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THE IMPACT OF FOREST FIRES ON PROPERTY VALUES AND THE ENVIRONMENT

Ebiwari Wokekoro

Research Scholar, Department of Estate Management, Rivers State University, Port Harcourt, Nigeria

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ABSTRACT

The study examined the impact of forest fires on property values, the built environment and the natural environment. An extensive literature review was undertaken to unravel the impact of forest fires on the environment. The study found that forest fires decreased property values in areas the forest fires occurred and nearby areas. The study also revealed that forest fires destroyed buildings, homes, churches, schools, roads, railways and entire neighbourhoods. The study showed that forest fires resulted in the death of human beings, plants and animals. It also resulted in the migration of birds and animals. It negatively impacted the tourism sector and loss of jobs. The further indicated forest fires leads to forest loss, deforestation, lower water quality, air pollution, global warming and climate, The study concludes that forest fires have deleterious impact on property values, the built environment and the natural environment. The study recommended that human induced forest fires should be prevented through proper forest management, planting of fire resistant trees, construction of manmade defenses and government should not permit developments near the forest.

KEYWORDS: *Property, Values, Built, Natural, Environment*

INTRODUCTION

Forest fires are destructive and have devastating effect on the environment. Wildfires threat can occur in any part of the world and in almost all 50 U.S. states but more prevalent in the southwest (Amadeo, 2019). According to Moseley, et. al (2012) forest fires displace workers, families, employers, communities and have negative socio economic impacts. Roy (nd) stated forest fires negatively impact the physical environment such as land cover, land use, biodiversity, climate change and forest ecosystem. Forest fires also adversely impact human health and socio-economic activities (Roy,nd). According to Maddan (2020) forest fires are also called wildfires, bushfires, forest fires, woodland fires, grass fires, vegetation fires, and peat fires depending on the kind of vegetation being burnt and they are unwanted, unpredictable and unplanned fires that occur in wild lands. Wildfires are so intense that they can burn at a temperature of more than 2,000 degrees Fahrenheit (Maddan, 2020).Wildfires can come with little or no warning (Amadeo, 2019). There are two major causes of wild fire namely: natural and human causes. Human beings cause 90 percent of wildfires such as campfires, smoking, machines, accidents, arson, burning of debris and fireworks and 10 percent by natural causes such as lightning and volcanic eruptions Wildfires caused by natural forces vary from region to region and dependent on vegetation, weather, climate and topography (Madaan, 2020).Amadeo (2019) asserted that severe wildfires are caused by high temperature, shorter winters, more pests, drought, and fire suppression. The first four are caused by climate change and is responsible for the first four. Wildfires are driven more by the temperature and moisture content in the air than by the moisture content in the soil (Amadeo, 2019). Dead vegetation, warmer air, and decreased rainfall also increase the

frequency and severity of wildfires. (Amadeo, 2019) This study investigated the impact of forest fires on property values, the built environment and natural environment.

LITERATURE REVIEW

Eves, 2003 revealed that bushfires over the period 1988 to 2002 in Sydney resulted in substantial loss of properties, life, national parks, bush land reserves and that insurance covered only physical loss but not personal loss and emotional stress.

Jha *et. al* (2016) monitored forest fires in Uttarakhand, India based on satellite data from IRS AWiFS and LandSat 8 satellites and found that the burned area covered approximately 2,200 km2.

According to Chandra (nd) the India State of Forest report estimated fire prone area to be 53.91 % (heavy1.33 %, moderate 6.48 % and mild 46.1%) of the total forest area. Annually, 3.69 % of the recorded forest area experienced forest fires affecting ground flora and organic matters. According to Chandra (nd) other studies have shown that 54.7 % of India's forests are prone to forest fire (9.2% affected by frequent fires and 45.5% affected by occasional fires). Annually, about 2.3 % of the total forest of the country is affected by forest fire. Chandra (nd) suggested that in order control the impacts of forest fires real time monitoring of forest fires, pre warning for forest regions and Burnt Area Impact Assessment should be adopted.

Nielsen-Pincus, M., Evers, C., Ellison, A and Moseley, C. (2012) asserted that Large wildfires have immediate and long term impacts on local economies such as recreation, tourism, forestry, and natural resource sectors, which may be disrupted during fire and recovery periods. They investigated the effect of wildfire suppression contracting on Local Business Capacity during Large Wildfires. Their sample was 135 large wildfires that burned in 75 western counties and found that it cost the Forest Service $ 1.2 billion to suppress these fires from 2004 to 2008 representing about 20 percent of the total suppression spending of slightly above $6 billion on all fires during the five-year period. Their study further revealed that each fire cost between $ 1 million and $86 million and the average fire suppression spending was $9 million.

Tecle and Neary (2015) stated that forest fires have caused severe economic, cultural and ecological damage to many parts of the United States. Tecle and Neary (2015) examined data from the Rodeo Chediski and Wallow forest fires two of the biggest forest fires in Arizona and found that these two biggest fires negatively impacted the water quality of many streams, lakes, reservoirs killing majority of fishes in some and other ecosystem values. The findings of their study may encourage government agencies and other decision-makers to develop sound policies, guidelines and funding mechanisms to reduce devastating forest fires of Arizona.

Nikolaos, Dimitra and Agapi (2011) reviewed literature on the nexus between real estate market and environment and stated that the real estate market is not only affected and formed by economic and productive factors, but also by various qualitative characteristics of the natural and the built environment. The legal framework that provide the specifications and the restrictions on proximity to urban green spaces, to water resources, to unusual topography and to past and future occurrences of natural disasters affect the real estate market. Their study concluded that all factors such as economic, productive factors, legal framework, environmental should be taken into consideration in order to achieve sustainable real estate market.

Lentile, Zachary, Holden, Smith, Falkowski, Hudak,Morgan, Lewis,Paul, Gessler and Benson (2006) stated that space and airborne sensors have been used to map area burned, assess characteristics of active fires, and characterize post-fire ecological effects. Confusion about fire intensity, fire severity, burn severity, and related terms can result in the potential misuse of the inferred information by land managers and remote sensing practitioners who require unambiguous remote sensing products for fire management. Lentile et al (2006) carried out a comprehensive review of remote sensing methods used to assess fire behaviour and effects and ecological responses to fire so that potential misuse of inferred information by land managers and remote sensing practitioners will be eliminated who need remote sensing products for fire management. The essence of the study was to clarify the terminology to facilitate development and interpretation of comprehensible and defensible remote sensing products, present the potential and limitations of a variety of approaches for remotely measuring active fires and their post-fire ecological effects, and discuss challenges and future directions of fire-related remote sensing research.

Roy (nd) stated that Indian forests are rich in flora and fauna. Forest fires are a major cause of degradation and 90% of the forest fires are started by human beings. The degree of forest fire risk analysis and frequency of fire incidents are very important factors for taking preventive measures and post fire degradation assessment. Geospatial techniques are powerful tools to assess the forest fire risk and degradation assessment.

Rafael, María, Sergio, & Oscar (2015) examined the impact of forest fires in Puerto Rico from 20132014. The climatological factors analysed include precipitation, temperature, relative humidity, and wind. The study found that a combination of various factors increased these forest fires which include a reduction in precipitation and human involvement of approximately 40% between 5:00 pm to 8:00 am. In 2013, forest fires increased by 44% resulting in economic loss of $ 13.8 million. Fire also adversely affected the flora and fauna of the island.

Cignarale, Laucher, Allen and Landsman-Smith(2017) asserted that the availability and affordability of insurance coverage in certain regions of California has become an issue in the last few years. Cignarale et.al (2017) stated that the Valley Fire in Lake County and Butte Fire in Calaveras County destroyed more than 3,000 structures, more than 1,700 homes, caused several deaths and more than one billion dollars in insured damages, with additional damage to uninsured properties and public infrastructure in September, 2015 and destroyed more than 14,700 homes and 728 businesses, causing more than nine billion dollar in insured damages in October, 2017. These two forest fires according to the authors were the third and seventh most damaging wildfires in California that destroyed several structures. According to Cignarale et al (2017) “Over the past two decades, many wildfires have caused significant insurance damage in the wildland-urban interface (WUI). As a result, wildfire risk mitigation and insurance related issues in the WUI have a significant impact on the overall economy, government resources and infrastructure, and the safety and financial security of individual homeowners located in the WUI”. Cignarale et al (2017) averred that the California Department of Insurance (CDI) conducted an extensive review of consumer complaints, stakeholders’ feedback and an indepth analysis of the two major wildfire-risk models and found that many major insurers had refused to write new business insurance cover and renewals in some parts of the WUI, significantly increased premiums and wildfire surcharges in the WUI and majority of insurers do not consider wildfire mitigation conducted by homeowners or the community for underwriting and offering a premium credit for mitigation efforts.

Kiel and Matheson (2015) stated that in September 2010, the Four mile-Left hand Canyon forest fire burned 6,181 acres, destroyed 169 homes, and damaged properties worth $217 million making it the most expensive fire in Colorado

history at the time. The authors examined the effects of Four mile-left hand Canyon forest fire on housing prices in vulnerable neighbouring areas that were not directly impacted by the fire, controlling for the property's level of risk. The study revealed that the forest fires increased home owners' perceptions about the risk of living in wildfires prone forested areas to a significant extent and the total direct economic losses from the fire. They used a unique fire risk data set and a difference-indifference approach, the study test whether buyers of houses in areas with different risk levels before the fire adjust expectations differently. The study found that buyers in the highest risk area are most likely to change their perceptions in response to a fire with a decrease of 21.9 % in sale price of houses.

Moseley et.al (2012) conducted a research to analyse the effects of large wildfires on labour markets and examine how spending on fire suppression may reduce these effects. The research found that wildfires impacts labour markets positively during the course of fire in the short term, it leads to greater economic instability by amplifying seasonal variation in employment in the long term and local suppression spending reduce negative impacts on labour markets.

Nielsen-Pincus, Ellison and Moseley (Fall, 2012) examined the effect of large wildfires on local labour markets and found that in general, both employment and average wages increased in counties during quarters when large wildfires occurred more than the state wide average. Wages also increased in counties adjacent to large wildfires but there was no increase in employment.Yeo (2018) stated that Economists are knowledgeable about the negative impact of forest fires on prices of houses and that the prices of houses decrease after a nearby wildfire. According to Yeo (2018) McCoy and Walsh, examined the effects of wildfires on the housing market in Colorado and found that the areas that are close to the fire occurrence experienced one to three-year decrease in price, and an increase in sales rate. For houses with a direct view of the fire destruction, the return to prices before the fire, took a longer period. In addition, their study showed that house prices decline not because their homes have lost beautiful forest views, but because residents are aware of the risks of fire.

Acording to Yeo 2018 "Americans' increased vulnerability to wild fires is due to decades of poor forest management and the effects of climate change and that Americans are increasingly building their homes on the edge of forestland. As of 2005, some 39 percent of residential housing was located in this so-called Wildland-Urban Interface. Despite the inherent risks of living next to flammable forests, there are ways that homeowners can reduce those risks and protect their properties in the case of a fire."

Hamed (2019) stated that in 2018, The Golden State has witnessed the most destructive wildfire season on record. According to Hamed (2019) since mid-July 2018, a series of large wildfires erupted across California, including the tragic Carr Fire, Mendocino Complex Fire, Woolsey Fire, and Camp Fire and burned a total of 1,665,746 acres – the largest amount of burned acreage recorded in a fire season. These fires caused severe damage affecting residents, homes, and businesses across several counties. According to Hamed (2019) and Amadeo (2019) in their separate studies stated that in 2018, the Camp Fire completely destroyed the town of Paradise, burned 153,336 acres, and destroyed 18,733 buildings and the Woolsey Fire in the same period burned 96,949 acres, affecting thousand Oaks and Malibu and destroyed 1,500 buildings. The two fires caused 81,000 people to leave their homes (Hamed, 2019; Amadeo, 2019).

Hamed (2019) found that Forest fires reduce real estate prices in the areas affected by the fire and also nearby properties not affected. The reason is that people choose houses for both the amenities and the neighborhood. Wildfires also destroyed

residential properties, neighborhood infrastructure and reduce the quality of life in the neighborhood. It also causes noise pollution due to reconstruction of houses and community infrastructure. Forest fires affect real estate prices only immediately after the wildfire but rebound within 2 to 5 years after the area is rebuilt. Homes prices and rental properties values rise in areas in California that were not touched by the wildfire due to limited supply of houses and increased demand.

Top of Form According to Amadeo, K. (2019) forest fires are very deadly and destructive and these fires destroyed 1.1 million acres of land in 2019, 2.7 million acres in 2018 and 10 million acres in 2017 in California. Fifty forest fires were caused by very high temperatures in the state of Washington in March, 2019 and global warming is a major cause forest fires. In 2018, the Camp fire killed 85 people and 11 persons were reported missing. In July 2018, the Mendocino fire burned 459,123 acres, the Carr fire damage was $ 845 million in insurance claims in September 6, 2018 (Amadeo, 2019). In 2017, 71,499 fires burned 10 million acres and $ 2.9 billion was expended to quench these fires. The Thomas fire burned 283,800 acres in December, the Wine Country fires in 2017 cost $ 10.4 billion in claims and smoke from these fires polluted the Earth's stratosphere (Amadeo, 2019).

Amadeo (2019) stated that economic impact of forest fires include $ 400 billion damage in California in 2018, $ 14.3 billion worth of real estate was damaged in 2015, increased home insurance premium in fire prone areas and increased cost of forest fire protection due to proximity of 33 % of houses to the forest and the California utility Pacific Gas and Electric (PG & E) filed for bankruptcy due to $ 30 billion fire related liability cost. Seventeen wildfires were caused by equipment as a result of its inability to maintain thousands of miles of aging power lines and trim millions of trees in a service year (Amadeo, 2019). It is mandatory for PG & Eto remove 100 million trees on federal, state, and private property. (Amadeo, 2019)

United Nation Department of Agriculture (USDA) (2020) examined the effect of wildfire risk on property values in Colorado during the spring and found that wildfire risk variables such as having flammable roofing materials were found to have a negative impact on housing values. The conventional wisdom among some realtors and many homeowners is that actions on private property to mitigate wildfire risk will decrease property valuesTrapasso (2017) stated that forest fires completely destroyed 3500 homes and buildings, 170,000 acres, twenty one deaths in twenty two large fires in seven counties, including the famous wine-producing areas of Napa and Sonoma and mostly in North California. A family lost a four bedroom town house, personal belongings, pet, artwork, antique furniture that has been in the family for generations. The fires also destroyed many neighborhoods including stores, restaurants and other businesses, churches, schools, devastated the housing market by reducing housing prices, displaced homeowners and destruction of multibillion dollar tourism industry and loss of jobs associated with it. Wildfires are common in California, Western states of Washington, Oregon, and Colorado, in late summer and fall. But those burning in Northern California are unusual. Wildfire occurrence in areas uninhabited is beneficial to the environment by reproducing certain pine species. You have to have fires to have certain plants to reproduce" like certain pine species. According to Trapasso, the properties that were not burnt, prices were reduced by 10 % to 35 % while properties that were destroyed were discounted as high as 60 %. In 1991 The Oakland Hills fire in California's killed twenty-five people and destroyed about 2,900 structures on 1,600 acres.

Alert Media (2019) assert that wwildfires have devastating impact on businesses including direct and indirect impacts. The direct impacts are the destruction of buildings owned or occupied by business organizations, equipments, assets and people both staff and customers and the indirect impacts include negative on labor markets such as employees taking leaves of

absence, or sick leave to take care of their families and neighbors or move out of the area, transportation difficulties due to bad roads and railways, destruction of utilities such as power plants and sewage facility and difficulty in communication.

Wildfires can completely destroy an extensive forest or vegetation land area within minutes. Wildfires cause huge destruction to humans and environment. According to the U.S. Fire service, more than 700 wildfires occur every year, destroying about 7 million acres of land, and over 26,000 structures. Central and local organizations work together to control these fires each year. The U.S. spends more than $5 billion dollars to fight fires each year including funding a brigade of firefighting forces, deployment of airplanes that drop water to cool the fires, drop phosphate fertilizer to slow down its spread and trucks to cut off the spread of fire (Maddan, 2020)

To start a fire, oxygen, heat, and fuel must be present, referred to as the fire triangle by Foresters. The only way to put out or control a fire is to significantly limit one of these three elements. The major causes of wildfires destroying acres of land are human and natural causes. Human beings are the cause of 90% of wildfires which include carelessness such as campfires and smoking (negligence in discarding cigarette butts), machines, accidents, arson, burning of debris and fireworks (Madaan, 2020).

Ten percent of all wildfires are caused by natural causes. Wildfires caused by natural forces vary from region to region and dependent on vegetation, weather, climate and topography. Lightning and volcanic eruptions are the only two major natural causes of wildfires. Lightening can sometimes strike power cables, trees, or rocks and any other thing and this can trigger off a fire. Hot magma in the earth's crusts is usually expelled out as lava during a volcanic eruption. The hot lava then flows into nearby fields or lands to start wildfires Madaan(2020)

Effects of wildfires include destruction of habitat, flora and fauna leading to Loss of Ecosystems and Biodiversity, forest degradation, air pollution, climate change, global warming, soil degradation, death of beneficial soil microorganism, soil erosion, economic losses such as destruction of properties and millions of dollars spent to quench or control the wildfires, deployment of firefighters to put out the fires, airplanes to drop huge liters of water and phosphate fertilizer, trucks and logistics, destruction of watersheds, impacts on human well-being and health such as breathing difficulty especially with persons with allergies and respiratory disorder and also negative impact on fire fighters and lifesavers. Madaan(2020)

Benefits of forest fires include growth of new vegetation, new Jackpine and flowering and fruiting of some plant species. The destructive effects of wildfires can be mitigated by being responsible when handling aspects that could trigger any fire and reporting early when you witness any nature-instigated fire. Madaan (2020)

Pierre-Louis and Popovich (2018) stated that "the continued release of greenhouse gases from cars, factories and other sources will make fires more frequent, including very large fires that burn more than 12,400 acres."Climate change is not the only factor responsible for the size and devastation of a fire but also the increased intrusion of human beings into wild land areas to build communities. In November 2016, wildfires near Gatlinburg, Tenn., caused extensive damage and the compulsory evacuation of at least 14,000 residents.

Abatzoglou and Williams (2016) stated that fires are expected to increase as temperatures (warming) and drought increase. Abatzoglou and Williams (2016) further stated that extensive forest fires can also contribute to the rise in carbon

emissions, forest mortality, decreased air quality and substantial fire suppression expenses.

According to the Environmental Literacy Council (2015) man-made and natural forest fires contribute to forest loss, loss of biodiversity, cause deforestation which is a key emitter of carbon dioxide and improves forest health by regenerating new plants.

Fires have positive and negative effects on plants and animals. Negative impacts include damage to wildlife and vegetation, kill or injure individual plants and animals, causes erosion and sedimentation of creeks and wetland, expose open up areas to the impacts of weed and feral animal invasion as well as human access and vandalism. Positive effects include cracking of seed coats and germination due to heated soil, release woody seed pods onto fresh and fertile ash bed, reduce seedlings competitions by clearing thick under storey, encourages new growth that provides food for many animals and creates hollows in logs and trees used for nesting and shelter by animals. Fire should be managed in national parks to reduce the ecological impact on wildlife and native vegetation. (Department of Planning, Industry and Environment, 2018)

Dwilson (2019) noted that deforestation, cattle ranching and other factors such as drought, climate change, wind, dry and hot weather are the causes fires in Brazil. Beef, soy, palm oil, and wood product are the four major deforestation drivers. In Latin America, conversion of forest to pasture for beef cattle is main cause of destroying 2.71 million hectares of tropical forest each year (Dwilson, 2019). Yale School of Forestry and Environmental Studies (2020) reported that "Cattle ranching are the largest driver of deforestation in every Amazon country, accounting for 80% of current deforestation rates"

Law (2020) assert that bushfires destroyed millions of acres, killed twenty four people and 500 million animals in Australia and destroyed cemetery near Mogo, New South Wales due drought and climate change.

Joyce and Westerman (2018) averred that the Camp Fire in Northern California destroyed more than 113,000 acres and recorded 29 deaths north of Sacramento and in Southern California the Woolsey, Fire killed two people and burned more than 91,000 acres due to poor forest management.

Pesce (2019) asserted that fire destroyed the 850-year-old Notre Dame cathedral in Paris and its sacred relics visited by almost 13 million people each year. This is a huge loss to the Paris economy and the tourism sector. Fire has also destroyed valuable real estates in urban areas across the globe such as, homes, school, industries, markets and other Commercial properties.

According to the City of Vancouver (2020), the effects of fire in real life are confusion as a result of thick black smoke, emission of poisonous gases that can destroy the human senses and eventually kills, severe burns and loss of consciousness due to severe heat and destruction of lives and properties both personal and real estate. Smoke alarms and home fire escape plan will enable victims to escape.

METHODS

A comprehensive literature review was undertaken to unravel the impact of forest fires on property values, the built and natural environment. The literature includes peer review articles and other sources. Findings of the paper were based on the information from the literature review.

FINDINGS OF THE STUDY

The literature review revealed that forest fires have deleterious impact on property values, built environment and the natural environment. The study further revealed that forest fires have both adverse and beneficial impact on the forest. The study found that forest fires reduce home prices, increase in insurance premium, unwilling by insurance firms to underwrite new insurance and renewals, increased awareness by homeowners and residents of the risk of fire. The study further showed that forest fires decrease real estate values of property in areas that are affected by fire and nearby areas not affected by the forest fires. The study also revealed that forest fires have negative impact on socio economic activities. Forest fires also have an adverse impact on the tourism sector and loss of tourism related jobs.

The study also revealed that forest fires destroyed residential, commercial, industrial, educational, agricultural, recreational and other real estates. Forest fires displace residents, homeowners, business owners, businesses, workers and school children. The study also found that forest fires destroyed entire neighbourhoods and infrastructure such as churches, schools, roads, rails and power plants and power lines. The review further revealed that forest fires killed and injured firefighters and other human beings. The study further showed that forest fires destroyed several acres of land in California, Colorado, Brazil, the Amazon, India and other areas in the United States of America. Forest fires negatively impact plants and animals. The study further revealed that forest fires negatively impacted the atmosphere. Forest fires are major cause of forest loss, biodiversity loss, deforestation, air pollution, decrease in water quality in streams and lakes, global warming, emission of poisonous gases and climate change. It also leads to the migration of birds and animals. The review also revealed that forest fires are a result of poor forest management. The benefits of forest fires are improvement of forest health and encourage the growth of certain plant species such as pines.

CONCLUSIONS

Forest fire is a major environmental disaster that adversely affects property values, the built environment and natural environment. The study investigated the impact of forest fires on property values, the built environment and the natural environment. The study found that forest fires have both negative and positive impact on the natural environment. The study further revealed that forest fires reduced values of properties in areas impacted by forest fires and nearby areas not impacted by the fires. The study also indicated that forest fires destroyed churches, schools, beaches, roads, railways, buildings, homes, restaurants, others, businesses and entire neighborhoods. Forest fires negatively impacted the atmosphere, forest, plants and animals. The study further revealed that forest fires caused forest loss, biodiversity loss, air pollution, decreased water quality, global warming and climate change. The study concludes that forest fires have a negative impact on property values, built environment and the natural environment. The study recommends that human induced forest fires should be prevented through good forest management, formulation of government policies to plant fire resistant plants such cork oaks, construction of manmade defenses, utilisation of natural defenses, Home and other developments should not be permitted close to forests.

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