

Sparks, Climate Change, and Human Activities

The fire triangle burning up our ecosystems

Naturally occurring wildfires are essential for the evolution of biodiversity in some ecosystems. Nevertheless, just as a few ecosystems literally rise from the ashes, others may become seriously affected by the conflagrations. Human intervention, combined with high temperatures from climate change, are creating the perfect cocktail for wildfires to become increasingly voracious. What is the spark that started it all?

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The ashes and flames from a small campfire at a hunting camp suddenly spread rapidly through a North American temperate forest, igniting logs, vegetation, and pretty much everything in its path. The frightened forest animals flee in terror. Among them, the silhouettes of two white-tailed deer (*Odocoileus virginianus*) stand out amid the flames that literally consume the wilderness while they and the rest of the animals seek refuge in the water...

We all remember this scene from the movie *Bambi* (1942), when the fawn and his father manage to escape the raging fire caused by the burning ashes from a campfire that some hunters had started the night before and that, in a matter of minutes, had consumed everything. This animated film, among many others, vividly exemplifies how human actions can cause disastrous forest fires, even when, in all honesty, this is not entirely true.





Are wildfires also naturally occurring?

Actually, yes. In ecosystems, naturally occurring wildfires are usually started by lightning. However, their expansion may be conditioned by several factors specific to each zone, and therefore, there are ecosystems with more naturally occurring wildfires than others. Hence, each ecosystem has a particular wildfire regime and, according to their ecosystem-wildfire relationship—by which ecosystems can sometimes benefit or become very damaged—ecosystems have been classified into three types: *fire-sensitive*, *fire-independent*, and *fire-dependent*.

[Fire-sensitive ecosystems](#), such as the Andean forests, are not very flammable due to their type of vegetation and the amount of moisture they retain. Consequently, they do not allow wildfires to spread. For this reason, their biodiversity is not adapted to fires.

[Fire-independent ecosystems](#) are not related to fire since they exist in very cold or



Naturally occurring wildfires do not destroy ecosystems. Instead, in Colombia, raging forest fires, which every year become larger and more severe, are mostly caused by deforestation-related activities.

very humid areas or places without vegetation and they do not allow flames to spread, such as deserts and tundra.

Finally, those ecosystems that are benefited by fire, where even their biodiversity has evolved due to the presence of fire, are known as [fire-dependent ecosystems](#). Temperate forests, like the one wherein our beloved Bambi lives, are examples of these ecosystems. In these forests, flames burn through the underbrush or debris, but thick trees have adapted to fire and are not incinerated. Hence, when the fire runs out of tinder or kindling, it simply subsides and dies down, and everything is peaceful once again...

Nevertheless, as the saying goes, “*Where there was fire, ashes remain...*”: new seeds grow from the burning ashes, which prompts the forest to recover and cover itself once more with vegetation. Here, if a new spark is generated with favorable conditions for burning off this material (such as low humidity, high temperatures, and strong winds), flames will expand again. This cycle is naturally repeated over and over again, thus benefiting biodiversity.

US fire fighters are well acquainted with fire regimes since, during the spring months, they often work tirelessly to control fires, not only spreading water on impacted sites but also



Laura Obando, a researcher from the Faculty of Natural Sciences at Universidad del Rosario, points out that forests are commonly burned at their borders to clear land for agricultural and cattle farming activities. “These controlled fires change moisture levels in and around the burned area, making them drier and more vulnerable to wildfires.”



“The problem is that by suppressing fires in these semi-open fire-dependent forest areas, human intervention has densified their vegetation, which subsequently makes raging wildfires spread faster and become more devastating since these areas have modified their natural fire regime,” asserts Stijn Hantson, a professor from the Faculty of Natural Sciences at Universidad del Rosario.



starting controlled fires that burn brush to prevent wildfires from spreading.

So why are forest fires getting more and more devastating?

Currently, high temperatures characteristic of climate change processes, in tandem with the fact that humans are intervening in fire regimes, are causing increasingly devastating wildfires.

A study published in [Nature Communications](#), in May 2022, indicates that human-ignited fires in California are becoming more ferocious.

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wildfires spread faster and become more devastating since these areas have modified their natural fire regime,” comments [Stijn Hantson](#), professor from the Faculty of Natural Sciences of the Universidad del Rosario and lead author of the study. The professor adds that “in California, there are currently very dense and dry forests that, together with extreme drought intensified by climate change, are generating wildfires that are getting more and more extreme.”

In fact, and according to the [Fire and Resource Assessment Program](#) (FRAP) of the state of California, the average area of the annual wildfire perimeters has doubled in recent decades (2010-2018) from previous decades (1980-2010). The increase has been from 172,100 hectares (ha) per year to 330,900 ha/year.

For this reason, the study conducted by researchers from the University of California (Irvine campus) sought to follow and model forest fires in that area of the western United States in the last 20 years, in near real time, based on satellite images



from the [Suomi National Polar-orbiting Partnership](#), which is operated by the National Office of Oceanic and Atmospheric Administration (NOAA) and NASA.

“These satellite data identify not only fire perimeters but also fire behavior (for example, how fast the flames spread), which can be used to later detect and assess the impacts on the ecosystem, such as the percentage of dead trees. In this way, new alternatives will be available for an improved management of wildfires,” complements Hantson.

In the face of increasingly voracious and frequent fires caused by human intervention, the number of dead trees has also increased since these trees lack the evolutionary time to adapt to these new fire regimes. Consequently, the plant structure of the different ecosystems can vary at unknown levels.

For this reason, the research study led by Professor Hantson will generate methods for the management, regulation, and control of forest fires after the corresponding follow-up activities have been implemented. In addition, the study will



At a general level, 31 protected areas in the country have experienced a sharp increase in deforestation in the years after the conflict, which has raised the deforestation rate to 177 percent; This translates into 33,000 hectares of protected forest losses.

monitor wildfires in parts of the world without follow-up programs, such as Colombia.

It is well known—and proclaimed with fervor—that Colombia possesses a wide variety of ecosystems. The Amazon, for example, reflects this characteristic.

On the one hand, unlike the temperate forest where *Bambi* lived, the Amazon is a *fire-sensible* ecosystem that is negatively affected by conflagrations.

On the other hand, it is a tropical humid forest with some peculiarities that make it less prone to wildfires because it literally “extinguishes” them naturally.

Deforestation: the big culprit

So why are these forests *fire-sensitive*? The problem is that human activities are creating



the ideal conditions for these forests to catch fire. Since they have not adapted themselves to wildfires, they burn uncontrollably. This is somewhat similar to what happened at the end of “*The Jungle Book*” (Spoiler Alert!) when Mowgli wanted to face Shere Khan the tiger with the much feared “red flower” lit on a torch but [ends up accidentally burning part of the monsoon forest](#).

Particularly, in the Amazon, deforestation is one of the main causes for the proliferation of raging wildfires.

A [study published in 2013](#) by researchers from the Universidad Nacional de Colombia and Universidad Autónoma de Barcelona, directed by Professor [Dolors Armenteras](#), assessed satellite data from the [MODIS](#) sensor (which remotely detects potential fire sources) collected between 2000 and 2009 as well as satellite images from the [United States Geological Service](#) (USGS) in parts of the Colombian Amazon area, with an area of 5,413,597 ha.

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“These forests are commonly burned at their borders to clear land for conducting agricultural and cattle farming activities,” explains Professor Laura Obando..

The group concluded that the Amazon is burning because deforestation is “breathing down its neck.” Only in this period of time, 19,600 ha of forest were deforested, which has prompted grasslands to increase from 8 percent to 10.3 percent. The study also confirmed that fire is the most commonly used method for converting Amazonian soil into grasslands.

According to [Laura Obando](#), a researcher from the Faculty of Natural Sciences at Universidad del Rosario, “forests are commonly burned at their borders to clear land for conducting agricultural and cattle farming activities. Traditionally, a section of forest is removed through the ‘slash and burn’ process and the resulting ashes help to fertilize the soil. Consequently, these controlled fires change moisture levels in and around the burned area, making them drier and more vulnerable to wildfires. The fauna and flora are affected because they have not had time to adapt to these new fire regimes”.

The post-conflict era has unleashed “other fires”

Even when, in Colombia, these fires have been influenced by several socioeconomic and political aspects, the post-conflict is also currently playing an important role. According to an international collaborative study published in 2021 in [People and Nature](#), co-authored by Laura Obando, since signing the Peace Agreement with the Revolutionary Armed Forces of Colombia (FARC for the Spanish acronym), communities have had access to previously restricted lands, which are now being used for agricultural activities. This is one of the main reasons why deforestation and, in turn, wildfires have increased, especially since 2016.

Overall, 31 protected areas in the country have experienced a sharp increase in deforestation in the years following the conflict, which has raised the deforestation rate to [177 percent](#). This translates into 33,000 hectares of protected forest losses. Only in the department of Meta, within three areas of the Parques Nacionales Naturales de Colombia (Network of National Natural Parks of Colombia [Cordillera Los Picachos, Sierra La Macarena, and Tinigua]), deforestation has increased by [69 percent, thereby expanding from 7,800 ha in 2017 to 13,800 ha in 2018. Hence, wildfires have also multiplied by six](#).

Then, the unspoken fear that the evil tiger from The Jungle Book had of the “red flower” cannot surprise us at all. Still, naturally occurring wildfires do not destroy ecosystems. Instead, in Colombia, raging forest fires, which every year become larger and more severe, are mostly caused by deforestation related activities.

In conclusion, without clear policies that promote the rational use of soil and forests in our country, the survival needs of the rural population will continue to prevail over forest conservation.

Just like the phoenix rises from the ashes after the fire, when a wildfire burns up a *fire-dependent* ecosystem, life finds a way amid the debris. Still, given the climatic variations and the indiscriminate deforestation caused by us, human beings, we will not know which ecosystems our children and grandchildren will inherit. For this reason, deep down, Shere Khan was not really afraid of the “red flower” but rather of the humans who with used its power to deforest his natural habitat. Once again, fiction turns into reality. ■

Wildfire Figures in Colombia

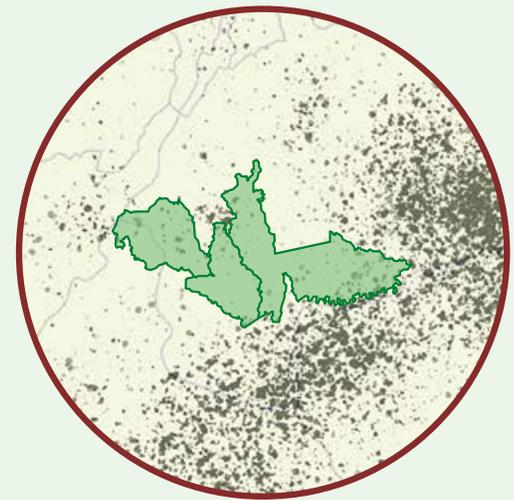
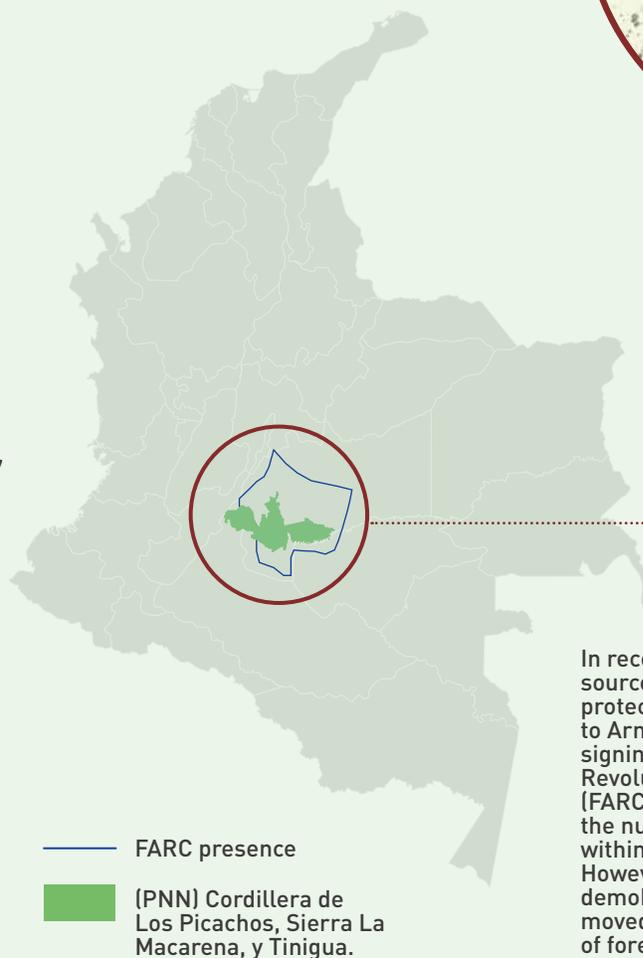
From 2000 to 2009, 90.5 percent of the heat sources detected, which may later turn into fires, were located in unprotected lands throughout the country (mainly in the [Orinoquía region, which is a fire-dependent ecosystem](#)), while less than 9.5 percent were concentrated within protected areas

Source: Armenteras et al. 2009, <https://ref.scielo.org/gvfgqt>

The team led by Professor Armenteras (2013) have assessed the number of fires in the Parques Nacionales Naturales de Colombia (National Natural Parks of Colombia) (PNN, for the Spanish acronym) of Cordillera Los Picachos, Sierra La Macarena, and Tinigua. The number of fires per each 100,000 hectares has varied through the years (approximate data). 2007 was the year for which the largest number of fires was reported:

Number of Fires 2000–2010

2001: 7
 2002: 5
 2003: 19
 2004: 25
 2005: 10
 2006: 11
 2007: 60
 2008: 15
 2009: 14
 2010: 20



In recent years (2017 and 2018), heat sources have increased within the protected areas of Colombia. According to Armenteras et al. (2019), after the signing of the peace agreements with the Revolutionary Armed Forces of Colombia (FARC for the Spanish acronym), in 2016, the number of forest fires increased within these National Natural Parks. However, these territories were not fully demobilized until 2017 when the FARC moved out, which prompted the number of forest fires to increase.

Number of Forest Fires 2017–2018

2017: 136 (Farc present)
 2017: 263 (Farc not present)
 2018: 241 (Farc present)
 2018: 870 (Farc not present)

Source: Armenteras et al. 2013, <https://dx.plos.org/10.1371/journal.pone.0054310>

Source: Armenteras et al. 2019, <https://doi.org/10.1038/s41559-018-0727-8>