

# Assessing the Economic Resilience and Adaptation Strategies of the United States in the Face of Escalating Wildfire Frequency and Intensity Due to Climate Change

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## Abstract

Wildfire is an annual disaster in the United States (US) that has greatly impacted the economy cutting across many states. The influence of climate change has further resulted in the frequency and intensity of wildfires in the country such that there is a need for constant assessment of economic resilience to the fire and the adaptation strategies employed in the country over the years. The objective of the study is to assess the economic resilience and adaptation strategies of the country at the instance of wildfire frequency and intensity of occurrence over time. A mixed-method approach was employed in the study using quantitative and qualitative methods to interpret and analyze data retrieved through secondary sources. The study revealed that though there were efforts made by the government to strengthen the economy and institute formidable strategies, wildfires have continued to occur in the country which made government agencies commit more funds to the event to suppress the escalation over the years. It was recommended that the government and other agencies could do more to motivate other sectors for growth and financial sustenance.

**Keywords:** wildfire, economic resilience, adaptation strategy, climate change, wildfire frequency, wildfire intensity.

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## Introduction

### Background to the study

Globally, the recurring issue of climate change has become one of the challenges every government and relevant agency in countries is striving relentlessly to seek interventions and lasting solutions for. Changes that occur in the climatic condition, which cut across the continents, have brought about many unprecedented and unexpected events that dictate the rhythm and tone of political, social, economic, health, and environmental understanding among other sub-structures of society. In the wake of these events, climate change has become a general discourse to many concerned agencies because of some associated factors. Among the factors of climate change under examination is the discourse of wildfires which has occurred severally in many developed and developing countries. Studies and reports have revealed that wildfires, owing to climate changes in the natural environment, began many years ago affecting people's lives and damaging property which gravely affected the economic stability of concerned areas. And the yearly occurrences of the disaster in the affected countries have been too devastating to adequately control. The magnitude of the disaster has resulted in widespread damages being reported at many infrastructures, causing losses to divert resources and the deaths of many people. In addition to the destruction, vegetation, agriculture, tourist centers, resort centers, growing industrial areas, and many income-generating ventures were affected by the intensity of the fire. The United Nations Environment Programme [UNEP], (2022) reported that wildfires had happened in countries such as Australia, and the Arctic in North, and South America among others with an alarming record of events. A usual consideration of the disaster can be drawn from countries such as the United States (U.S). The United States Environmental Protection Agency [EPA], (n.d) opined that in the United States [U.S], the government spent several billions of dollars to address wildfires in the country. The National Oceanic and Atmospheric Administration [NOAA], (2023) submitted that wildfires were a common occurrence in the Western U.S. Some other developed countries in the world have had major and minor wildfires as a result of climate change but the annual records of the incidents have inarguably presented the U.S. as a case study. The reason is that the U.S. has consistently witnessed wildfires as a yearly national occurrence. Congressional Research Service [CRS], (2022) revealed the estimated economic losses in the U.S. years 2010 and 2020 to be counting into billions of dollars. It indicated the usual losses in the country directly and indirectly.

Undoubtedly, more searchlight into cases of wildfires in the U.S. showed that the occurrence had affected many states on different occasions. The records of wildfire destruction have also revealed the impact on some sectors of the country including the economy affecting both the small and big enterprises and organizations. The bigger picture of economic losses has seen the U.S. government losing \$20-30 billion to wildfires annually (McDaniels et al., 2020). Similarly, White et al. (2022) revealed that \$21.5 billion was lost economically due to wildfires when annually estimated. Also, when the economic losses were examined in the different parts of the country, California became one of the annual red flags of wildfire occurrences and most affected states. CAL Fire (2022) asserted that in the year 2020, \$82.3 billion was estimated in economic losses in California due to wildfires' impact. In the year 2021, the estimated loss was \$148.5 billion in the economy (CAL Fire, 2022). Even though wildfires are arguably linked to some natural occurrences, the unguided human dominance in the environment and the use of unprotected and unregulated machines are another because that has constantly resulted in annual wildfire occurrences.

In the face of this disaster, the U.S. government was suggested to, directly and indirectly, respond to the event by ensuring that the economic resilience of the country to the disaster was not crippled, and mapping out some adaptation strategies to mitigate the impact of wildfire in the country, was not left out (Guan et al., 2020; Hino, 2022; Hino & Field, 2023; Smith et al., 2023). Among the several strategies employed by the U.S. government to mitigate the frequency and intensity of wildfires on the economy were managing the land use to reduce the effect of wildfires, presenting effective plans to get the community prepared for any wildfire occurrence, embarking on research that addresses the disaster, and the appropriate technology use to mitigate it while addressing the climate change, and other coping ways. All these interventions and strategies were centered on getting the sectors working despite the wildfires' impact.

While the efforts of the government in the U.S. could be commendable towards addressing the annual event of wildfires in the country, there are concerns over the country's ability to effectively withstand the intensity of the wildfires, economically. This is to assess the working situation of sectors such as agriculture, tourism, labor, and supply chains among others. Also, the question of how effective strategies initiated by the government have been able to manage the recurring wildfires in the country regarding some States that were prone to wildfires. For instance, infrastructural building, pre-disaster preparedness, and post-disaster initiatives in the communities. It is therefore necessary to assess how the U.S. economy has been able to withstand the impact of wildfires in various sectors and to examine the strategies adopted to mitigate the frequency and intensity of wildfires in the U.S. considering the effects the incidents have had on the economy in recent years.

### **Statement of Problem**

Wildfire is a common natural disaster in the U.S. resulting in many economic losses of the States and the country at large. Ever since the disaster began several years ago, it has remained an annual disaster the government at various levels of the country have watched out for by preparing and making efforts to mitigate the effects of the occurrence when it unexpectedly happens. Reports have shown that the U.S. has economically lost over \$ 100 billion to wildfire incidents in the country ever since it was recorded, with many other states reporting their financial value of losses as well. Burke et al. (2020) asserted that wildfires have impacted the U.S. economy directly and indirectly leading to losses in property, infrastructure, and ecosystem. In an ideal state, non-occurrences, and non-incidences of wildfires in the country are a great period capable enough to give the government every opportunity to try out many policies and programs that benefit all and sundry. However, the absence of this favorable climate change which usually necessitates wildfire, has resulted in many negative outcomes and consequences to the country.

The economic losses recorded in many states such as California (McDaniels et al., 2019; Anderson et al., 2020), and the country at large owing to incidents of wildfire, would have been invested in many developmental programs and projects that would have impacted the lives of the people and further help improve the country economically. The constant occurrences of disaster have exposed States and the country to many difficult situations to cut across the political, social, economic, educational, and other societal sub-structures. In this regard, legislating adaptation strategies to address wildfire issues had also become a task while assessing the effectiveness of these measures over the execution period. The reason is that there are concerns over the economic status of various sectors in the country, the workable policies of the government, and the rebuilding processes aftermath of the disaster. When all these concerns are put together, it is crucial to determine the economic resilience and the adaptation strategies initiated by the government to curtail wildfire in the country as a result of climate change.

### Research Questions

While the problems of wildfires have persisted in the U.S. despite the economic resilience and adaptation strategies to the effect, the following questions will be considered in the study:

1. What are the economic resiliencies instituted in the U.S. to mitigate the effect of wildfires?
2. What are the adaptation strategies employed in the U.S. to mitigate the impact of wildfires?
3. How has the economic resilience of the U.S. economy withstand the recurring wildfires' escalating effect in the country?
4. How have the adaptation strategies in the U.S. checked the impact of wildfire frequency and intensity in the country?

### The Objectives of the Study

The main objective of the study is to assess the economic resilience and adaptation strategies of the United States in the face of escalating wildfire frequency and intensity in the country. The specifics are:

1. To determine the economic resilience of the U.S. toward the impact of wildfire in the country
2. To identify the adaptation strategies of the U.S. economy
3. To assess the stability of economic resilience to mitigate the impact of wildfires in the country
4. Also, to determine the effectiveness of the adaptation strategies toward the effect of wildfires in the country.

### Significance of Study

Several studies and reports have indicated that wildfire can affect the socio-economic and environmental factors of society if it is not properly controlled. That is why countries that are vulnerable to the annual incidents due to uncontrolled climate change, are coming up with measures, recommendations, and strategies that can strengthen the economy in the event of wildfire occurrence. However, the constant re-visitation of such strategies and economic fortification done regularly to curtail the impact of wildfires has not limited the effect of the disaster on the economy. Therefore, to understand this phenomenon, there was a need to assess the economic resilience of the sectors and the involvement of adaptation strategies in mitigating the impact of wildfires in many spheres of the country. This understanding necessitated the relevance of the study in present times.

The study has the potential to awaken the government and other relevant agencies in the U.S. to comprehensively make and take decisions that are productive to the growth and development of the economy as well as to society in general. The significance of the study also presents interested researchers a guide and assistance to further explore the correlations that exist among the variables. In addition, the study would contribute to the existing knowledge about determining the U.S. economic resilience and adaptation strategies in the face of growing wildfires in present times.

### Scope of study

The study centered on a few variables that define the understanding of the focus areas. The primary variables that were considered are economic resilience, adaptation strategies, and wildfire frequency and intensity. In its entirety, the study focused on the US economy which tends to affect some economic sectors such as tourism, agriculture, gross domestic product, industry, and labor productivity in the country. States in the U.S. were chosen for study considering their vulnerability and constant wildfire occurrences in the country.

Additionally, the study considered a few strategies such as the insurance policy, pre-fire, and post-fire initiative plans, as well as tax-weaver plans of the government to re-energize the affected businesses and investments to a functional organ of society as witnessed at the onset.

### Definition of Terms

**Economic resilience:** This is the ability of any potential economy to survive and withstand any circumstance or event that poses a threat or risk to its functionality.

**Adaptation Strategies:** In the context of this study, it refers to different measures, policies, and coping ways to overcome or manage the challenges or difficulties that arise at a given period.

**Wildfire:** This is a natural disaster in the form of an uncontrolled inferno, that has the potential to destroy and damage resources, investments, ecosystems, and many other inventions which are viable to bring growth and development to the concerned area.

**Wildfire frequency:** This is defined as the speed and movement of fire in any occurrence at a particular region.

**Wildfire Intensity:** It refers to the extent and magnitude to which wildfire affected a land or area in a particular year.

**Climate change:** This is unprecedented alterations or changes that occur in the weather and atmospheric conditions that in turn affect the natural and human environment such as the wildfire incident.

## Literature Review

In this section, relevant literature was employed to address certain areas that focus on the study. The review was categorized under sub-headings which addressed areas such as the brief history and causes of wildfire in the U.S., the impact of wildfires on the economy, the economic interventions by the government, the initiated adaptation strategies, and the effectiveness of the economic interventions and strategies.

### Wildfire: Brief History and the Recurring Causes in Society

The records of wildfire were dated to centuries before the official reports began to take effect in recent years. In the US, wildfires saw many regions and States in the country gravely affected by the occurrences. The unexpected reality of climate change has further ignited the frequency and intensity of the fire across many States in the country. Ever since the official records of wildfires were taken in the US, the occurrence has begun as an annual event destroying infrastructures, agriculture, and tourist areas, and directly and indirectly, affecting the economy among others. The baseline for the annual occurrence has been associated with human influence and non-human interference on several grounds. The National Interagency Fire Center [NIFC], (2023) revealed that human beings have accounted for 85% of the wildfires that occurred in the U.S. The negligence and unnoticed involvement of people in the environment have resulted in widespread wildfires in many regions. The interference of climate change has though aided the spread of wildfire where many acres of land were affected with the frequency of fire causing more damages in the country.

### Wildfire: Human-Related Causes

Wildfires have been associated with some causes traced to human involvement and interference. The National Interagency Fire Center [NIFC] (2023) revealed that the involvement and influence of human beings in the natural environment have resulted in the many wildland fires in the country. NIFC presented the various ways through which humans have caused wildfire occurrences. They were arson, unmonitored debris and open burning, equipment, and vehicle use, firearms and explosives use, unguarded fireworks, fires created by children, transmission of power, rail cracks fire, smoking, ceremonial use fire, and others.

Igini (2023) opined those humans, accidentally or intentionally, caused wildfires witnessed in several places. Igini asserted that such wildfires were caused as a result of open burning, failure of equipment, faulty engines, unrestricted disposal of cigarettes on dry grasses, and destruction of public or private structures. National Park Service (n.d) also submitted that humans accounted for a greater percentage of the wildfires in the U.S. The wildfires were linked to human factors such as discarded campfires, uncontrolled debris burning, poor functioning equipment, and acts of arson. In a similar vein, Dempsey (2023) asserted that human beings were not exempted as one of the causes of wildfires. Wolters (2023) also agreed that the uncultured influence of man in the natural environment has resulted in wildfires in places and led to major disasters. The various submissions indicated that wildfires were the handiwork of human beings whose interaction with the vegetation and natural environment was unmonitored. Western Fire Chiefs Association (2023) also opined that the various engagements and involvements of people in society caused wildfires at various times.

### Wildfire: Non-human Causes

On several grounds, mankind has been associated with the causes of wildfires. Differently, wildfires are also caused by non-human interference and natural influence. In real-time, climate change is the underlying factor that necessitated wildfire in society. Igini (2023) asserted that wildfires were natural disasters caused by changes in climatic conditions. Igini argued that wildfire could begin as a result of dryness in vegetation such as leaves and grasses making them vulnerable to fire spread. Igini further stated that the changes that occur in the air could become heated, capable of igniting and burning the dried grasses and leaves as a result of undue contact. Lightning, according to Igini, was the usual source of ignition that eventually caused the fire. In all of the processes, heat was generated from the hot ignition that naturally caused the wildfires. In the general understanding of Igini's submission, climate change begins with the impact on the component of fuel left the vegetation dried and the potential for it to catch fire at any hot ignition from the atmosphere. The National Park Service (n.d) submitted that lightning generated leaders and strokes- components of voltage that could cause fire in the long run. The potentiality for fire to occur is determined by the duration of heat in either the leaders or the strokes that caused such fire.

Burge (2023) in a related submission affirmed that lightning among other factors could cause wildfire at a given period. Burge believed that dryness in vegetation was an open-source occurrence. Western Fire Chiefs Association [WFCFA], (2023) also submitted that changes in climatic conditions could give rise to volcanic activity which can ignite wildfires in the vulnerable areas. Wolters (2023) revealed that climate change could make wildfires devastating as a result of the severity of the weather such as the heat generation process, and air

transmission of the unexpected fuel that makes it run fast and wide. Dempsey (2023) affirmed that climate change resulted in the frequency and intensity of wildfires in several places in the U.S. Dempsey (2023) cited vulnerable areas such as California, Arizona, Nevada, and Oregon among others.

#### Wildfire: Strengthening the Economy from falling

It was submitted and reported that wildfires could gravely affect the economy if it was not attended to at the appropriate time.

Wildfires have a great impact to cripple many sectors in the country and importantly, the economy sector which defines the growth and development of the country at any period. In the wake of wildfire occurrences in the country, the government at various levels might have economically instituted strategies that could stabilize the economy in the long run. Areas of concentration on many grounds are the allocated budget to sectors such as agriculture, industry, services, and many other areas where the gross domestic product per year is increasingly actualized.

#### Wildfire: The Impact of Disaster on the Economy

Given a closer look at the U.S. economy, Brown et al. (2022) opined that counties that were associated with wildfire risks were liable to be affected by economic losses. Adams (2019) opined that wildfire harmed the economy due to losses recorded in the forest areas. He asserted that \$1-2billion was annually lost to the event. In a similar exposition, Carter et al. (2021) asserted that economic losses would be largely affected due to wildfires' impact on the U.S. agricultural sector including the crop and livestock sections. Adams et al. (2020) revealed that wildfires could positively or negatively impact tourism depending on the area of the event in the country. While presenting work on the state of California, McDaniels et al. (2019) asserted that several billions of dollars were lost to damages that were accounted for by the economy, property, and other activity. In another submission, McDaniels et al. (2020) viewed that the impact of wildfires on the U.S. economy was the damages done to property, loss of productivity, and the negative effect on tourism. McDaniels et al. (2022) on another note revealed that the Western United States was vulnerable to wildfire threat and the ability of the rural areas, especially areas with the elderly, would be negatively affected economically. Assessing the impact of wildfires on the economy connotes the understanding of various determining indexes. The effect of wildfires on the economy can be directly or indirectly felt in the country when certain indicators are subjected to investigation and consideration.

The economic sector of the country which has attracted the contributions of components such as the agricultural, industry, and services among others was considered vulnerable to wildfire attack. Pew (2022) revealed that though collaborative efforts were needed to strengthen the pillars of growth and development in the country, the impacts of wildfires on the annual budgetary position of the country have continuously fallen to the demands and attacks of wildfire occurrences. The suppression costs and financial involvement of relevant agencies indicated that wildfires were capable of destroying the economic benefits of an area if urgent action was not taken.

Figure 1

*A typical wildfire intensity covering acres of land.*



Note.

Source: Flicker photos on Lincoln National Forest in New Mexico, 2018, NIFC (2023).

### Wildfire: The Adaptation Strategies

The annual event of wildfire has initiated efforts by the government to come up with different mitigation strategies that could curtail wildfire's escalating impact on the community. NIFC (2023) outlined some preparedness methods to cope with wildfire occurrences in the country. The relevant fire services believed that certain factors were essential as adaptation strategies to mitigate wildfire impact in any region of the country. The strategies included the prevention approach, preparedness methods, and the response strategy needed at the time of wildfire occurrences.

Figure 2

*A programmed drone to monitor wildfire occurrence.*



Note.

Source: Flickers photo, NIFC (2023).

### METHODOLOGY

The research method is meant to present the logical processes followed in retrieving, gathering, and presenting the data for the study.

#### Research design.

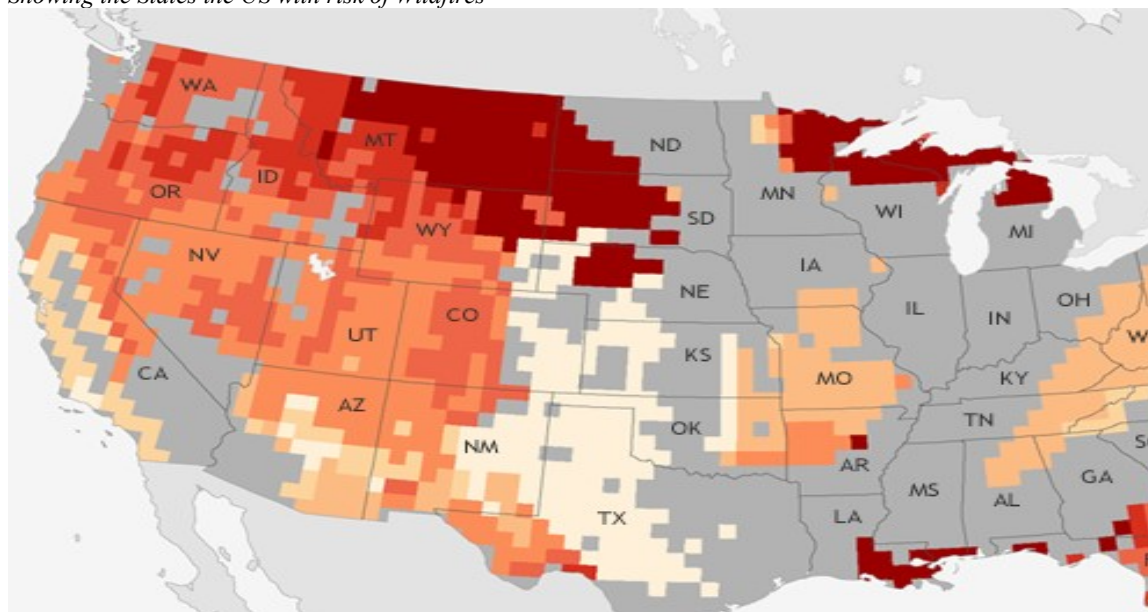
The research was designed to follow certain structures and guidelines that examine the study's concerns. Research design is meant to specify how a study will be carried out, outlining the plans, structures, and methods of data collection, analysis, and interpreting the data (Creswell & Creswell, 2023; Gilles & Morrison, 2023). The study presented the introductory part of the study that included the statement of the problem, research questions, objectives of the study as well as the significance and scope of the study. The research structure went further to review related literature about the discourse. The study employed a mixed-methods approach that focused on the qualitative and quantitative means of data to examine and assess economic resilience, adaptation strategies, and the impact of wildfires in the US.

Data was collected through a secondary source of data. The retrieved data was analyzed using descriptive analysis, and content analysis. The collected data was interpreted using a qualitative and descriptive presentation to give a clear understanding and better picture of the study.

#### Study Area

The United States (US) was chosen as the study area because of the peculiarity and record of wildfire incidents in the country. The U.S. has been associated with annual events of wildfire that happen in some states of the country.

Figure 3  
*Showing the States the US with risk of Wildfires*



Source: National Interagency Fire Center [NIFC] (2023).

#### **Population of Study**

There was no clear or specific population chosen for the study because of the magnitude of the area covered. The study primarily focused on the economic resiliency of the U.S. and adaptation strategies to mitigate wildfires' impact.

#### **Method of Data Collection**

Mixed methods were used in collecting data for the study. The methods were Quantitative and qualitative. The quantitative method was employed in the study focusing on the secondary source of data collection that was based on retrieving relevant data for the study. The measure was employed by retrieving records and reports from the datasets of the U.S. government agencies, peer-reviewed articles, and web-related searches on the specified variables about the study such as the economic resiliency of U.S., the adaptation strategies initiated by the stakeholders as well as the relevant reports presented by US. Fire Management agency and other relevant organizations. The qualitative method dealt with content analysis that focused on text-based data to identify meanings and relevant themes for the study.

#### **Sampling Technique**

Probability and non-probability sampling techniques were used in the study. The probability sampling technique focused on simple random sampling that addressed the frequency and intensity of wildfires in some States of the U.S. The random sampling also drew samples from vulnerable and most affected states, as well as the impacts on some economic indicators of the country due to wildfires. The non-probability sampling that was employed majorly focused on purposive sampling that targeted the U.S. economy.

#### **Methods of Data Presentation, interpretation, and Analysis**

The study employed qualitative and quantitative methods in presenting the data while a qualitative method was used in, interpreting, and analyzing the data.

The data was presented using visual representations such as charts, infographics, and graphs for the study. It formed the basis for qualitative data presentation. The quantitative presentation used tables, and graphs for the study.

The data interpretation focused on qualitative methods where thematic and discourse analysis were used for that purpose. A qualitative method was employed in analyzing the data such that categorizing and organizing data generated from textual form was presented for understanding.

#### **Discussion of findings**

The study employed a descriptive method in discussing the findings retrieved from the data. The essentiality of

this section was aimed at giving a better understanding of the study.

### Ethical consideration

The study declared no conflict of interest for the study. Respondents' consent was not required in the study because data were drawn from secondary sources of data. The research observed the necessary confidentiality of the data collected and that they were meant for research purposes. English Language was the official language used in the course of study.

### Data Presentation, Interpretation, and Analysis

Question 1:

#### Economic resilience by the US

The U.S. has over the years-initiated measures that outlined the ability of the government to have robust economic stability to withstand any occurrences and natural disasters that are capable of crippling the economy and importantly in the case of recurring wildfires in the country.

The economic resilience of the U.S has been observed in the following ways:

Table 1

*Showing the economic resilience of the US to mitigate disaster.*

Economic Resilience	Strategically Ways Employed
Boosting the Gross Domestic Product	Agriculture sector Industry sector Service sector
Insurance concentration	Motivating more insurance companies and organization
Economy diversification	Encouraging other sectors to be productive and active
Social Safety models	Initializing safety and motivational ways for people, businesses, and organization

Note.

Source: National Interagency Fire Service (2023), US DOI (2023)

Table 1 shows the various levels at which the US government initiated moves to strengthen the economy through some outlined measures to mitigate the impact of wildfires. The gross domestic product revealed the strategic ways through which the economy was boosted. Its gross domestic product is focused on the agriculture, industry, and services sectors which are affected by any occurrence of wildfire. Other concentrated areas were insurance penetration, economy diversification, and social safety models which identified parts of economic resilience against the impact of wildfires in the country.

Table 2

*Showing the gross domestic product of the U.S, in financial strength and annual growth rate from 2015 to 2022*

Year	GDP in billions of US dollars	Annual growth rate in percent
2022	25,461.3	2.1%
2021	23,315.1	5.9%
2020	21,060.5	-2.8%
2019	21,381	2.3%
2018	20,533.1	2.9%
2017	19,477.3	2.2%
2016	18,695.1	1.7%
2015	18,206	2.7%

Note. Source: Statista 2023



In table 2, it was revealed that the gross domestic product of the US was financially strengthened by the subsequent years which indicated the ability of the country to withstand any pressure such as the wildfire. The table showed that the year 2022 had a financial capacity of \$25,461.3 with an annual growth of 2.1%. The year 2021 however saw the annual growth increase to 5.9% compared to other years which annual growth was within the range of 2.1% and 2.9%.

**Table 3**  
*Showing the value added to gross domestic product across economic sectors in the US, 2015-2021*

Year	Agriculture %	Industry %	Services %
2021	0.96	17.88	77.6
2020	0.95	17.51	78.14
2019	0.84	18.28	77.18
2018	0.9	18.63	76.74
2017	0.95	18.44	77.03
2016	0.94	18.04	77.44
2015	1.03	18.59	76.74

Note. Source: Statista 2023, World Bank

Table 3 shows the various sectors in which the economy by gross domestic product was maintained. It was revealed that within the years 2015 and 2022, the service sector had a value added to the GDP by 78.14% compared to the agriculture and industry sectors which had 1.03% and 18.63% as the highest percentage growth in the years 2015 and 2018 respectively. The table revealed that the agricultural sector has had a share of losses in growth over the years maintaining a staggering percentage of 0.93% in all the years except the year 2015.

**Question 2: What are the Adaptation strategies of the US?**

**Table 4**  
*Showing the various adaptation strategies employed by the U.S*

	Method	Adaptation Strategies	Workable Actions
1.	Prevention	Fire Management	*Managing burns in prone areas to minimize flammable vegetation *Managing fuel density by thinning the forest and controlling fireworks *Using mechanized treatments to masticate and logging out hazard-prone fuels, trees, vegetation
		Land Use Planning	*Regulations and restrictions in the development of areas prone to fire *Ensure that building codes and wild-fire resistance for newly constructed places are followed
		Public sensitization and awareness	*A drive to educate the citizens about wildfire threats, risks, prevention strategies, and plans for safety *Fire safety programs and community sensitization *Quality dissemination of information about wildfire time and period.
2.	Preparedness	Reinforcement of firefighting ability	*Funding for fire agencies at all levels of government; federal, State, and local *Training for personnel in the fire departments and agencies *Development of fire-resistant technology for firefighting agencies such as drones *Deployment of the new fire-resistant technology to all firefighting agencies *Pre-positioning of fire-resistant equipment and quick supplies for immediate action
		Community Participation and engagement	*Volunteering training and arranging support programs for dwellers on fire occurrence *Preparedness for evacuation in communities through safety passages and emergency drills *Synergy between the firefighting agencies and community fire service.
		Infrastructural guide and mitigation plan	*Fortifying vital infrastructural places against wildfire impact *Advancing the use of fire-resistant structures and re-modeling volatile buildings against fire *Vegetation policies as a safety guide around infrastructure.
3	Response Strategy	Fire Agencies	*Coordination and synergy among fire agencies *Deployment of resources in terms of fire emergency *Plan for safety route and evacuation *Recovery plan for post-fire occurrence

Note. Sources: NIFC, 2023, US Department of the Interior [DOI] (2023)

In Table 4, it was shown that there were categorized adaptation strategies employed by the country to reduce the impact of wildfires on the economy and the country at large. It was revealed in the table that methods that could ensure effective adaptation strategies fell under different approaches such as prevention, preparedness, and response strategy. The country had instituted a prevention strategy whereby the frequency and intensity of fire could be managed by managing burns that could ignite more fire in vulnerable areas, thinning the forest to minimize wildfire intensity, and using mechanized treatments to reduce fuels in the areas. The land use planning proposed that when there were regulations and land use reforms, the escalating wildfires in any occurrence would be minimized while public sensitization was aimed at educating the citizens on the proper use of fuels and managing of fires in the community.

The preparedness approach was aimed to reinforce the firefighting services through funding and technological use to detect and minimize fire escalation at any time. In that wise, community participation and engagement were essential so that adequate training and knowledge about wildfires were given to the volunteered citizens. The preparedness also covered the infrastructure and essential buildings in society such that the structures were protected from any fire threat and risk. There was suggested use of fire-resistant vegetation and environmental protection against any related fires. The response strategy indicated that at any occurrence of wildfire, there was quick action of relief from relevant agencies made available to affected areas and vulnerable places. It was aimed to reduce the frequency and intensity of wildfires in areas of risk in the country.

### 3. How the U.S. economic resilience has been able to mitigate the impact of wildfires across the States

Table 5  
 Showing the financial Cost of the Federal Firefighting Agency to suppress wildfires.

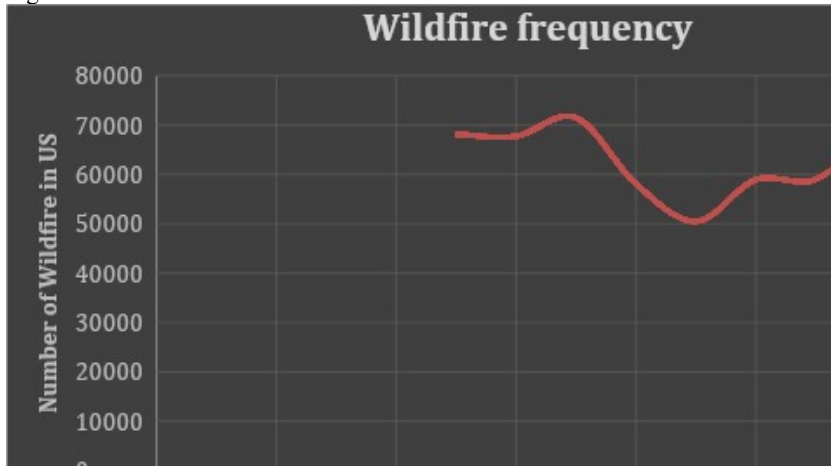
Year	Fires	Acres	Forest Service (\$)	DOI (\$)	Agencies	Total (\$)
2022	68988	7577183	2,900,000,000	649,000,000		3,549,000,000
2021	58985	7125643	3,741,000,000	648,000,000		4,389,000,000
2020	58950	10122336	1,764,000,000	510,000,000		2,274,000,000
2019	50477	4664364	1,150,000,000	440,000,000		1,590,000,000
2018	58083	8767492	2,615,256,000	528,000,000		3,143,256,000
2017	71499	10026086	2,410,165,000	508,000,000		2,918,165,000
2016	67743	5509995	1,603,806,000	371,739,000		1,975,545,000
2015	68151	10125149	1,713,000,000	417,543,000		2,130,543,000

Note.

Source: National Interagency Coordination Center [NIFC], (2023)

Table 5 shows the financial cost accrued in the country to suppress the wildfire effect in the country. The table revealed that \$4,389,000,000 was spent in the year 2021 to suppress the wildfire effect in the country, which made up the financial contribution from the Forest Service Department and the Department of Interior (DOI) to reduce the frequency and intensity of wildfires in the country. However, the financial cost to suppress fires in the year 2022 was not as high as the financial cost spent to suppress fires in the year 2021 despite the number of fires recorded in that year.

Figure 4



Source: NIFC (2023)

Figure 5

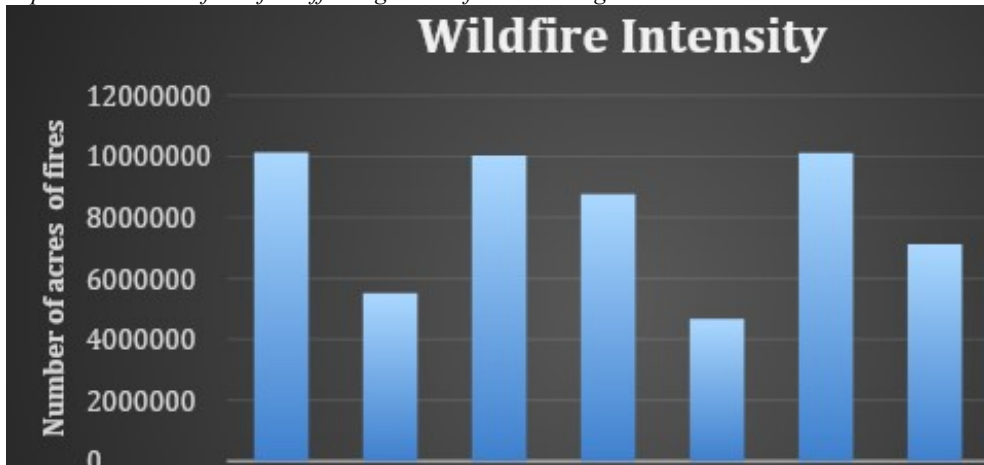
*Showing a typical wildfire frequency in a particular region*



Source: Flickr photos, NIFC (2023)

Figure 6.

*Impact and extent of wildfire affecting acres of land in a region.*



Source: NIFC (2023), Survey study (2023).

**Table 6**  
*The correlation between the financial amount in GDP, suppression cost, and annual growth rate in the US.*

Year	GDP in billions of US dollars	Financial Cost to suppress fires \$ billion	Annual growth rate in percent
2022	25,461.3	3,549,000,000	2.1%
2021	23,315.1	4,389,000,000	5.9%
2020	21,060.5	2,274,000,000	-2.8%
2019	21,381	1,590,000,000	2.3%
2018	20,533.1	3,143,256,000	2.9%
2017	19,477.3	2,918,165,000	2.2%
2016	18,695.1	1,975,545,000	1.7%
2015	18,206	2,130,543,000	2.7%

*Note.*  
 Source: NIFC (2023)

Table 6 indicates the financial stability of the country, and its annual growth rate to withstand wildfires' effect on the economy. The table showed that in the year 2022, the GDP financial ability of the country improved to \$25,461.3 billion with an annual growth rate of 2.1%, and a protection guide in the year compared to other years that had over \$1billion in GDP financial growth. The GDP financial strength for the years 2015 to 2022 indicated that the country has tried to stabilize the economy against wildfire impact and occurrence.

**Figure 7**  
*A kind of financial burden that goes into suppressing a wildfire occurrence.*



*Note.*  
 Source: Flickr photos, NIFC (2023)

#### 4. How have the adaptation strategies in the U.S. checked the impact of wildfire frequency and intensity in the country?

Table 7

*Showing the adaptation strategies to mitigate wildfire effects in the country.*

Methods	Adaptation strategies	Implementation effort
Prevention	Fire management	*Battling the incessant risks of wildfire in vulnerable areas by the Federal government *Incorporating fire risk into the decision-making of the country *Reducing risks for households
	Land use planning	*Enforcement of building codes and wildfire resistance. *Regulations observed on the development of vulnerable areas
	Public awareness and sensitization	*Tribal communities gave their support. *Mobilizing communities to understand and plan for fire risk *Protection of communities from extreme heat *Different safety programs
Preparedness	Supporting the different fire agencies	*Federal government funding of \$50 billion bipartisan infrastructural law  *The involvement of technologies like drones to combat wildfire occurrences
	Community participation and engagement	*Synergy ensured among relevant fire agencies Fire-smart structures to appear inflammable.

Note.

Sources: Drafted records from NIFC (2023), Pew (2022), Wh. Gov fact sheet (2023)

#### Discussion of Results and Findings

In the various tables presented, it was revealed that wildfire incidence was an annual occurrence and disaster in the US. The frequency and intensity of wildfire in the country emphasized the impacts the disaster had in various states and covered many acres of land as a result of human and non-human influences. The tables also revealed the economic resilience of the country in terms of some associated factors that were vulnerable to the impact of wildfire.

The economic resilience of the US that was considered and identified in the study were agriculture, industry, and service sectors. The sectors formed the purposively sampled components of economic resiliencies in the US. The measure was employed to work in line with the objective of the study on assessing the economic resilience and adaptation strategies of the US in the face of the frequency and intensity of wildfires due to climate change. The unavailability of diverse records and data on the status of the totality of the U.S. economy against wildfire limited the study to some areas of concentration in the economics of the country. For that reason, the study depended on the limited retrieved records from the National Interagency Fire Center [NIFC], Statista, the World Bank, and the White House Facts Check Report. The retrieved data also focused on the generality of the US adaptation strategies, irrespective of the application in the various states, which were initiated and by the availability of retrieved data in the study, were implemented to mitigate against wildfires in the country.

The following objectives were observed in the study:

**Objective 1: Determining the economic resilience of the US to mitigate wildfire in the country.**

It was discovered in the study that the incidence of wildfire frequency and intensity in the US has called for the central government to initiate a plan that would help improve and strengthen the economy against the re-occurrence of wildfires. It was recorded that the country had planned to revitalize the economy by boosting the Gross Domestic Product (GDP), concentrating on the insurance sector for productivity, encouraging economic diversification, and giving room for social safety means to the affected businesses, entrepreneurs, and organizations. In the area of gross domestic product which concentrated on the value of productivity added in the different sectors, agriculture, industry, and services were witnessed to have added value to the economy by the annual growth experienced in the country.

The US economy saw the year 2021 accruing a GDP of \$23,315.51 billion with 5.9% annual growth over other years considered (2015-2022). Although the year 2022 witnessed a GDP of \$25,461.3 billion, the annual growth from the preceding year saw it decrease to 2.1%. The results showed that the economy, despite the yearly occurrences of wildfire and many other disasters, experienced a boost that saw the effort of the government to make the economy thrive. In another presentation, the study discovered that the US economic resilience through the considered sectors witnessed different contributions to the economy. In the year 2015, the agricultural sector had a value added to GDP of 1.03% while it experienced the lowest GDP in 2019 with 0.84%. The industrial sector witnessed a GDP growth of 18.63% in 2018 while the other years indicated lower rates of growth. However, the service sector had a GDP growth of 78.15% in 2020 while it witnessed the lowest fall in the year 2015 and 2018 with 76.74% separately. While the wildfire occurrences persisted in the country, it had remained viable, economically, in certain areas of the sector such as agriculture, industry, and services. It indicated that while the agricultural sector has persistently generated a lower GDP growth, other sectors of the economy were achieving a boost in such a way that the economy was strengthened against any disaster risk or threat.

**Objective 2: Identify the adaptation strategies of the US economy.**

It was discovered in the study that the US government had some adaptation strategies to mitigate wildfire occurrences in any region of the country. The US government through its policies and regulations initiated some strategies to mitigate some unprecedented wildfires in the country while taking into consideration the processes and workable plans to be employed in any given area. It was revealed in the study that major adaptation strategies formulated for operationalization in all states were categorized into prevention, preparedness, and response strategies. They were strategically positioned to prevent and minimize wildfires from occurring. The presentation was based on the fact that if they were implemented, it would go a long way in mitigating the frequency and intensity of the fire in the country while focusing on the communities that were vulnerable to the incident. To prevent the occurrence of wildfires, fire control and management, land use planning, and public sensitization were targeted for action. The preparedness was aimed at reinforcing the firefighting agencies, encouraging community participation in the campaign against wildfires, giving infrastructural guidance and mitigation plans as well as ensuring that prompt response strategy was taken at the time of pre-incident and post-incident wildfires. The NIFC (2023) revealed that if the various steps in preparedness towards mitigating wildfires in the country were followed, it could help stabilize any part of the country against the disaster.

**Objective 3. Assessing the stability of economic resilience to mitigate the impact of wildfires in the country.**

The study discovered that the potentiality of the US economy to withstand the impact of wildfire could be assessed by the financial strength and annual growth of the various sectors which the country depended upon to know and examine its per capita income. It was on that basis that a few sectors that constituted the economic stability of the country were considered. The study revealed that the US economy has been impacted by the wildfires resulting in the higher amount of financial cost used in suppressing fires in all the states of the country. Many acres of land were affected as a result of the frequency and intensity of the wildfires. The ability of the country to withstand this trend was witnessed in the annual growth rate of the economy. It was revealed in Tables 1 and 2 that though the financial suppression cost spent in the year 2021 was \$4,389,000,000, the annual growth rate rose from negative 2.8% in the preceding year to a positive 5.9% in the following year. The financial GDP cost for the year 2022 was \$25,461.3 billion. The average annual growth of the country stood at 2.1% in the years recorded. It showed to some extent that the U.S. economy has maintained its stability by maintaining an annual average growth of 2.1% in all the years under consideration even though the financial actualization for each year differed.

From all indications as discovered in the study though the government had tried to encourage people to generate income by engaging in sectors such as agriculture, industry, and services, the impact of wildfires in any given year, has resulted in spending more to suppress wildfire through her financial responsibilities to fire service

agencies and support it rendered to other regions through community engagements and trainings as well as provision of technologies such as drones. According to the White House fact check (2023), several billions of dollars were assigned to mitigate wildfires in the year through other regions and the firefighting services.

#### **Objective 4. Determine the effectiveness of the adaptation strategies toward the effect of wildfires in the country.**

Assessing the effectiveness of adaptation strategies to wildfires' frequency and intensity at any occurrence in the US, findings revealed the destruction of many acres of land that were caused by wildfires. Table 7 revealed the implementation processes to curtail the annual occurrence of wildfires in the country. It was revealed in the White House Facts Check (2023) about the bipartisan support to mitigate wildfires in the country. In addition to the support received from the fire service, the Department of Interior [DOI], and other relevant agencies also pulled funds to reduce and suppress the intensity of wildfires in the country. The fire management was fortified by battling the incessant risks of fire in vulnerable areas of the country. The study discovered that part of the strategies employed was a method of using land planning and public awareness to monitor and harness them so that the effect of wildfires did not extend to other important areas. The preparedness stage focused on supporting different fire agencies in the country through funding and the provision of new technologies to monitor and combat fire in the country. The preparedness ensured that the community was involved in taking precautionary measures against wildfires by constructing fire-resistant structures and limiting fuel-inflammable components in society.

While the adaptation ways have proved to be commendable and effective in some areas in the U.S., the efforts of government and relevant agencies to mitigate have not substantially reduced the occurrences of wildfires and their impact on the economy. The financial cost of suppressing wildfires in the country increased from \$2,274,000,000 in the year 2020 to \$4,389,000,000 in the year 2021 signaling the extent of the frequency and intensity of wildfires within those periods and years. The financial suppression cost has indicated the involvement of the government in fortifying other associated regulations that could help in curtailing the impact of wildfire impact.

#### **Summary, Conclusion, and Recommendation**

##### **Summary**

The main objective of the study was to assess the economic resilience and adaptation strategies of the United States in the face of escalating wildfire frequency and intensity due to climate change. In light of this focus, the study was carried out under five chapters.

The first chapter focused on the introduction and background to the study, the statement of the problem, the research questions, the objective of the study, the scope of the study, the significance of the study as well as the definition of terms used in the study. Chapter two centered the discussion on the review of the literature that was relevant to the study. The chapter focused on areas such as the causes of wildfires, the economic resilience in the country, and the adaptation strategies employed in the country.

The following chapter three discusses the methodology used in retrieving and analyzing data. The vital areas that were discussed in the methodology were the research design employed for the study, the study area, the population of the study, the method of data collection, the sampling technique, the research instrument, and the method used in presenting, interpreting, and analyzing the data. Chapter four therefore was centered on data presentation, interpretation, and analysis used in the study. The final chapter focused on the summary, conclusion, and recommendation for the study.

##### **Conclusion**

Wildfires are one of the disasters that has become an annual occurrence in the U.S. due to climate change which has further increased the frequency and intensity of the fire in any period. The impact of the disaster has been felt in many areas such as the economy of the country which affects sectors such as agriculture, industry, and services among many others. The recurring event of wildfire has questioned the ability of the U.S. government's economic resilience and the adaptation strategies employed at various times to curtail the disaster yearly. That is why there is a need to assess the economic stability on this ground and the effectiveness of the adaptation strategies to mitigate wildfire on this ground.

It was discovered in the study that though there were instituted economic resilience and adaptation strategies by the US against Wildfire, the various efforts put in place have not hindered the disaster from happening in any year. The financial application employed as suppression plans to reduce the frequency and intensity of fire

indicated the reality of wildfires happening in the country every year. Although the continuous effort by the government to strengthen the economy was witnessed in the year under observation through the annual growth rate witnessed in the country, wildfires have impacted the economy and become a challenge considering the financial cost. The unrelenting effort by the government and relevant stakeholders could position the economy to mitigate against wildfires that unexpectedly occur in any year.

### Recommendations

Following the results and findings revealed in the study, there is a need for the central government and relevant agencies to take more proactive actions in reducing the annual wildfire recurrence in the country through these ways:

1. The government should further encourage States to invest more in their local economy through which their different financial base can grow.
2. The country should motivate other sectors by updating and taking necessary financial records to know their capabilities in assisting regions against wildfire threats and risks.
3. The government should revitalize the agricultural sector so that more positive outcomes can be recorded in any given year.

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