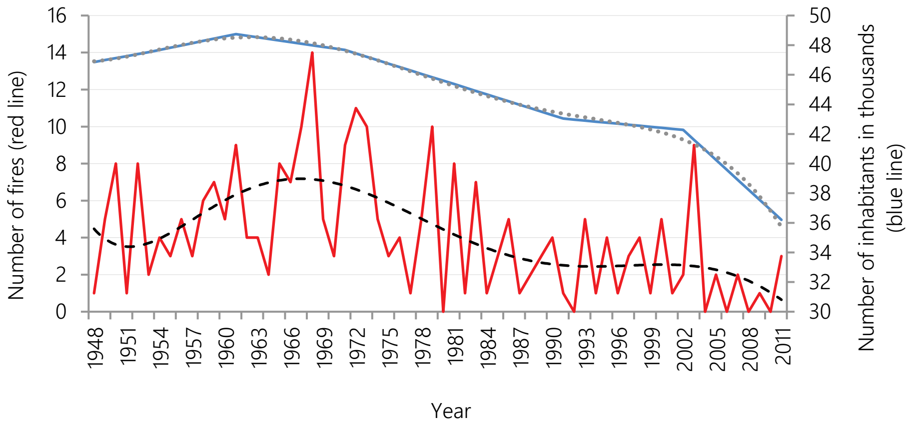

Figure 6. The number of inhabitants in surrounding settlements and the number of forest fires in Deliblatska peščara from 1948 census to 2011 census: trends shown as polynomial of the sixth degree (dotted line and dashed line).

Note. The data in the figure are obtained from *2011 Census of Population, Households and Dwellings in the Republic of Serbia: Book 20. Comparative overview of the number of population in 1948, 1953, 1961, 1971, 1981, 1991, 2002 and 2011 – Data by settlements*, by SORS, 2014a (https://publikacije.stat.gov.rs/G2014/Pdf/G20144008.pdf). In the public domain; *Forest Fire Documentation* [Unpublished raw data], by Vojvodinašume, n.d.

The downward trend of both variables and the high value of the correlation coefficient value support the assumption that human activity is the primary cause of forest fires in this area. However, certain prerequisites are necessary for the occurrence of forest fires and this link must be understood first and foremost as the alignment of the underlying risk factor with the dynamics of the number of forest fires. In this respect, population projections could be used in the research of the risk of forest fires in Deliblatska peščara.

4. Conclusion

In Deliblatska peščara, in the period 1948–2017, there was a statistically significant downward trend in the number of forest fires. Non-significant growth trends were observed for the total annual burned area and total annual burned forest area. These indicators were significantly influenced by the four largest fires in the recent history of Deliblatska peščara (1973, 1990, 1996, and 2007). In the studies of the relationship between air temperature and the number of forest fires, no expected results were obtained. Specifically, with the decrease in the number of fires, an increase in air temperature was observed. In the study of the connection between fires and the AMO, statistically significant Pearson's correlation coefficient (*r*) values were observed for annual number of fires only. The highest values were recorded for June (–0.373) and July (–0.375), both statistically significant at $p \leq .01$. The *r* value for AMO for the main fire season (February–August) and the number of forest fires is –0.331 (statistically significant at $p \leq .01$). In the settlements in the area of Deliblatska peščara during the investigated period, there were decreasing trends in the number of inhabitants, agricultural population, and agricultural households. Bearing in mind the widely accepted opinion that human factor is the most important cause of forest fires, these trends contribute to reducing the risk of fire. The value of *r* between the number of fires and the number of inhabitants is .50 and is statistically significant at $p \leq .01$. The reduction of agricultural activities contributes to reducing the risk of fire. On the other hand, the greater presence of tourists is a risk factor.

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