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## Effects of forest fire on climate change

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**Abstract-** Forest fire acts as a deadly cause for destroying homes, wildlife habitat, timber and polluting the air with emissions harmful to human health. According to system Forest survey of India, the fire in Simlipal biosphere, Odisha topped the list of forest fire incidents with 6627 fire spot which started in 24<sup>th</sup> February 2021. On 13<sup>th</sup> March 2021 government of Odisha has claimed that the situation is in control and forest fire is completely contained. Causes of forest fire may be natural or manmade. Many forest fire start from natural causes such as lightening which set trees on fire. However, rain extinguishes such fires without causing much damage. High atmospheric temperatures and dryness (low humidity) offer favorable circumstances for a fire to start. As fire burn carbon stored in trees and other vegetation combust, releasing carbon dioxides and other potent greenhouse gases such as methane and nitrous oxide into the atmosphere. This means that as the fire increases so do emissions. This building up of greenhouse gases in the atmosphere is rapidly warming the planet. Global warming is contributing to forest fires and those fires are stoking further heating so that we can say that it is deadly cycle. Climate change is expected to alter forest boundaries and types as well as impact productivity, species population and migration occurrence of pest and diseases and the capacity for forest to regenerates. Observations over the past 20 year show that the increasing intensity and spread of forest fire in Asia were largely related to rise in temperature and decline in precipitation in combination with an increasing intensity of land use (IPCC 2017).

**Key words:** Forest fire, global warming, greenhouse gases, IPCC: Intergovernmental Panel on Climate change

### INTRODUCTION

A wildfire, bushfire, wild land fire or rural fire is an unplanned, unwanted, uncontrolled fire in an area of combustible vegetation starting in rural areas and urban areas. Depending on the type of vegetation present, a wildfire can also be classified more specifically as a forest fire, brush fire, bushfire (in Australia), desert fire, grass fire, hill fire, peat fire, prairie fire, vegetation fire, or veld fire.<sup>1</sup> Fossil charcoal indicates that wildfires began soon after the appearance of terrestrial plants 420 million years ago.<sup>2</sup> The occurrence of wildfires throughout the history

of terrestrial life invites conjecture that fire must have had pronounced evolutionary effects on most ecosystems' flora and fauna. Earth is an intrinsically flammable planet owing to its cover of carbon-rich vegetation, seasonally dry climates, atmospheric oxygen, and widespread lightning and volcanic ignitions.<sup>3</sup>

Wildfires can be characterized in terms of the cause of ignition, their physical properties, the combustible material present, and the effect of weather on the fire.<sup>4</sup> Wildfires can cause damage to property and human life, although naturally occurring wildfires may have beneficial effects on native vegetation, animals, and ecosystems that have evolved with fire.<sup>5,6</sup> Wildfire behavior and severity

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result from a combination of factors such as available fuels, physical setting, and weather.<sup>7</sup> Analyses of historical meteorological data and national fire records in western North America show the primacy of climate in driving large regional fires via wet periods that create substantial fuels, or drought and warming that extend conducive fire weather. Analyses of meteorological variables on wildfire risk have shown that relative humidity or precipitation can be used as good predictors for wildfire forecasting over the past several years.<sup>8</sup>

### **CAUSES**

The causes of forest fire include natural and by human activity.<sup>4</sup> Leading natural causes of wildfires include:

- Global warming
- Dry climate
- Lightning

Human activity: In middle latitudes, the most common human causes of wildfires are equipment generating sparks (chainsaws, grinders, mowers, etc.), overhead power lines, and arson in the tropics, farmers often practice the slash-and-burn method of clearing fields during the dry season. When thousands of farmers do this simultaneously, much of a continent can appear from orbit to be one vast blaze.

Coal seam fires burn in the thousands around the world, such as those in Burning Mountain, New South Wales; Centralia, Pennsylvania; and several coal-sustained fires in China. They can also flare up unexpectedly and ignite nearby flammable material.<sup>9</sup>

### **FOREST FIRE AND CLIMATE CHANGE**

Forest fires, of the kind that the US saw last year and in some years before that, have just become frighteningly real for India. Fire in the Simlipal Biosphere Reserve, in Odisha, raged for over 10 days, destroying nearly a third of the national park. While the state is now reporting that firefighters have finally gained control over the fire, the source of the fire is yet undetermined. The forest has occasionally seen fires, especially in the summer months, but none that match the scale of the latest one. While poachers set alight dry shrubs to drive out animals, villagers from the area sometimes engage in controlled burning to better enable picking of mahua flowers. However, this year's fire is singular in the sense that there has been an early onset of summer and a prolonged dry spell, creating the conditions for the fire to spread quickly.

The government-both the states and the Centre-need to view this as a warning of the consequences of climate change and mount mitigation efforts urgently. With the world now on the verge of running out of time to meaningfully act to limit global warming to a lower bound, such disasters will keep recurring with devastating consequences not just for flora and fauna, but humans as well. There have been serious losses of forests that are the most effective carbon sinks, in India as well as elsewhere in the world. If countries don't work on reducing emissions, expect more California's and Simlipals. Heat waves, droughts, climate variability such as El Niño, and regional weather patterns such as high-pressure ridges can increase the risk and alter the behavior of wildfires dramatically. Years of precipitation followed by warm periods can encourage more widespread fires and longer fire seasons. Since the mid-1980s, earlier snowmelt and associated warming has also been associated with an increase in length and severity of the wildfire season, or the most fire-prone time of the year in the Western United States.<sup>10</sup> Global warming may increase the intensity and frequency of droughts in many areas, creating more intense and frequent wildfires.<sup>11</sup> A 2019 study indicates that the increase in fire risk in California may be attributable to human-induced climate change. A study of alluvial sediment deposits going back over 8,000 years found warmer climate periods experienced severe droughts and stand-replacing fires and concluded climate was such a powerful influence on wildfire that trying to recreate pre settlement forest structure is likely impossible in a warmer future.

Intensity also increases during daytime hours. Burn rates of smoldering logs are up to five times greater during the day due to lower humidity, increased temperatures, and increased wind speeds. Sunlight warms the ground during the day which creates air currents that travel uphill. At night the land cools, creating air currents that travel downhill. Wildfires are fanned by these winds and often follow the air currents over hills and through valleys. Fires in Europe occur frequently during the hours of 12:00 p.m. and 2:00 p.m. Wildfire suppression operations in the United States revolve around a 24-hour fire day that begins at 10:00 a.m. due to the predictable increase in intensity resulting from the daytime warmth.<sup>12</sup>

### **SIMLIPAL FOREST FIRE**

The 2021 Simlipal forest fires is an ongoing forest fire, occurring in the Indian state of Odisha in March and

April 2021. The fires have affected the ecologically sensitive Simlipal Biosphere Reserve, and caused widespread damage to the local environment as well as property and livelihoods. The Simlipal Biosphere Reserve is located in the Indian state of Odisha and encompasses several state and national wildlife parks and sanctuaries, including the Simlipal National Park, the Hadgarh Wildlife Sanctuary and Kuldiha Wildlife Sanctuary, as well as buffer zones of forested areas including the adjoining Natio and Satkoshia Tiger Reserve and forest.<sup>13</sup> The Biosphere was declared as such in 1994 by the Indian Government, and in 2009, UNESCO recognized the Simlipal Biosphere Reserve as part of the World Network of Biosphere Reserves, which are areas designated for balanced relationships between people and nature. Following this, the Regional Plant Resource Centre in Odisha launched a project to identify and catalogue the varieties of flora and fauna in the reserve.<sup>14</sup> The Reserve is home to a vast number of rare and endangered species of flora and fauna, including forests of sal trees, 93 varieties of orchids and 52 species of endangered flora, as well as the Royal Bengal tiger (*Panthera tigris tigris*), the gaur, or Indian bison, the Asiatic Elephant (*Elephas maximus*), several varieties of wild cats, including the Fishing cat, Jungle cat, and Leopard cat; the four-horned antelope or chowsingha, and many rare birds, including the Red breasted falconet, grey-headed fishing eagle, slender billed scimitar babbler, white eared bulbul, east-Himalayan long-tailed minivet and common sand piper. Documentation of endemic species within the Biosphere is not yet complete and is ongoing, and in 2019, researchers discovered a tenth species of vine snake, which added to the existing documentation of nine species of vine snakes after a gap of more than 100 years. The Simlipal National Park is an area that has received funds under India's Project Tiger, aimed at tiger conservation, to ensure the maintenance of viable Bengal tiger populations in the reserve.<sup>15</sup>

## MATERIALS & METHODS

- Destroyed plant species were identified through flora and fauna.
- The Fire Alerts System managed by the Forest Survey of India tracks large fire events across India on real-time basis using the data of SNPP-VIIRS (Suomi-National Polar-orbiting-Visible Infrared Imaging Radiometer Suite).

- Survey methods was done for outlining the damaged plant species, animals and also used other methods like asking from people and also from the available sources.
- Data collected from the respected available sources.
- Other information was also gained from the forest officers.
- The availability of green house gases was measured by observing the climate after the forest fire.

## RESULT

Forest fire is a major environmental issue, creating economical and ecological damage while endangering human lives. Similipal, situated at the Indian state of Odisha, is the only tiger reserve in the world, where the melanistic form of tiger is found and is properly conserved. The paper has tried to identify and evaluate the forest fire incidences in Similipal Tiger Reserve (STR) using Remote Sensing (RS) and GIS technique for four years, such as 2006, 2009, 2013 and 2016. Primary fire incidences data were collected from respective meteorological offices along with location co-ordinates with prevailing weather conditions. The forest fire incidences are mapped in Arc GIS 10.1 software environment. It shows unusual distribution of forest fire incidences in STR. The year 2009 has the maximum number of forest fire incidences in STR underlined by extremely hot weather and low precipitation condition. Ground trothing in the STR shows disturbances due to anti-social activities in some patches of the area, limiting the scope for preventive measures, caused large number of forest fires incidences. Forest fire caused by local people (man-made) associated with the presence of Particularly Vulnerable Tribal Groups (PVTGs) also are increased in numbers. Forest fire incidences can be reduced drastically with future planning and using modern technologies under most unfavorable climatic conditions. The forest fire destroyed nearly 3rd of the simlipal bio reserve park.

## DISCUSSION

The knowledge in systematic forest fire control is limited to the short term. There are weaknesses in the evaluation, ranging from fire detection to the coordination of preventive steps. At this time, the need to establish an adaptive management plan is critical. Sector-wise, with

short and long-term visions, clear points are suggested for the implementation of a holistic fire prevention plan in the light of climate change. Some of them include mitigation measures to minimize the uncertainty in baseline data, strengthen present fire-fighting programs, developing precautionary measures, integrating institutional efforts, publicity, extension, and training, legal measures, and funding of more programs aimed to improve the current status.

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