



CLIMATE CHANGE'S ROLE IN WORSENING FOREST FIRES

It is a common observation that during the recent past, the intensity and frequency of forest fires have increased at an alarming rate globally. Forest fires created havoc and devastated huge forests and other property across the world over the past few years. The huge fire in Australian forests spanning 2019-20 captured world attention, due to the killing of a large number of wild animals. During the early phase of the first wave of COVID-19, fires burned large forest tracts in Colorado and Arizona. Boreal and Tundra forests in Siberia also witnessed large forest fires in the recent past.

Among other major fires during the year 2020, the California fire is counted as one of the worst fires of the year. The fire in California claimed the lives of 31 people, including 3 fire-fighters and damaged more than 4 million acres of forest. The region experienced its first "Gigafire- a wildfire spreading over 1 million acres" during the year. The creek fire grew to be the largest single fire in the history of California, damaging watersheds and adversely affecting the lives of more than 40 million people. {2020 FIRE SIEGE (ca.gov).}

During the period, the global trend of forest fire was very much experienced in India too. In the year 2021, till the end of May 2021, the Forest Survey of India sent around 3,90,000 forest fire alerts, which were almost double the previous year's figures. States like Madhya Pradesh, Uttarakhand, Odisha and several NE states, mainly Mizoram witnessed several devastating forest fires during the last decade. Forest fire in the Similipal National Park of Odisha was the worst among these fires that badly affected the ecologically sensitive Similipal Biosphere Reserve, and caused widespread damage to the environment along with forest and other properties. The other major fires experienced during the season were in Uttarakhand, where the fire began in October 2020 and kept on burning till April 2021. As per the Uttarakhand Forest Department report, the fire badly damaged more than 1297 hectares of forest cover in the state. Climate change is real: Six months on, Uttarakhand forests still ablaze (downtoearth.org.in).

Among the north-eastern states, Mizoram was very badly affected by the forest fires during the recent fire season. According to the Forest Survey of India (FSI), there were about 2,671 forest fire points in Mizoram between 20th April and 26th April 2021. Lunglei, Serchip, Lawgtlai and Hnahthial, were hit by the fire hazard in the recent past. According to the Mizoram Forest Department, dry vegetation due to scarcity of rainfall coupled with strong winds made the fire more strong and damaging.

In Central India too, the forests witnessed more fire alerts in comparison to earlier days. Between November 2018 and June 2019 Madhya Pradesh, Maharashtra, Odisha and Chhattisgarh forests were badly hit by various intensity fires and there were 2,723, 2516, 2,213 and 1,008 fire alerts in these states respectively.

All the above-cited fire incidence figures indicate that the forest fire situation is worsening at the global level. As far as India is concerned the forest fire trend during the last few decades has become more threatening. The fire alerts sent by FSI system of fire alerts, which is based on near real-time fire points data processed by the National Remote Sensing Centre, Hyderabad also supported the statement.

There are several reasons for wildfires getting worse globally. The increasing human interference in forest areas is one of the major reasons for this increase. The rise in human population and the encroachments in forest areas have made the forests more vulnerable to fires and other hazards. The increasing human habitation in and near the forests also called wild-land-urban interfaces (WUI) has further enhanced the forest fire risk to the community. According to one report, the number of people in WUI at risk of forest fire has doubled in the last forty years. California is a great example of such habitation, where people are expanding to the forest landscape, which is very prone to fire. Besides, the change in temperature conditions and variability in rainfall, probably due to climate change is also considered as one of the major factors for increased fire incidences, mainly fire severity in the forest region. Several pieces of researches carried out show that climate change and variability lead to warmer and drier conditions, causing fire spread.



Climate Change: Major factor for Forest Fire Increase

Fire is the naturally occurring companion of energy released in the form of heat and light when oxygen combines with a combustible material at a suitable high temperature. There are three components, i.e. fuel, heat and oxygen that are needed in the right combination to produce a fire. A combination of these components produces the "Fire Triangle". By nature, a triangle needs three sides, missing any one of the sides will collapse the triangle and extinguish the fire. A steady supply of oxygen (a fire needs air that contains at least sixteen percent oxygen), fuel and temperature become critical for sustaining a fire once it is ignited. Thus the relationship between fuel and temperature is very simple: the more fuel, the higher the heat; the more heat, the faster the fire spreads. When there is plenty of heat and fuel, a fire starts on its own. Climate change induced increasing global temperature and variability in rainfall results in more dried vegetation, which works as fuel for the fire. Thus climate change, in addition to human population pressure is one of the main causes of the increased number of forest fires and their increased intensities. Since the beginning of the Industrial period, the Earth's temperature has increased by almost 2°C. This increasing heat is contributing to two main components for forest fire, i.e. heat and the availability of fuel in the form of dry vegetation.

Thus when there is plenty of heat and fuel, once fire is ignited, it spreads very rapidly and furiously. In the words of one fire behaviour expert, "Large fires live to feed themselves." Once the fire is large, they create their own winds and weather, increasing the flow of oxygen. A large fire is capable of generating hurricane-force winds with a speed of up to 120 miles an hour.

"Thus fires are one of the major responses to climate change, but fires are not only a response – they provide feedback to warming, which feeds more fires. When vegetation burns, the resulting release of stored carbon increases global warming. As fires burn, it releases carbon from forest vegetation combusts and releases carbon dioxide and other gases, such as methane and nitrous oxide into the atmosphere. For example, in the case of California, fire-related emissions in 2020 are already three times higher than the historical 21st-century average. In California, the worst days of forest fires have generated emissions that are roughly four to eight times higher than the average daily emissions. < 2020 US Fires and the Climate Feedback Loop | World Resources Institute (wri.org)>

The more fires release the more carbon dioxide and other gases that results in more warming – and more warming causes more fires. The very fine soot, known as black carbon, that is released into the atmosphere by fires also contributes to further warming (Fig.-2). Forest fires affect the global carbon cycle, and thus the climate, in the following three main ways (Kasischke and Stocks, 2000).

1. First, fire releases large quantities of carbon into the atmosphere through the combustion of plant material and surface soil organic matter.



Forest Encyclopaedia Network & Ward, 2001

"Unprecedented rains followed by deadly flooding in Central China and Europe. Temperature of 120 Fahrenheit (49 Celsius) in Canada, and tropical heat in Finland and Ireland. The Siberian tundra ablaze. Monstrous U.S. wildfires, along with record drought across the U.S. West and parts of Brazil. "

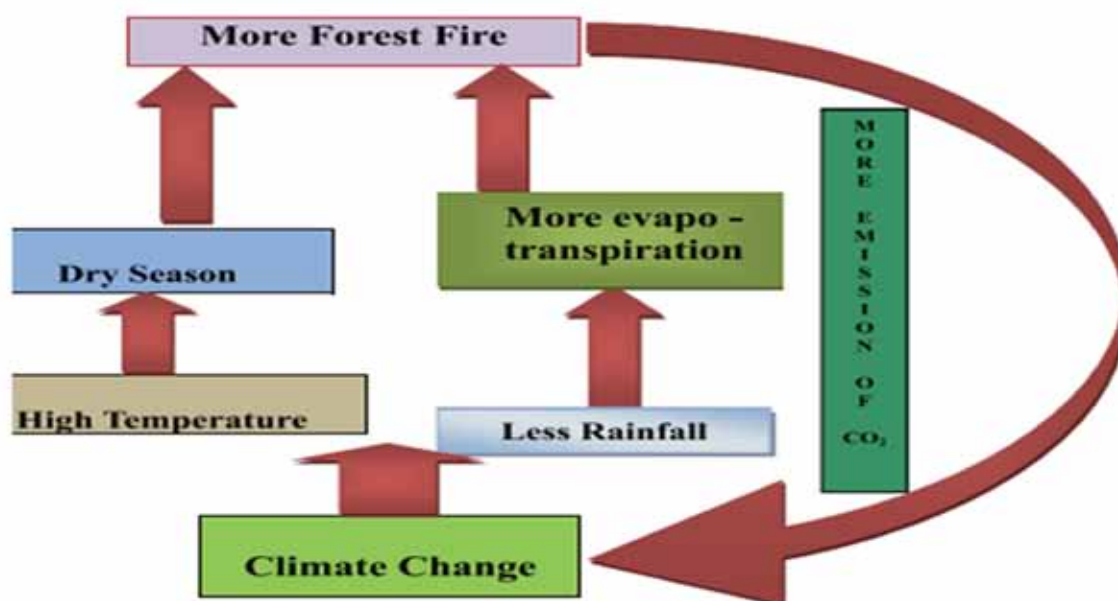
"Global Warming was well predicted, but now you see it with your own eyes."

By Corinne Le Quere, a climate scientist at the University of East Anglia.

Source: Extreme weather renews focus on climate change as scientists update forecasts | Reuters

2. Second, fire-burned vegetation decomposes over time emitting carbon.
3. Third, the vegetation on newly burned sites may not absorb as much carbon from the atmosphere as the decaying vegetation emits, or as much as the pre-fire vegetation absorbed, for several years or decades after a fire.

Fires are thus an important part of the global carbon cycle, with increased fire frequency generally causing a net reduction in biosphere carbon storage.



In its fourth assessment report, the Intergovernmental Panel on Climate Change (IPCC) said: "Disturbances such as wildfire and insect outbreaks are increasing and are likely to intensify in warmer future with drier soils and longer growing seasons." It added: "Warmer summer temperatures are expected to extend the annual window of high fire ignition risk by 10-30 %"

Source: Then and now: The burning issue of wildfires - BBC News

Flannigan et.al. (2000) reviewed the climate change and forest fires relation by using two transient general circulation models (GCMs), namely the Hadley Centre and the Canadian GCMs, to estimate fire season severity in the middle of the next century. Ratios of $2 \times \text{CO}_2$ Seasonal Severity Rating (SSR) over present-day SSR were calculated for the means and maximums for North America. The results suggest that the SSR will increase by 10-50% over most of North America; although, there are regions of little change or where the SSR may decrease by the middle of the next century. Increased SSRs should translate into increased forest fire activity. Thus, forest fires could be viewed as an agent of change for forests as the fire regime will respond rapidly to climate warming. This change in the fire regime has the potential to overshadow the direct effects of climate change on species distribution and migration.

Thus, it is clear that as the world warms, more of those regions are likely to burn, accelerating the warming. In such rapidly changing conditions, there is a need to strengthen the forest fire management systems through good capacitated forest departments, improved data banks and research to fill the knowledge gap and last but not the least, creating public awareness to prevent forest fires. A global level and national level database, bringing together satellite-based data and field data, will be very instrumental for assessing longer term trends of forest fires across nations, provinces and regions and for more effective forest fire management using preventive, mitigation and response mechanisms. ■



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