

Chain Reaction Research is a coalition of Aidenvironment, Profundo and Climate Advisers.

Contact:

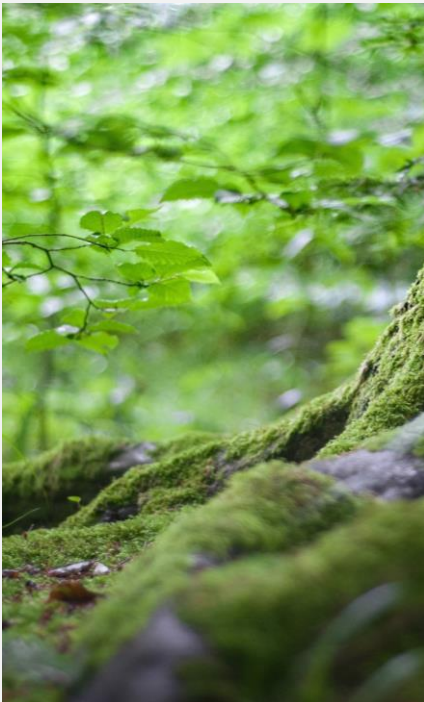
www.chainreactionresearch.com
info@chainreactionresearch.com

Authors:

Marco Tulio Garcia, Aidenvironment
Gerard Rijk, Profundo
Matthew Piotrowski, Climate Advisers

With contributions from:

Barbara Kuepper, Profundo
Okita Miraningrum, Aidenvironment
Tim Steinweg, Aidenvironment
Christopher Wiggs, Aidenvironment
Roland Sinulingga, Aidenvironment
Bart Slob, Aidenvironment



Deforestation for Agricultural Commodities a Driver of Fires in Brazil, Indonesia in 2019

May 2020

Widespread fires in Brazilian tropical forests were at the center of media attention in 2019. NGOs, politicians and celebrities called for action to stop deforestation for soy and livestock, the main cause of the fires. Indonesia also endured extensive blazes in 2019, often linked to deforestation for palm oil. Forests in Brazil and Indonesia capture carbon, retaining vast amounts of carbon dioxide and regulating global temperatures. Fires release that stored CO₂ back to the atmosphere, contributing to further climate change.

This report describes the main drivers of the fires in Brazil and Indonesia, the actors involved, the political context, and the risks for investors.

Key Findings

- **NASA data shows the magnitude of last year's fires in Indonesia and Brazil.** From July to October 2019, there were 981,282 fire alerts in Brazil. In the same period, there were 329,546 fire alerts in Indonesia. In both countries, most fires occurred on the frontier between areas already used for farming and areas with native vegetation.
- **The area burned in Brazil was 3.7 percent (31,838,900 ha) of the country's landmass. In Indonesia, 0.84 percent (1,649,258 ha) of its total landmass was burned.** Part of the fires is related to deforestation for agricultural land expansion, while other fires are the result of natural causes and maintenance of agricultural land.
- **Due to high demand for agricultural commodities, Brazilian farmers and Indonesian smallholders ignite most of the fires.** In Indonesia, 'ready-to-plant' land, which has already been slashed and burned, has higher economic value compared to cleared land that is not ready yet for planting. In Brazil, the business model of investors, real estate firms and agribusinesses aims to increase land value by acquiring land, clearing it from vegetation and transforming it into farmland.
- **In Brazil, companies such as JBS, Cargill and Bunge are exposed to a risk of fires in their supply chains.** A large number of fires happened in areas close to these companies' facilities.
- **Palm oil traders run a risk of fires in their palm oil supply chains in Indonesia.** Traders and refiners in Indonesia are likely to have direct or indirect suppliers with fires inside their concession areas, even though the former have NDPE policies.

Agricultural interests fueled fires in 2019

In 2019, extreme fire events took place around the world. Wildfires burned in Indonesia, Australia, the Amazon and California. Forest fires are at times part of nature. Every year, Brazil and Indonesia experience a fire season between the months of July and October. However, climate change and commodity-driven deforestation are making them more frequent and more intense. Driven by agricultural expansion and production of mainly cattle and soy, Brazil experienced a heavy fire season in 2019. The same agricultural interests, at a smaller scale, fueled fires in Indonesia, where increased palm oil demand for biofuels exacerbated the widespread fires in the country.

NASA data shows the magnitude of widespread fires in Indonesia and Brazil

CRR used NASA's Visible Infrared Imaging Radiometer Suite (VIIRS) as a parameter to calculate the number of fire alerts for Brazil and Indonesia. The VIIRS active fire alert system is the latest product released by NASA to detect fires globally with a spatial resolution of 375 meters.

VIIRS data has a high level of accuracy, and the alerts are visually confirmed with satellite imagery for the same time period (Figure 1).

Figure 1: Example of VIIRS alerts confirmation visualization in Floresta Nacional do Jamaxim, Pará, August 2019

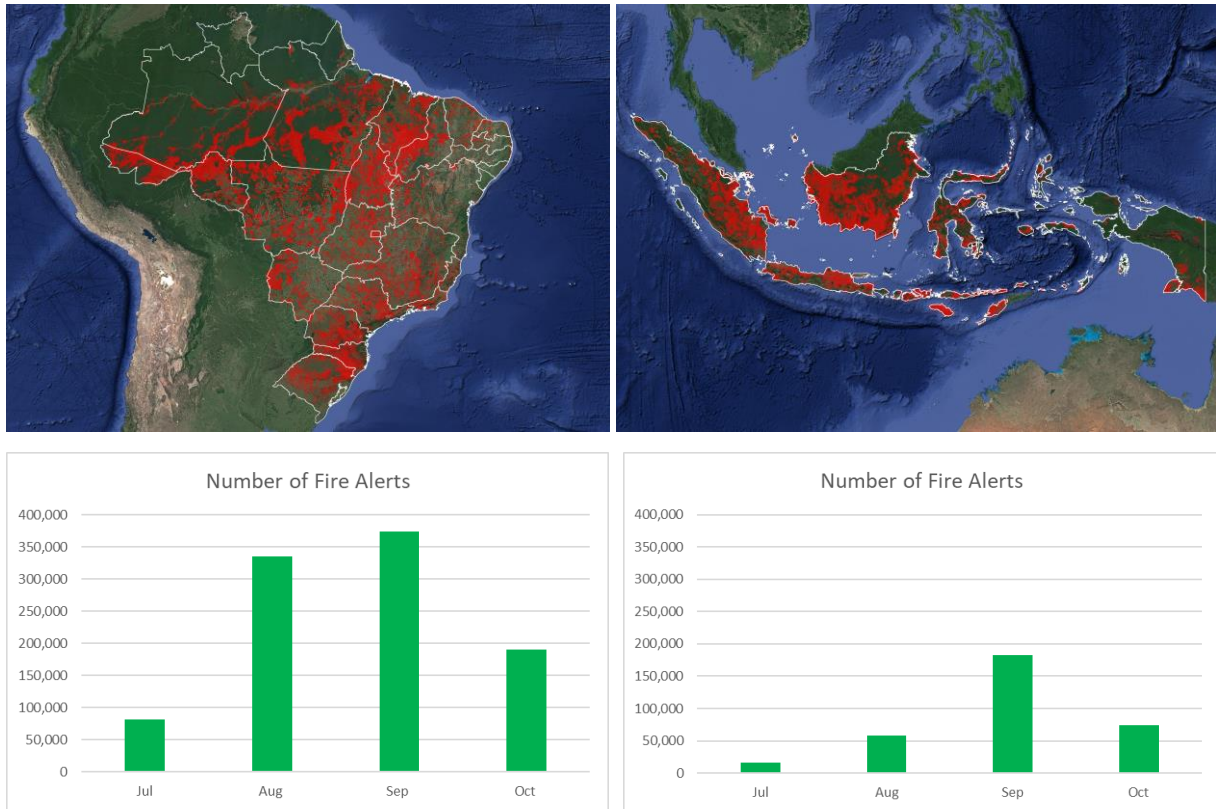


Source: NASA VIIRS fire alerts, Sentinel-2 satellite imagery

The number of VIIRS alerts observed during the fire season (July-October 2019) in Brazil totaled 981,282, while for the same period in Indonesia the number was 329,546.

Figure 2 shows the high concentration of fires in the area of Brazil where the Amazon transitions into the Cerrado biome. In Indonesia, a large concentration of fires happened in Central and West Kalimantan, southeast Sumatra and smaller islands under Kalimantan and Sulawesi.

Figure 2: VIIRS alerts in both Brazil and Indonesia (top) and number of alerts per month (bottom)

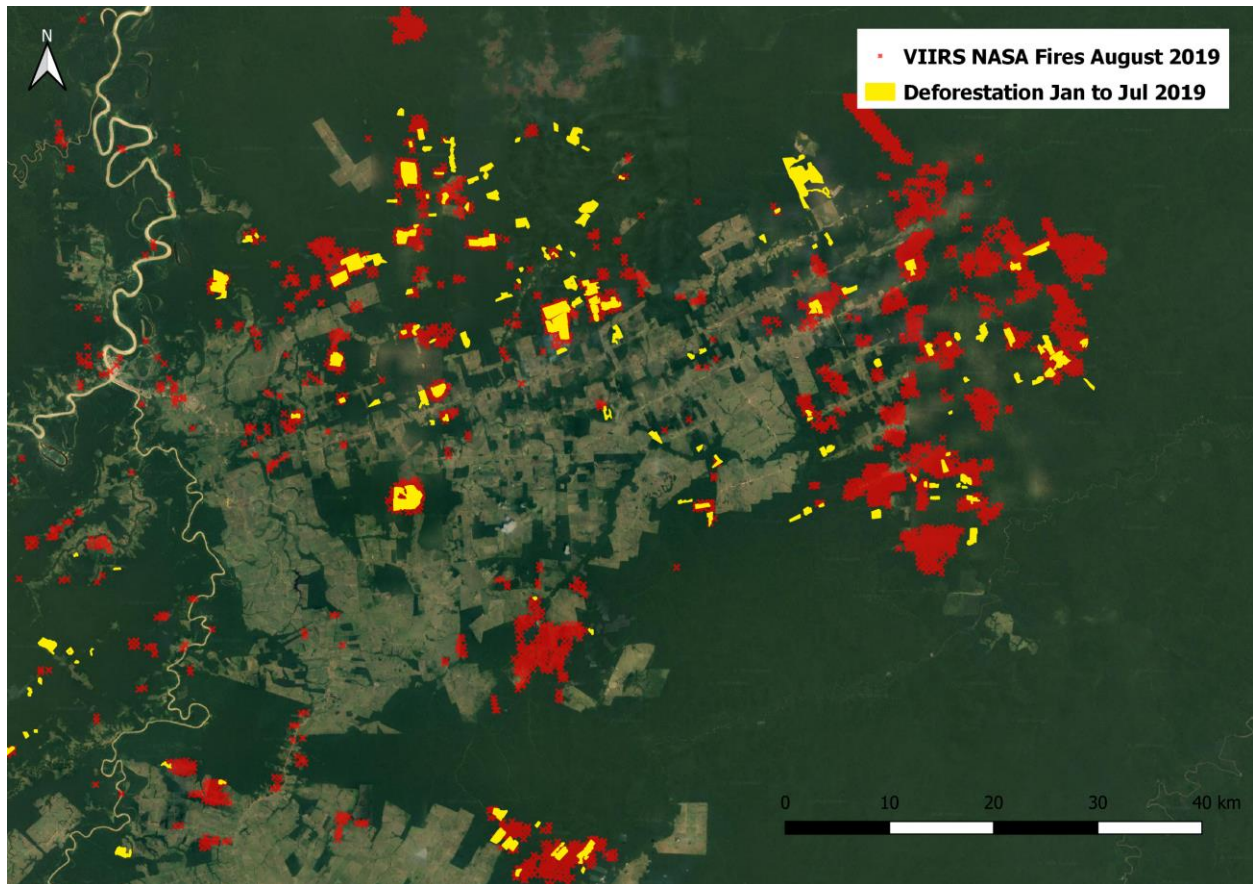


Source: NASA VIIRS fire data, Google satellite imagery; only alerts in Brazil and Indonesia are shown on the maps.

Deliberate fires clear land on agricultural frontiers

The slash-and-burn method is a common practice in Brazil and Indonesia. The majority of fires in the Brazilian Amazon follows this method. First, machines clear the forests, and then the remaining vegetation is left to dry for a period, normally three to four months around the dry season. Next, the dry vegetation is set on fire to consume the biomass and alter the soil properties to make it more fertile and prepare the land for farming. Many of the fires seen in the Amazon were in areas previously deforested in 2019 (Figure 3). The slash-and-burn method is also used in Indonesia to develop land for agriculture, either for industrial plantations or smallholder areas. [Experts](#) believe that many of the blazes in Indonesia started as man-made fires that spread during the dry season. Sources also suggest that the lack of incentives for proper land preparation without burning is the root [cause](#) of the fires.

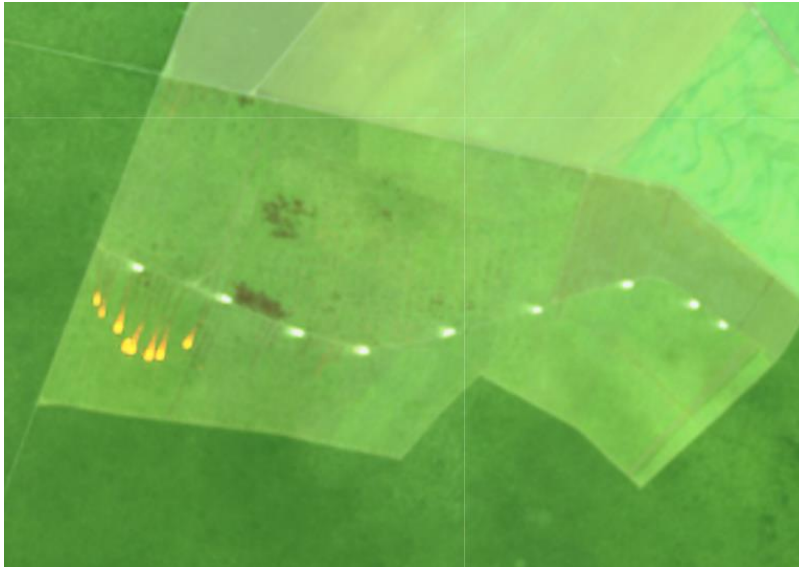
Figure 3: Deforestation from January to July 2019 and fire alerts in August 2019 – Amazon State farming area, Brazil



Source: NASA VIIRS data, Deter alerts, and Google satellite imagery

The [area burned](#) in Brazil in 2019 totaled 31,838,900 ha, which represents 3.7 percent of Brazil's landmass. The large number of fires in Brazil was not only related to clearing new land for agricultural purposes. Farmers also set fires to clear and maintain areas for new pastures for cattle grazing and remove any excess vegetation (figure 4). This process prepares the land for grains cultivation. Soil properties change over the years until the land is suitable for crops like soy. Brazilian farmers see fires as a common [strategy](#) to manage existing agricultural areas, providing nutrients that fertilize the soil and help plants grow.

Figure 4: Example of man-made fire at a farm in Formosa do Rio Preto, Bahia, August 2019. The fires follow specific lines inside the farm boundaries



Source: Sentinel-2 processed imagery

The fires in Indonesia are also linked to agricultural expansion. The country's forests and peatlands, which are too moist for fires to ignite naturally, are typically drained and set aflame to prepare for agriculture. Land development is either for industrial plantations or smallholdings. Oil palm plantations are the primary industrial plantation in Indonesia and are [recognized](#) as a driver of the fires. Still, other plantations that produce rubber and pulpwood incentivize the use of fires as well. Smallholders igniting fires is an established tradition and is not specific to one commodity.

Figure 5: Aerial photo on burned peat area in PT Samora Usaha Jaya's concession in south-east Sumatra Island, Indonesia, October 2019



Source: Aidenvironment

Natural and deliberately lit fires: A double threat to global forests

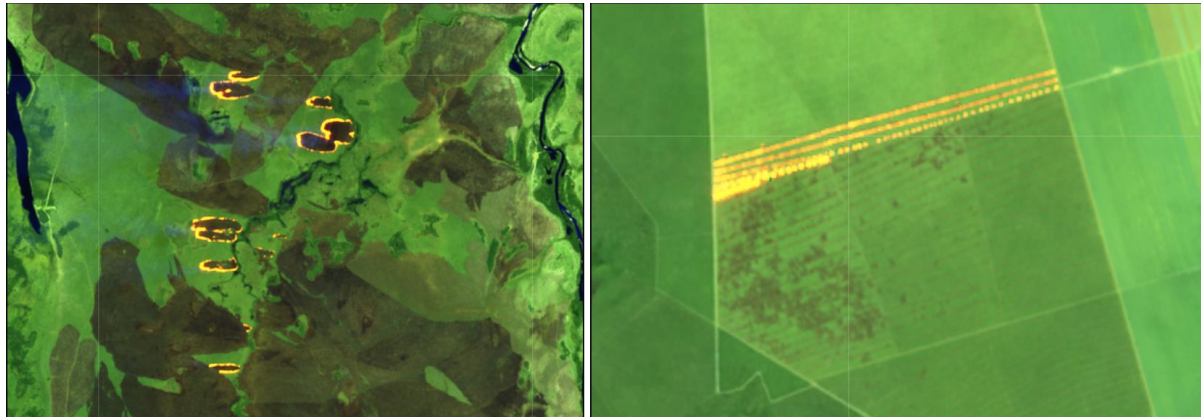
Man-made fires in Brazil and Indonesia are different from other (natural) climate-related fire events globally. Australia, for instance, experienced a devastating early bushfire season in the last months of 2019. These fires were a [result](#) of record-breaking temperatures and months of severe drought. [California](#) has experienced the most destructive wildfires in recorded history in recent years, including 2019. The change in California's climate has exacerbated the existing dry conditions and extreme winds that made the fires so destructive. Similar dry conditions fueled the worst wildfires on record in [Siberia](#) in mid-2019, where the fires were particularly difficult to fight amid limited access to areas in the northern regions of Russia.

Natural fires are part of the ecosystem cycle in the Brazilian Cerrado biome. The Cerrado biome is a tropical savanna that dominates the Great Plateau of central Brazil. Since it is a savanna-type ecosystem, natural fires occur due to lightning strikes during the wet season. Both the seasonal climate with a marked dry season and the continuous grassy herb layer that constitutes a flammable material when dried contribute to recurrent natural fires each year in the Cerrado. These natural fires, which have been part of the Cerrado cycle for millennia, have led to fire-resistant adaptations for the flora and fauna in the biome. These adaptations make native trees [resist](#) the fires, thanks to their thick corky bark, while grasses re-sprout a few days after a fire. However, the number of fires compared to 2018 were much [higher](#), making the naturally resistant adaptations difficult to handle the sharp year-on-year increases.

The combination of both natural and man-made fires has led to a high number of fire alerts detected by the NASA VIIRS system. Fires observed in the Cerrado over the last several years can also be man-made controlled fires inside farm boundaries as part of the maintenance of the farm and soil properties.

During the dry season, controlled fires may turn into wildfires outside of the farm property areas, making them large and destructive. The identification of man-made fires versus natural fires is simple to detect once the fire has been visualized (figure 6). Further analysis is required to determine how many fires in Brazil were controlled man-made fires, how many were man-made fires that escalated, and how many fires had natural causes.

Figure 6 – Example of natural fire (left) compared to man-made fires (right)



Source: Sentinel-2 processed imagery

Like deforestation, wildfires are driven by soy and beef production in Brazil, and palm oil production in Indonesia

Brazil is the largest exporter of beef and the biggest producer and exporter of soybeans in the world. Soybeans have become the most important protein crop globally. It is the key ingredient for livestock feeds and a source of edible oil feedstock for biodiesel. The beef industry is constantly looking for new grazing areas for cattle and opportunities for agricultural real estate development. This expansion, to satisfy the high international and domestic demand for beef and soy products, however, has come at the expense of vast areas in the Amazon and Cerrado in Brazil.

Brazil now produces over one-third of the world's soybean supplies. Brazil's soy [production](#) has steadily increased in recent decades. In 2018/19, Brazil produced 123 million metric tons (Mt) of soy or 37 percent of the global total, with 77 percent of that production exported. China and the EU were the main destinations, and the remaining 23 percent was processed domestically.

Brazil has one of the world's largest livestock sectors and high per capita meat consumption. Compared with its share in the global population (3 percent), the country's role is particularly important in beef consumption (14 percent of global total). Approximately 80 percent of beef produced in Brazil is [consumed](#) domestically. Brazil ended 2019 with a total of 1.8 million Mt shipped, equivalent to USD 7.5 billion, up 12.6 percent from 2018.

Indonesia, the world's [leading](#) oil palm grower, saw 1.6 million ha of land [burned](#) in 2019. The impacts of oil palm expansion on Indonesia's tropical forest and peatland are well [documented](#). Oil palm plantations also create hotter and drier [microclimates](#). In such ecological conditions, fires spread more quickly than they would normally. Oil palm plantations in Indonesia are mainly concentrated on the islands

of Sumatra and Kalimantan, which had the highest number of fires in 2019. The [El Nino Southern Oscillation](#) (ENSO) weather phenomenon exacerbated the fires, causing a hotter and longer dry period.

The expected growth in demand for biofuels worldwide has in part supported the expansion of the palm oil sector in Indonesia. Domestic demand for palm oil in Indonesia is likely to [grow](#) significantly as a result of the government's B30 program starting in 2020. This mandatory program requires biofuel products to contain at least 30 percent palm oil. Indonesia's biodiesel mandate under the B20 policy (20 percent palm oil) in 2019 [absorbed](#) more than 4 million Mt of palm oil, representing 9 percent of total palm oil [production](#) between January and October 2019. With the higher concentration of palm oil in the biodiesel mandate for year 2020 program, the number is expected to increase. However, the outlook is uncertain because of the impact of Covid-19.

Rearing livestock for meat and supplying palm oil for biofuels, the personal care sector and the global food industry have an enormous environmental footprint. High deforestation rates in Brazil and Indonesia during the first half of 2019 reflected the ever-increasing demand for soy, beef and palm oil. The land clearing during January-June paved the way for the fire season during the dry months of July-October. This cycle has taken place for several years, contributing to high deforestation rates in both countries and fire seasons that have received an increasing amount of media attention.

Political context: Weakening of existing laws in Brazil and lack of enforcement in Indonesia

In 2019, according to official government data, there were approximately 200,000 large fires (>60 m²) in Brazil, an almost 50 percent increase compared to 2018. This significant [increase](#) came after President Jair Bolsonaro took office in January 2019. Bolsonaro's [campaign](#) was backed by agricultural businesses and farmers, many of whom believed that too much of the Amazon was protected. He has expressed his intention to weaken laws protecting forests and has criticized civil servants who work to protect those forests. Bolsonaro has often shown his [disdain](#) of Ibama, Brazil's environmental enforcement agency in charge of the anti-deforestation laws and the application of fines to farmers involved in illegal deforestation.

Since Bolsonaro took office, Ibama's budget has [shrunk](#) by 25 percent. Among the cuts, funding for prevention and control of forest fires declined by 23 percent. Since the Amazon region is a vast area to monitor and the government reduced Ibama's budget, the lack of oversight led to high levels of deforestation and the increase in number of fires observed in 2019.

This situation has led to an increasingly less regulated sector. As a result, the government is mostly absent regulating illegal deforestation and fires in the Amazon and Cerrado biomes. On August 10, 2019, a day coined [dia do fogo](#) (fire day), farmers and land-grabbers planned coordinated fires to send a message to President Jair Bolsonaro to express their shared interest of expanding the agricultural frontier further into the Amazon (figure 7). The fires that burned during that day, which choked downwind communities with smoke, were a visible manifestation of the environmental problems in the Amazon region.

Figure 7. Satellite image of fires on August 10, 2019 (dia do fogo) in Floresta Nacional do Jamanxim, Para, Brazil

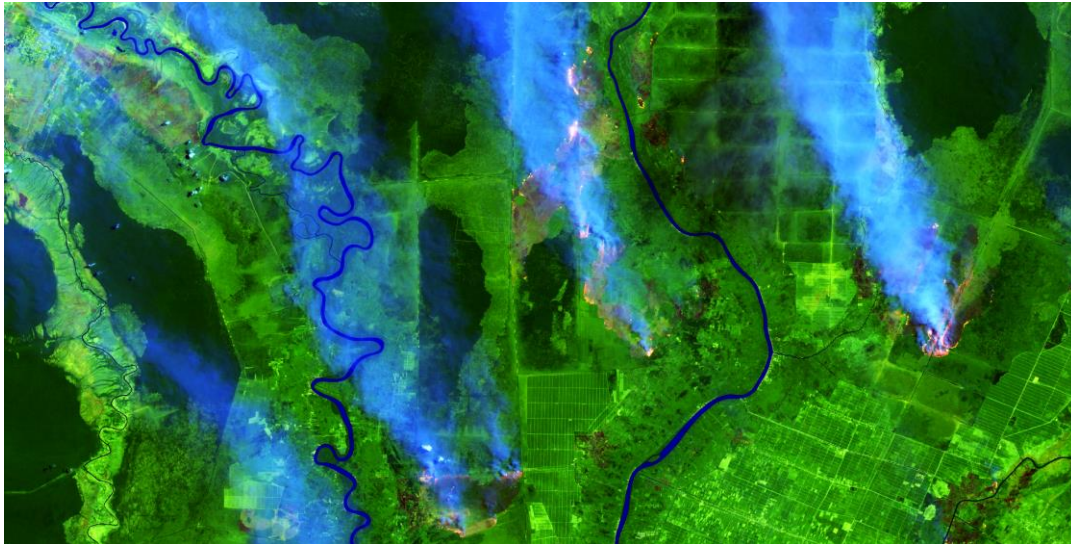


Source: Sentinel-2 imagery

The Indonesian government has primarily used moratoria as guidance without guaranteeing sanctions for non-compliance. The government first announced a moratorium on primary natural forests clearing in 2011 through Presidential Instruction Number 10/2011 and has extended it four times since then. Until 2017, each moratorium covered a two-year period. The latest one, announced in 2019, was made [permanent](#) through Presidential Instruction Number 5. Establishing a moratorium through a Presidential Instruction comes with a major drawback. In Indonesia’s legal system, a Presidential Instruction is a policy rule and has no basis in Indonesian law. Presidential Instructions provide guidance and cannot be tried throughout the court system.

Although the moratorium is [seen](#) as a way to improve forest conservation in selected provinces, local [authorities have not enforced it](#). More than 1 million ha of forests protected under the moratorium [burned](#) between 2015 to 2018. The moratorium’s focus on companies working with government rather than smallholders presents another challenge.

Figure 8 – Fire Burning in PT Rezeki Alam Semesta Raya (Pulang Pisau, Kalimantan, Indonesia, September 2019)



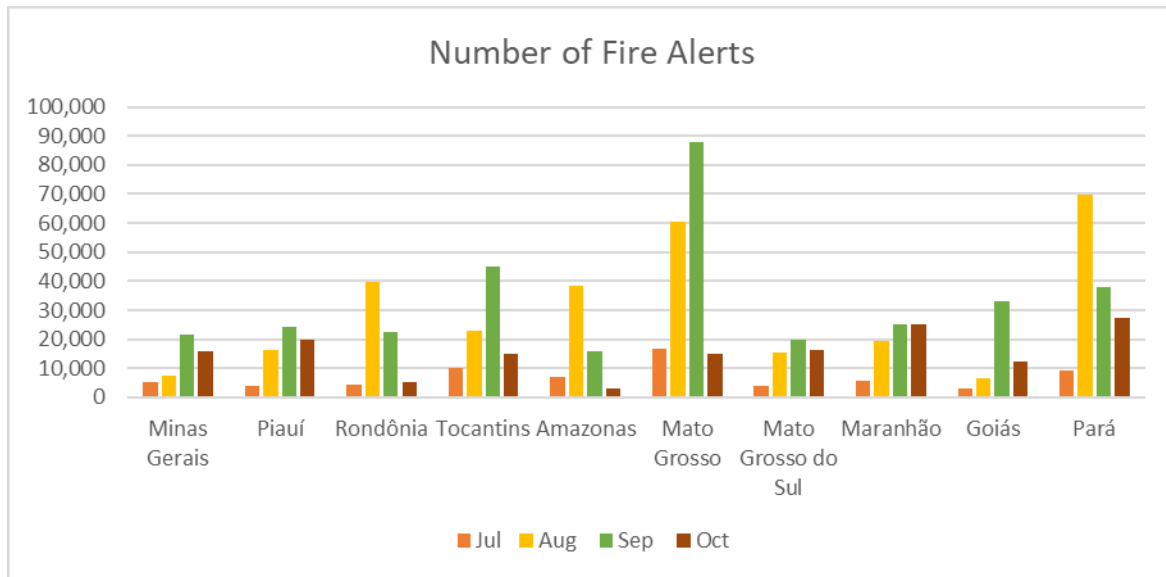
Source: Sentinel – 2 processed imagery

Large-scale farmland development contributes to fires in Brazil

Large-scale farmland development was the main driver behind the 2019 fires in Brazil. Given its geography and size, Brazil sees fires on a larger scale than Indonesia. In Brazil, real estate firms and agribusinesses have adopted a business model that aims to profit from land appreciation by acquiring land, clearing it from its native vegetation and transforming it into farmland. This large-scale farmland model has resulted in significant environmental impacts, such as the fires observed in 2019.

In Mato Grosso, a state roughly the size of Germany and France combined, farm sizes range from a couple of dozens of hectares to tens of thousands of hectares. Mato Grosso, located in the transition zone between the Amazon and the Cerrado biomes, saw the highest amount of fire alerts compared to any other state in Brazil (figure 9). Given its geographical location and its size, Mato Grosso is positioned as the leading producer of livestock and grains in Brazil. At the same time, the deforestation and fire rates there are high. Land clearing in the state [grew](#) from 144,950 ha in 2018 to 181,348 ha in 2019, an increase of 25 percent.

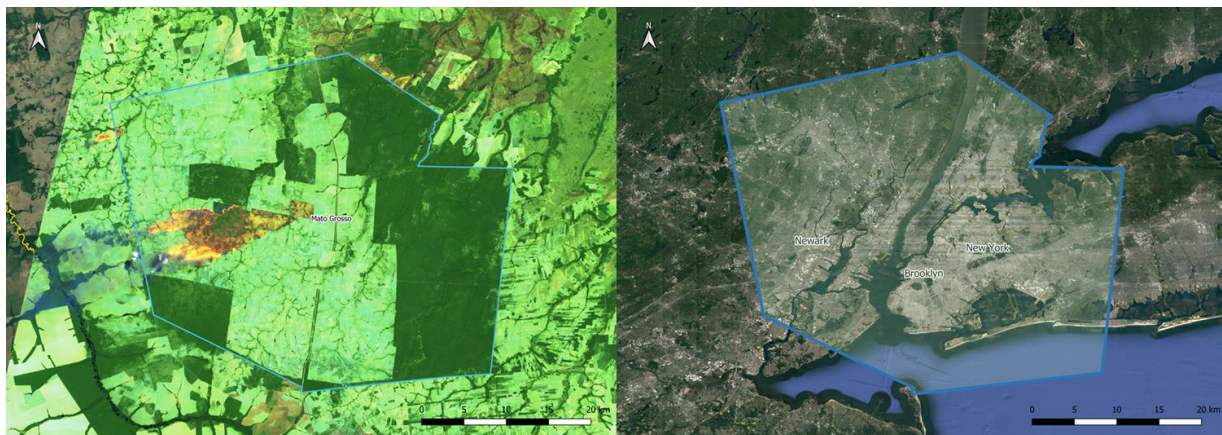
Figure 9. Top 10 Brazilian states with fire alerts during the fire season months in 2019



Source: NASA VIIRS fire alerts

Figure 10 shows the comparison between a farm east of Mato Grosso and New York City. While the farm itself is larger than New York City, the active fire on September 8, 2019 covered roughly the same area of the island of Manhattan. By the time the fire ended, it covered a total area of approximately 30,000 ha.

Figure 10. Comparison between a farm in Mato Grosso on September 8, 2019 and New York City



Source: Sentinel-2 processed imagery. The image of the left was processed to accentuate the active fires inside the farm (farm borders in blue and active fires in bright yellow).

Traders and meat companies exposed through 2019 fire season in Brazil

Fires in Bunge and Cargill vicinity areas were higher than all of the other main soy traders combined. The high numbers highlight the risks for Bunge and Cargill. From the location of each trader’s silo, CRR used a radius of 25 km as a proxy to estimate the number of fire alerts that may overlap with the supply chains of the top 10 soy traders in Brazil (figure 11). Since the level of transparency in the soy supply chain

is lower compared to the palm oil industry, this proxy estimation was used to calculate the risk of fire alerts inside the traders' vicinity areas.

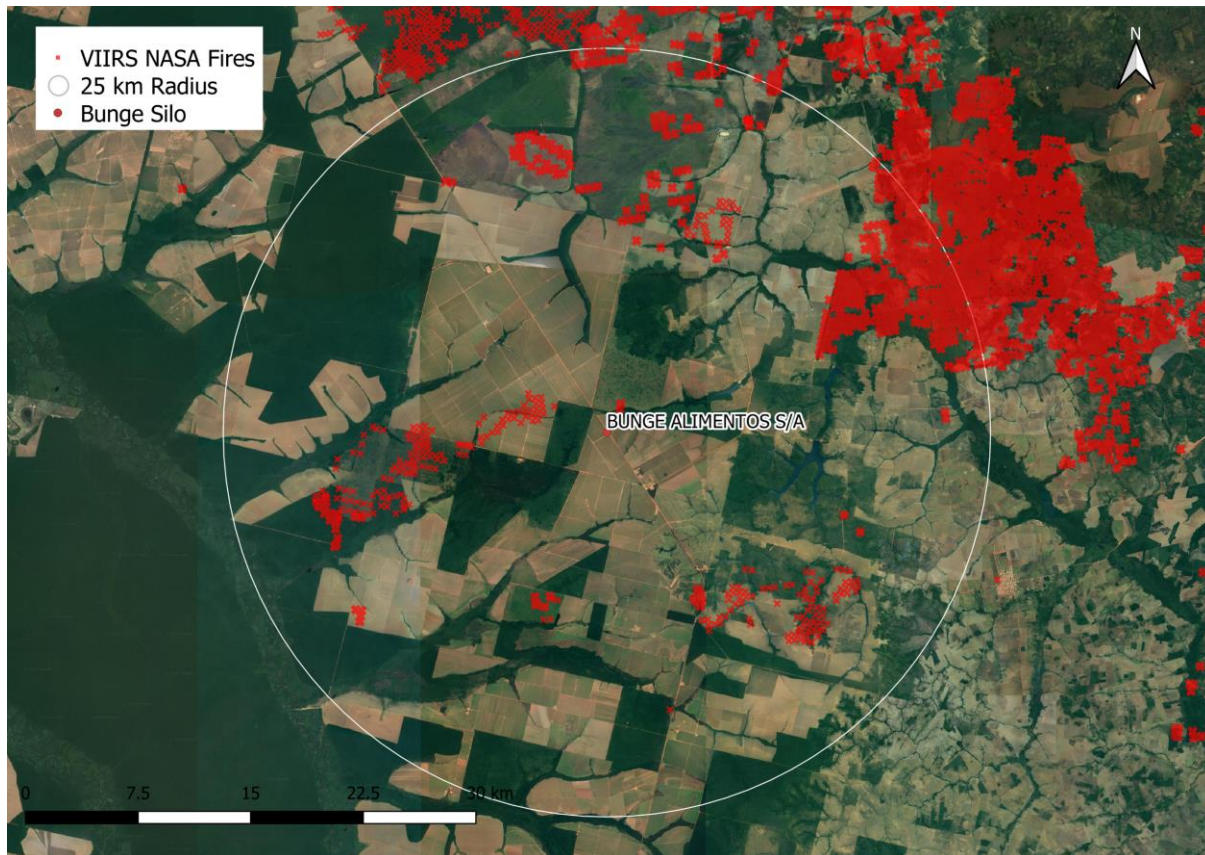
Figure 11. Top 10 soy traders with fires in vicinity of their silos, 2019

#	Trader	# Alerts Jul-Oct
1	Bunge	24,618
2	Cargill	15,304
3	ABC Industria e Comercio	9,028
4	ADM	6,707
5	LDC	4,898
6	Amaggi	4,781
7	Granol	3,890
8	Cofco	3,396
9	Multigrain	2,621
10	Glencore	353

Source: NASA VIIRS alerts overlaid in the vicinity of the top 10 soy traders sourcing areas, within a 25 km radius from the location of their silos.

The fires inside the vicinity of the traders' silos were present inside and outside planted areas. Figure 12 shows how farmers used fires to both clear land and remove excess vegetation as part of the yearly cycle of farmed areas.

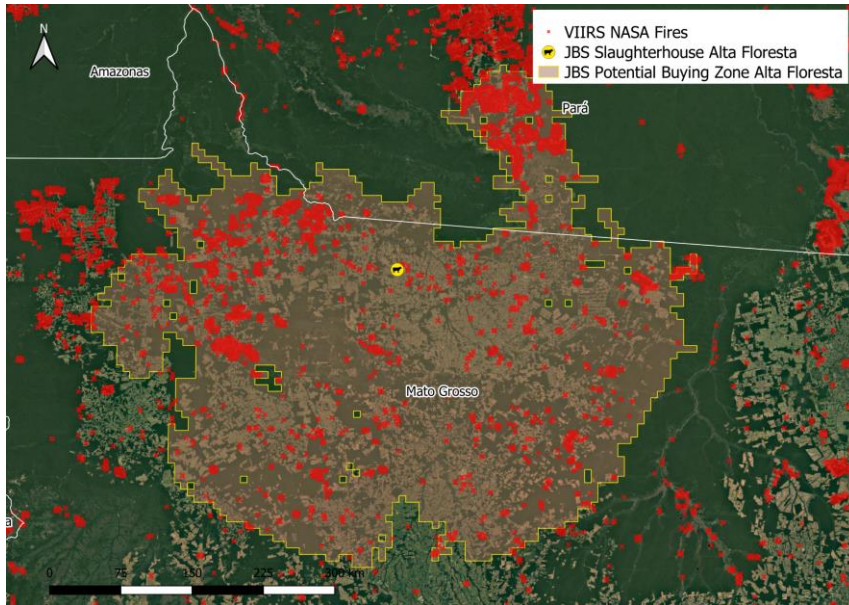
Figure 12. Example of fires in a 25-km radius around Bunge's silo in Bom Jesus do Araguaia, Mato Grosso, Brazil



Source: Google satellite imagery, NASA VIIRS data

JBS has the highest risk exposure among slaughterhouses to fires inside its potential buying zones. JBS' potential buying zone is based on metrics developed by [Imazon](#). JBS and its competitors Marfrig and Minerva account for almost 60 percent of the total fires inside the potential buying zones of the top 10 slaughterhouses. The combined 522,528 fire alerts inside the three companies' potential buying zones represent almost 50 percent of the total fires in Brazil. The majority of the slaughterhouses' potential buying zones are located in the transition area between the Amazon and the Cerrado, where most fires occurred during the 2019 fire season.

Figure 13. Fire alerts inside JBS potential buying zone in Alta Floresta Mato Grosso, Brazil, 2019.



Source: Google satellite imagery, IMAZON, NASA VIIRS fire data

Figure 14. Top 10 slaughterhouses with fires in their supply chains.

#	Company	# Alerts
1	JBS	317,096
2	Minerva	105,091
3	Marfrig Global Foods	100,341
4	Amazonboi	67,479
5	Vale Grande Industria e Comercio de Alimentos	66,663
6	Mercurio Alimentos	64,040
7	Masterboi	49,298
8	Irmaos Goncalves Comercio e Industria	46,891
9	Frigol	39,075
10	Matoboi Alimentos	29,644

Source: NASA VIIRS fire data. Note: NASA VIIRS fires were overlapped with the potential buying zones (IMAZON) of each companies' slaughterhouses.

Deforestation by smallholders leads to more fires in Indonesia

Smallholders are the main contributors to land burning in Indonesia. In Indonesia, particularly in Kalimantan and Sumatra, Indonesian and international companies own many large-scale concessions. Smallholders in Indonesia are divided into two broad categories: independent smallholders and those that are affiliated with a company, commonly referred to as plasma smallholders. The fastest growing [producing](#) group in Indonesia's palm oil sector, smallholders cover an [estimated](#) 40.8 percent of the total oil palm landscape in the country, which is expected to [grow](#) to over 60 percent by 2030.

Deforestation may present a growing risk to independent smallholders in future fire seasons. In Indonesia, smallholders are [confronted](#) with aging trees and declining yields. Financial and land tenure hurdles prevent effective financing of replanting, raising the risk of increasing deforestation and the fires that come with the land conversion process.

The Indonesian government has [banned](#) the use of fire to clear land for agricultural development, although in some areas smallholders have exemptions to use fire to clear land up to two hectares in size. Certification bodies like the Roundtable on Sustainable Palm Oil ([RSPO](#)) also ban the use of fire for development. However, for smallholders, slash-and-burn agriculture is an established tradition and typically the preferred method of land development. This preference has contributed to widespread fires in Indonesia on an almost annual basis. As suitable fertile land becomes increasingly scarce, smallholders are also seeking environmentally sensitive peat areas for [development](#). Additionally, a 'ready-to-plant' land, which normally is land that has already been slashed and burned, has higher economic value compared to cleared land not yet ready for planting. For this reason, farmers and local people sell their land in a 'ready-to-plant' condition, in which fires have already been part of the land conversion.

Palm oil companies are affected by fires in Indonesia

Almost 15,000 fire alerts took place in concessions owned by the ten companies most affected by fires in 2019. Although the number of NASA VIIRS alerts are high within the company concessions, these numbers represent a small percentage of the total number of fires in Indonesia (figure 15). The sum of the alerts for the top 10 companies represented only 4 percent of all alerts in Indonesia during the fire season (July-October), suggesting that the majority of fires in Indonesia occurred in small-scale holdings and not within company concessions.

Figure 15. Top 10 palm oil companies with fires in their concessions in Indonesia in 2019

#	Group	# Alerts
1	Oetomo Family	2,577
2	Tunas Baru Lampung Tbk	2,366
3	First Resources Ltd	1,933
4	Eagle High Plantations Tbk	1,412

#	Group	# Alerts
5	Indofood Agri Resources Ltd	1,077
6	NPC Resources Berhad	1,018
7	Gagah Putra Satria	978
8	Bumitama Agri Ltd	936
9	Golden Agri-Resources Ltd	926
10	Matahari Kahuripan Indonesia (Makin Group)	916

Source: NASA VIIRS fire data overlaid with company concession data

To comply with Indonesian legislation and policies of NDPE buyers, growers selling to NDPE markets will typically have fire prevention policies in place. Some of these companies have, however, highlighted that fires were started by smallholders or local individuals operating independently. Bumitama Agri Ltd [claims](#) on its website that fires detected on its concessions in West Kalimantan started because of rice farmers operating on farmland within its concession boundaries or illegal loggers entering the concession area. Other palm oil producers have claimed that fires started outside their concessions and likely spread onto their concessions by strong winds. Although such claims would need to be independently verified, they indicate the complexity of identifying the causes of fires. They also highlight some companies' attempts to publicly distance themselves from fire activity and the challenge of controlling smallholder fires in areas where oil palm plantation development has likely impacted local climatic conditions.

Fire-linked growers supply several trader/refiners with NDPE policies. Figure 16 identifies the ten trader/refiners with NDPE policies and the most exposure to suppliers with NASA VIIRS fires inside their concession areas. These trader/refiners all have NDPE policies that prohibit the use of fire and are also RSPO members. These traders may face increased pressure to ensure that their suppliers are investigating the source of fires, implementing suitable mitigation and recovery measures and not using the area burned for oil palm planting.

Figure 16. Top 10 palm oil trader/refiners with fires in their supply chains in Indonesia in 2019

#	Trader	# Alerts
1	ADM	28,258
2	Unilever	28,087
3	KLK	26,156
4	Neste Oil	24,864
5	Cargill	22,916
6	Bunge Loders Croklaan	22,359
7	Fuji Oil	21,203
8	Wilmar	19,709
9	Olam	19,459
10	AAK	18,126

Source: NASA VIIRS fire data overlaid with concession data

Investors face increased risks from deforestation and fires linked to agricultural expansion

Deforestation, often linked to fires, have undermined the reputation of the cattle and soy sectors. The 2019 fires were repeatedly in the global news and prompted international companies to reassess their business with cattle and soy sector in Brazil. Nestlé [stopped](#) sourcing Brazilian soy from Cargill in 2019 because of Cargill’s inability to trace soy from its suppliers and changes in Cargill’s policy regarding deforestation in [Brazil](#). VF Corp announced at the end of August 2019 that it would stop sourcing leather from [Brazil](#), highlighting the concerns over the environmental impact of the cattle industry. Fashion retailer H&M announced as well in September 2019 that it would stop purchasing leather from [Brazil](#) over concerns that the country’s cattle industry has contributed to deforestation in the Amazon biome.

As environmental issues remain largely unaddressed, some governments are considering restrictions on forest-risk commodities. Growing concerns over the environment and climate change, along with international accords like the Paris Agreement, have led to tighter restrictions on agricultural commodities such as beef and soy. In 2019, Members of the European Parliament [called](#) on the EU to block beef that may be linked to deforestation in Brazil. As concerns over deforestation and fires grow, producing companies may face market access risks to important areas such as the EU.

The EU-Mercosur trade agreement provides a recent example of how the backlash driven by high deforestation rates and fires in Brazil could derail such international agreements. The agreement already includes a chapter on [sustainability](#), requiring parties to implement the Paris Agreement. If

deforestation rates and fire events continue based on current trends, market access for soy and particularly beef traders may diminish.

Soy-producing companies face market access risks and financing risks from deforestation, while European financiers face reputational risks. Farmers are often financed by local Brazilian banks, local affiliates of international banks and barter agreements with soy traders. Large farmers are also financed by international banks and shareholders. Several financiers, notably those based in Europe, could face reputation risk from deforestation-driven fires.

Soy and beef traders could face market access risk from lagging zero-deforestation policies, as well as financing risk. Stranded asset risk is limited. As all large traders are lagging in policies, their customers (animal feed companies, FMCGs) have difficulty in avoiding traders with insufficient deforestation policies. As all traders are highly dependent on bank loans and other financial services, often from European banks with zero-deforestation policies, banks may use their increased leverage to engage.

Downstream/FMCG companies, including food retailers, restaurant chains, food companies and home & personal care companies, are most exposed to reputation risk. This risk could lead to a material impact on a company's market capitalization. On average, financing risk is more limited in size. As most consumer-facing companies are members of the Consumer Goods Forum, they may face conflicts with zero-deforestation commitments from 2020 onward. These downstream players are financed by a wide range of shareholders and bondholders as well as banks, which all could start to engage. European financiers may be first to engage as a large number have zero-deforestation policies.

Disclaimer:

This report and the information therein is derived from selected public sources. Chain Reaction Research is an unincorporated project of Climate Advisers, Profundo, and Aidenvironment (individually and together, the "Sponsors"). The Sponsors believe the information in this report comes from reliable sources, but they do not guarantee the accuracy or completeness of this information, which is subject to change without notice, and nothing in this document shall be construed as such a guarantee. The statements reflect the current judgment of the authors of the relevant articles or features, and do not necessarily reflect the opinion of the Sponsors. The Sponsors disclaim any liability, joint or severable, arising from use of this document and its contents. Nothing herein shall constitute or be construed as an offering of financial instruments or as investment advice or recommendations by the Sponsors of an investment or other strategy (e.g., whether or not to "buy", "sell", or "hold" an investment). Employees of the Sponsors may hold positions in the companies, projects or investments covered by this report. No aspect of this report is based on the consideration of an investor or potential investor's individual circumstances. You should determine on your own whether you agree with the content of this document and any information or data provided by the Sponsors.