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Fires in Mexico as Exceptional Events: Documentation and Implications

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1. Executive Summary

Southeast Texas occasionally observes elevated fine particulate matter ($PM_{2.5}$) concentrations due to smoke from fires in Mexico and elsewhere in Central America. Measured daily $PM_{2.5}$ concentrations that result from Exceptional Events can be excluded when considering attainment/nonattainment of the NAAQS. As stated in Section 319(b)(1)(A) of the Clean Air Act:

> "The term 'exceptional event' means an event that –
>
> 1. affects air quality;
> 2. is not reasonably controllable or preventable;
> 3. is an event caused by human activity that is unlikely to recur at a particular location or a natural event; and
> 4. is determined by the administrator through a process established in the regulations promulgated under paragraph (2) to be an exceptional event."

The most common $PM_{2.5}$ Exceptional Events are due to windblown dust and wildfires. This document provides evidence that the vast majority of the fires in Mexico and even more of the smoke from the fires are not caused by agricultural burning, that they do not recur at the same location, and that they therefore satisfy the third prong of the statutory test and can be considered as Exceptional Events. This evidence includes statistics on the source of fires from the Mexican government and other sources. Chapter 2 reviews the data from these sources. Chapter 3 demonstrates that the source of fires in Mexico—especially on the Yucatan peninsula—are mostly not caused by agricultural activity and that are unlikely to reoccur at a particular location.

The Mexican Government has collected detailed statistics and information about the incidences and area burned by fires since the 1970s. This information—publicly available—has been used by several Mexican agencies to guide policies for fire management, fire mitigation and to establish programs to reduce fire incidences.

Among the data provided by the Mexican Government are the activities reported to be likely causes of fires. These statistics are reported every year and indicate that 98% of the fires are due to anthropogenic activities with only 2% due to natural causes. Since 2020, agricultural and livestock activities accounted for only about 30% of the fires each year in Mexico. Agricultural fires include farmers conducting slash and burn of their fields or clearing new land for agricultural or livestock use. The former may or may not recur and the latter does not recur at a location. This means that the great majority of the fires experienced every year in Mexico are caused by human activity that does not recur at the same location.

Furthermore, several programs have been established since 2020 with the intent to educate farmers to modify practices and decrease the number of fires started by agricultural and livestock activities. These programs appear to be successful at reducing the number of fires due to agricultural practices in more recent years (e.g., 2021-2024). Accordingly, the minority of historic fires that might be expected to recur at a location has been reduced over time and can be expected to continue to decline.

In Mexico, a substantial proportion of the observed fires are forest fires or burns performed to clear land for development. These are not expected to recur at a particular location, as once the forest is burned at a specific location the biomass is consumed and not available for additional fires in the following years. Global Forest Watch is a website that documents deforestation due to forest fires across the globe and shows that areas in Mexico with tree loss due to forest fires occur in the east coast states adjacent to the Gulf of Mexico (e.g., Yucatán, Veracruz, and Tabasco) having some of the highest rate of loss due to forest fires.

Fires in Mexico have a seasonality that follows a known climatology with a dry season typically in the period of January to May that affects Mexico and Central America. The dry season favors the conditions for the start of fires and makes it is more likely for them to get out of control. However, as the data presented in this document shows, less than a third of these fires are caused by agricultural activities and most fires in Mexico are of uncontrollable anthropogenic origin. Given that agricultural fires tend to be small and controlled, they will produce much less smoke than other types of fires. Thus, most of the fires and even more of the smoke from fire in Mexico during this dry season should be considered non-recurring.

2. Mexican Government Data on Fires in Mexico

Fire plays a significant role in the dynamics of several ecosystems. Fires can be part of a natural process that contributes to the health of ecosystems, but when out of control they can cause severe damage in a brief time. Mexico often experiences fires due to a combination of natural and human factors. Over the last decade, changes to precipitation intensity, increased temperatures, and other factors due to climate change have affected the frequency and extent of fires in Mexico.

The Mexican institution in charge of the development of policies and practices that preserve Mexico's forests in a sustainable manner is the Comisión Nacional Forestal (CONAFOR) and was created by executive order on April 4, 2001[1]. One of CONAFOR's responsibilities is the development and maintenance of a database of fire statistics to establish fire management practices and to facilitate collaboration among other Mexican agencies on this issue. Figure 1 — taken from CONAFOR's fire management main page[2]—shows the incidence of forest fires in Mexico from 1970 to 2023. The information in orange shows the total number of fires, while the green indicates the total area burned in hectares (ha[3]). The time series at the bottom right shows that the area burned remains approximately constant from 1970 to 2015 at around 190,000 ha per year, with three major exceptions in 1988-1989 (500,000 ha), 1998 (849, 632 ha) and 2011 (956,405 ha). Since 2015 there has been a substantial increase in burned area with 2023 having a historic maximum of 1,047,493 ha. At the same time, the number of fires since 2015 has not increased and has fluctuated between 6,000 and 9,000 fires per year. This seems to imply that recent fires are now more intense and capable to burn larger areas indicating fires that are not controlled, possibly influenced by climate change leading to persistent drought conditions in Mexico.

Fires in Mexico are not only confined to states along the Gulf Coast and can occur over the entire country including in Central Mexico. State of Mexico, Jalisco, Michoacan, Chihuahua and Mexico City are the top five entities with the most fire incidences from 2021 to 2023[4]. Under the right meteorological conditions, the smoke from these fires along with those on the Yucatan Peninsula and Gulf of Mexico coastal areas (e.g., Veracruz) can be transported north and affect the air quality in the U.S., especially those located in the southern U.S. along the Gulf of Mexico like southeast Texas.

[1] Comisión Nacional Forestal (CONAFOR). Mission Statement. Accessed August 2024 at: https://www.gob.mx/conafor/que-hacemos

[2] Comisión Nacional Forestal (CONAFOR). Fire Management Statistics and Maps. Accessed August 2024 at: https://snif.cnf.gob.mx/incendios/

[3] A hectare is 100 m x 100 m and is approximately 2.5 acres.

[4] Comisión Nacional Forestal (CONAFOR). Fire Management Program CONAFOR Annual Summaries from 2019 to 2023 and partial 2024.Accessed August 2024 at: https://www.gob.mx/conafor/documentos/reporte-semanal-de-incendios

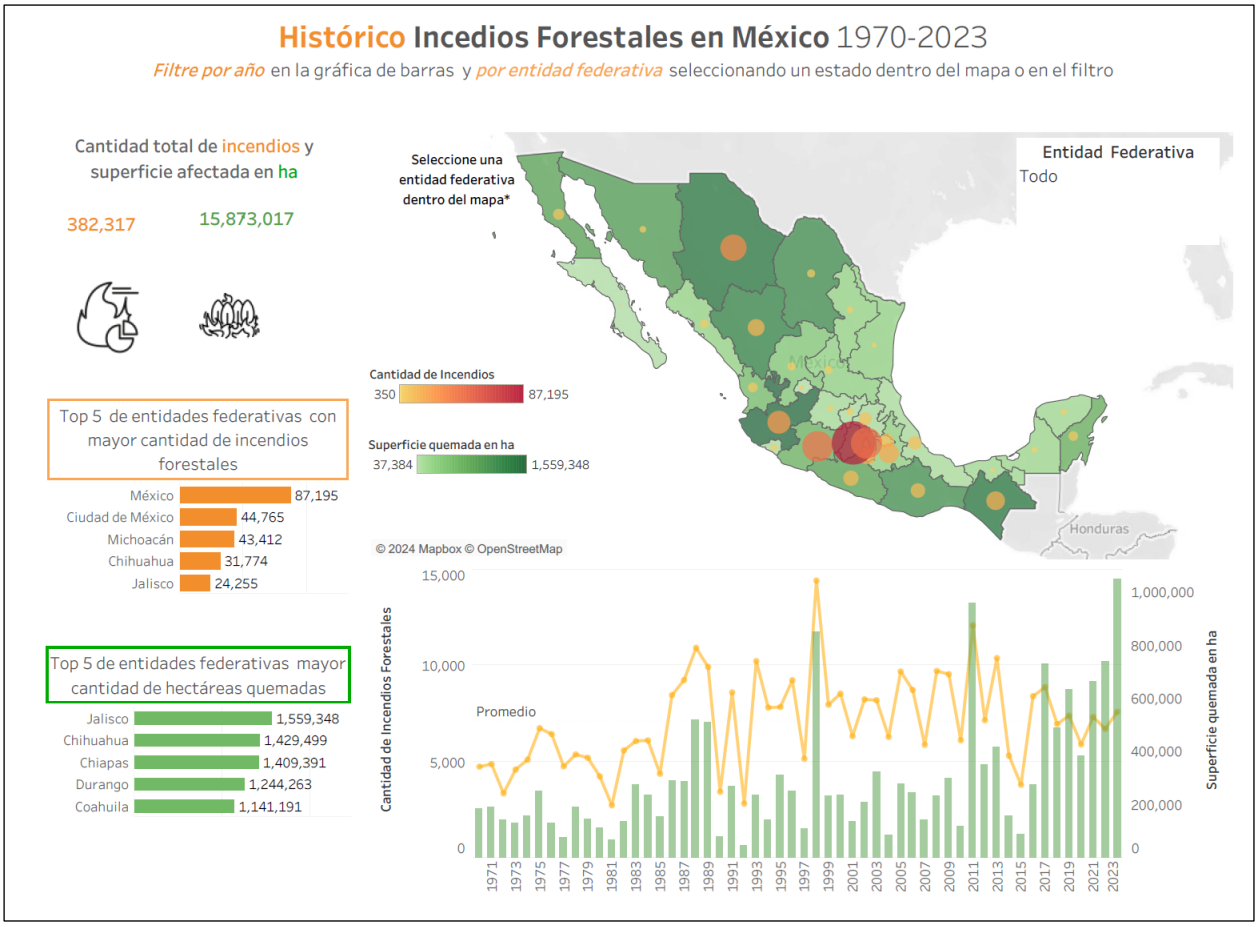

Figure 1. Incidence of Forest Fires in Mexico from 1970 to 2023[2]. In the time series at the bottom of the figure orange indicates number of fires, green shows area burned in hectares.

There are two main fire seasons identified in Mexico: the first from January to June occurs in central, north, northeast, south and southeast Mexico; the second, from May to September, in the northwest[5]. Both occur when the country experiences the dry or drought season. This is shown in Figure 2 that presents a heat map of the average fire incidences per month with data from 2015 to 2023 for all the Mexican States. Higher incidences are colored in red and orange shades. During the climatological dry season, high temperatures and low precipitation increase the probability to experience severe fires due to a combination of natural and human factors.

[5] Secretaria de Medio Ambiente y Recursos Naturales (SEMARNAT). Fire Seasons in Mexico. Accessed August 2024 at: https://www.gob.mx/semarnat/es/articulos/temporadas-de-incendios-forestales-en-mexico?idiom=es#:~:text=En%20M%C3%A9xico%20se%20tienen%20identificadas,sequ%C3%ADa)%20en%20el%20territorio%20nacional.

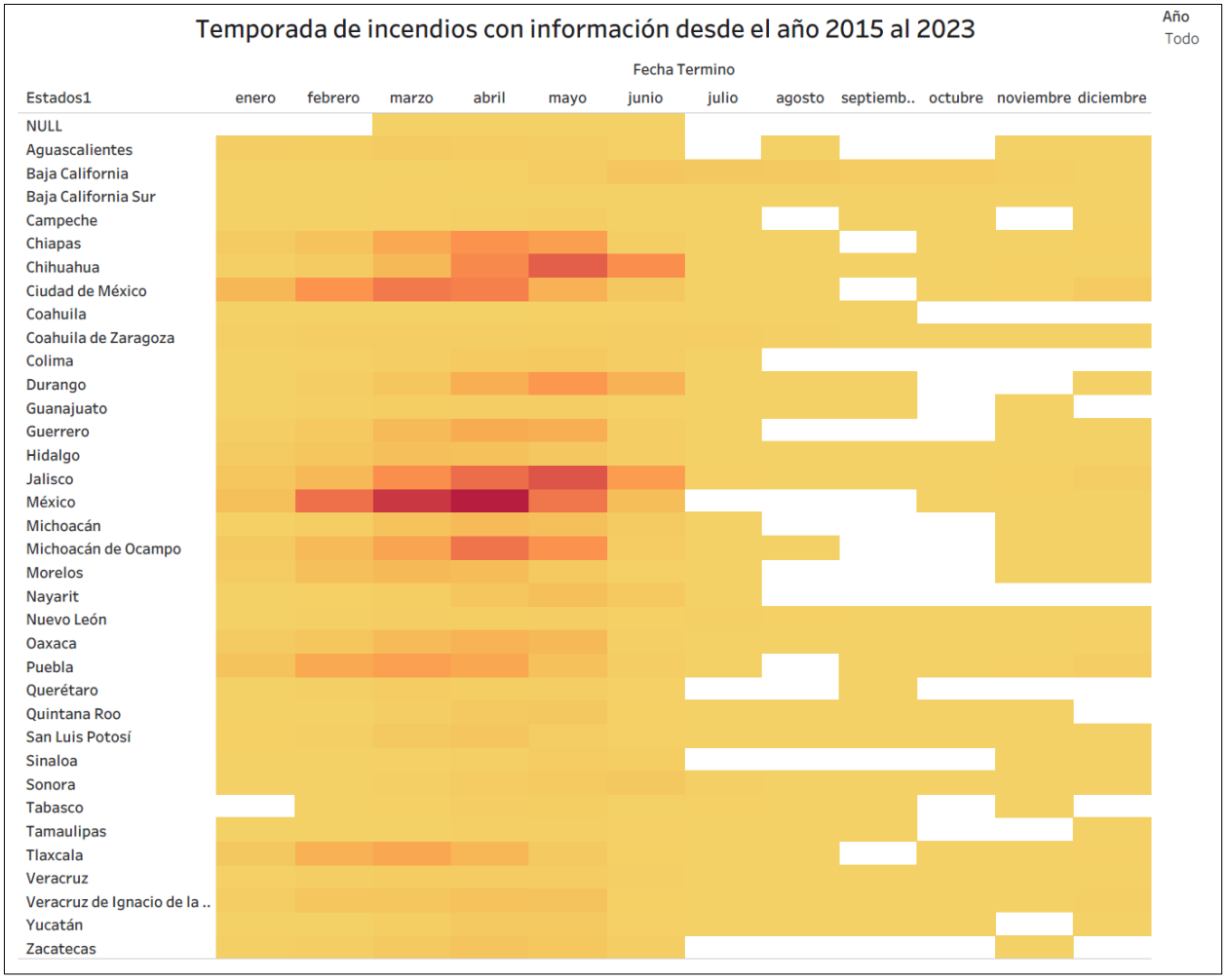

Figure 2. Heat map with the monthly average fire incidence from 2015 to 2023 for each state in Mexico. Red and orange color indicate higher number of fires.

According to CONAFOR, most fires in Mexico are started by human activity. During 1998-2019 anthropogenic causes were responsible for 98% of the fires with only 2% due to natural causes. Figure 3 shows the probable causes of fires in Mexico from 2019 to 2023 and partial data for 2024 (Jan to Aug). These are the main factors in the figure that contribute to occurrence of fires:

- Unknown: Includes accidental ignitions and fires started with no specific or unknown causes.
- Intentional: Includes efforts to clear land for development or other land use changes, vandalism and fires started by disputes over land.
- Agricultural: Includes fires started by traditional slash-and-burn farming methods (roza y quema). Farmers clear small plots of land by cutting down vegetation and burning it to prepare for the planting of crops. Sometimes these fires can get out of control and spread to larger areas. Note that he agricultural

fires used to clear land do not recur at the same location as it only needs to occur once.

- Livestock: Similar to agricultural fires, but the land is cleared to support livestock activities. The livestock fires may also not recur at the same location.
- Other Anthropogenic Causes: Includes fires caused by improper disposal of cigarette butts, campfires left unattended, or burning debris during windy conditions that can spread flames to unintended areas. It also includes fires started by hunters, fireworks at festivities, clearing land for other economic reasons or to open and clean roads from debris. It also includes prescribed fires.
- Natural: Includes fires started mostly by lightning during storms, but also volcanic activity in central Mexico (Popocatépetl, Volcán de Colima).

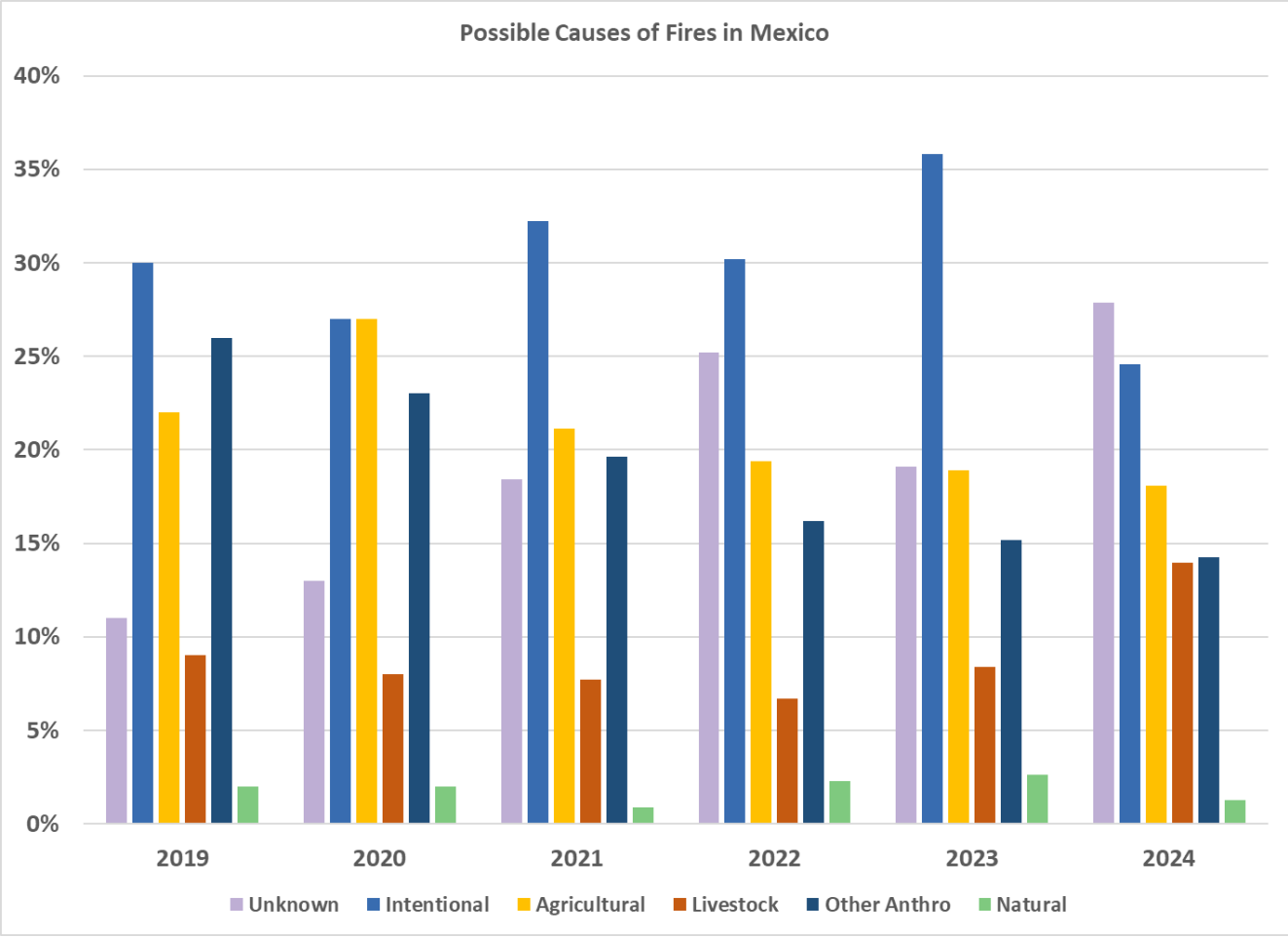

Figure 3. Possible causes of fires in Mexico from 2019 to 2024. Partial data for 2024 (January to August).

Figure 3 shows that agricultural fires are 18-21% of the fires in most recent years (2021-2024). Given that agricultural burning tends to be small fires that are under control, the amount of smoke produced by them is much less than most other types of fires (e.g., forest fires) so the contribution of smoke from agricultural fires would be much less than 20%. Fires to clear land for use by livestock may be recurring or non-recurring, although in the past EPA has classified burns for livestock as prescribed fires and approved them as Exceptional Events.[6] However, both agricultural and livestock activities account for approximately 30% of the fires each year in Mexico and would be much less than 30% of the smoke produced by fires in Mexico as they are much smaller and burn less biomass than most other types of fires. This means that over 70% of the fires and well over 70% of the smoke produced by fires in Mexico every year are caused by human activity but they are not "reasonably controllable or preventable" and are "unlikely to recur at a particular location." The combination of these factors contributes to the risk and occurrence of fires in Mexico sometimes resulting in significant environmental and economic impacts. Efforts to address these fires often involve improving agricultural practices, promoting sustainable land management, and enhancing fire prevention and suppression capabilities.

Forest fires caused by unintended agricultural burning put the lives of producers at risk, damage ecosystems and degrade soils, which translates into erosion and lower crop yields. According to the UN[7], many farmers consider agricultural burning to be the most efficient and cost-effective way to clear, fertilize and prepare land for new planting. The problem is that these burnings often get out of hand leading to wildfires and are the largest source of black carbon in the world, a threat to both human and environmental health. The Mexican Government has set goals with the intent to reduce the recurring burning of agricultural land by 40 percent by 2024[8]. The Secretaría de Agricultura y Desarrollo Rural (SADER) is the Mexican Ministry of Agriculture and Rural Development and launched the program "Mi Parcela no se quema" (my plot does not burn) in 2020[9] to promote the use of sustainable alternatives that reduce agricultural burning, such as waste management practices. This program involves other federal agencies like CONAFOR and state and local governments. The program organizes workshops for farmers with information to improve farming practices like reducing and composting organic matter into farmland without the need of burning. The number of workshops was initially small with only five provided in the entire country in 2020 but has increased substantially since to 493 workshops in 2023[10]. As a direct result of these efforts the program has reduced the areas that used to be subjected to agricultural fires by 47,200 ha between 2021 and 2023[10]. Figure 3 indicates the success of these

[6] https://www.kdhe.ks.gov/DocumentCenter/View/2209/Environmental-Protection-Agency-Region-7-Exceptional-Event-Flag-Concurrence-Letter-PDF

[7] https://www.unep.org/es/noticias-y-reportajes/reportajes/el-impacto-de-las-quemas-agricolas-un-problema-de-calidad-del-aire

[8] Mexico Business. SADER to Reduce Recurring Burning of Agricultural Land. Accessed August 2024 at: https://mexicobusiness.news/agribusiness/news/sader-reduce-recurring-burning-agricultural-land

[9] Secretaria de Agricultura y Desarrollo Rural (SADER). Mi Parcela No Se Quema. Accessed August 2024 at: https://www.gob.mx/agricultura/acciones-y-programas/miparcelanosequema

[10] Statistics on the implementation of the Mi Parcela No se Quema program. Accessed August 2024 at: https://www.datos.gob.mx/busca/dataset/campana-mi-parcela-no-se-quema/resource/9b505ab0-b6bf-444f-bd73-33779f99a010

programs as the percentage of fires caused by agricultural activities alone has been decreasing since 2020 (the program's inception) to 2024.

Conclusions of Mexico Government Statistics on Fires: In sum, according to the Mexican government historically a vast majority (> 70%) of the fires in Mexico are not burns for agriculture or livestock and with the emphasis in reducing agricultural burns in more recent (2020+) years the amount of agriculture burning is being reduced. Furthermore, most other types of fires (e.g., forest fires) produce more smoke per fire as they burn larger areas and consume more biomass than agricultural fires. Thus, smoke from fires in Mexico are primarily non-recurring and are clearly not reasonably controllable by U.S. agencies so satisfy the criteria of being classified as Exceptional Events.

3. Additional Evidence Most Fires in Mexico are not Recurring Agricultural Fires

Below we provide supporting information that most of the fires in Mexico are not agricultural burning so are not recurring.

Global Forest Watch Indicates Frequent Forest Fires on The Yucatan Peninsula and Eastern Mexico

Forest fires in Mexico are mainly caused by human activities either on purpose (e.g., to clear land for development) or by accident. In either event, such forest fires will not recur as once the forest is burned at a specific location the biomass is consumed. Global Forest Watch[11] is a website that documents deforestation due to forest fires across the globe, including Mexico. Figure 4 from the Global Forest Watch website shows areas in Mexico with tree loss due to forest fires in pink with the east coast states adjacent to the Gulf of Mexico (e.g., Yucatán, Veracruz, and Tabasco) having some of the highest rate of tree loss due to forest fires. Figures 5 and 6 show an average yearly tree loss of approximately 17,000 ha (~42,000 acres) in the states of Veracruz and 14,000 ha (~35,000 acres) in Yucatán respectively.

Conclusions from Global Watch Deforestation: Large amounts of deforestation by prescribed burns and wildfires occur on the Yucatan Peninsula and southeast coastal states in Mexico that do no reoccur so satisfy the requirements for being an Exceptional Event.

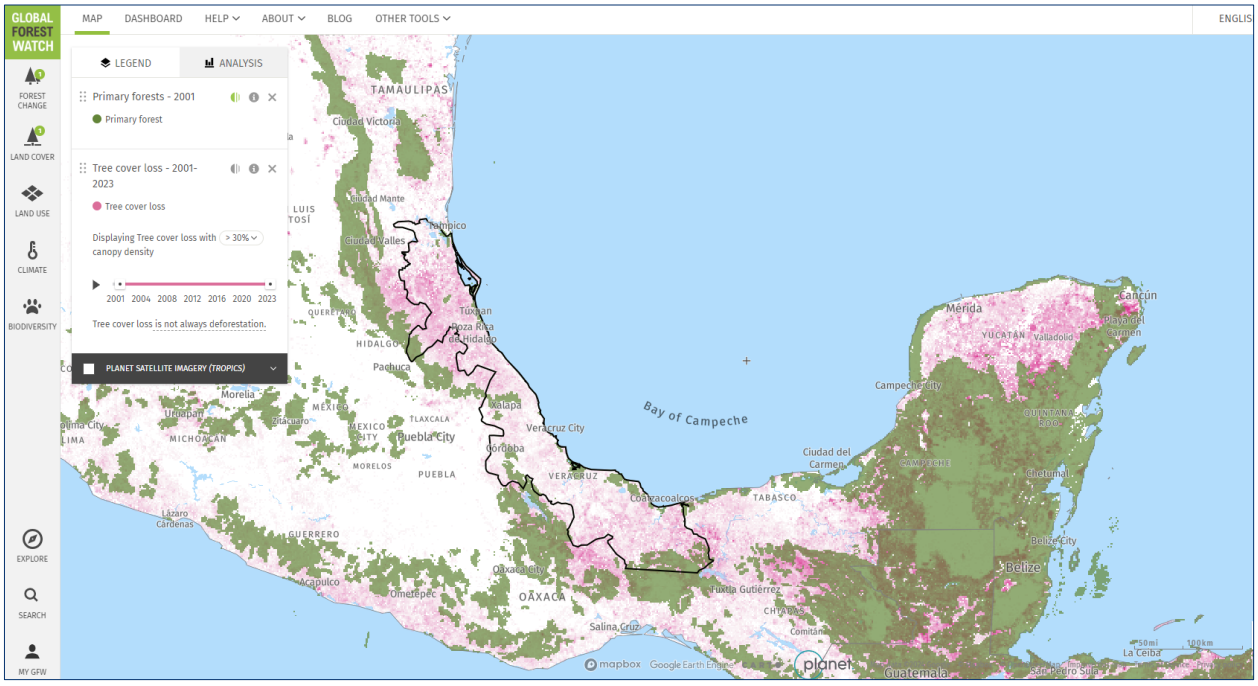

Figure 4. Locations of tree cover loss in southeastern Mexico (pink areas) that is primarily caused by Forest Fires.

[11] https://www.globalforestwatch.org/

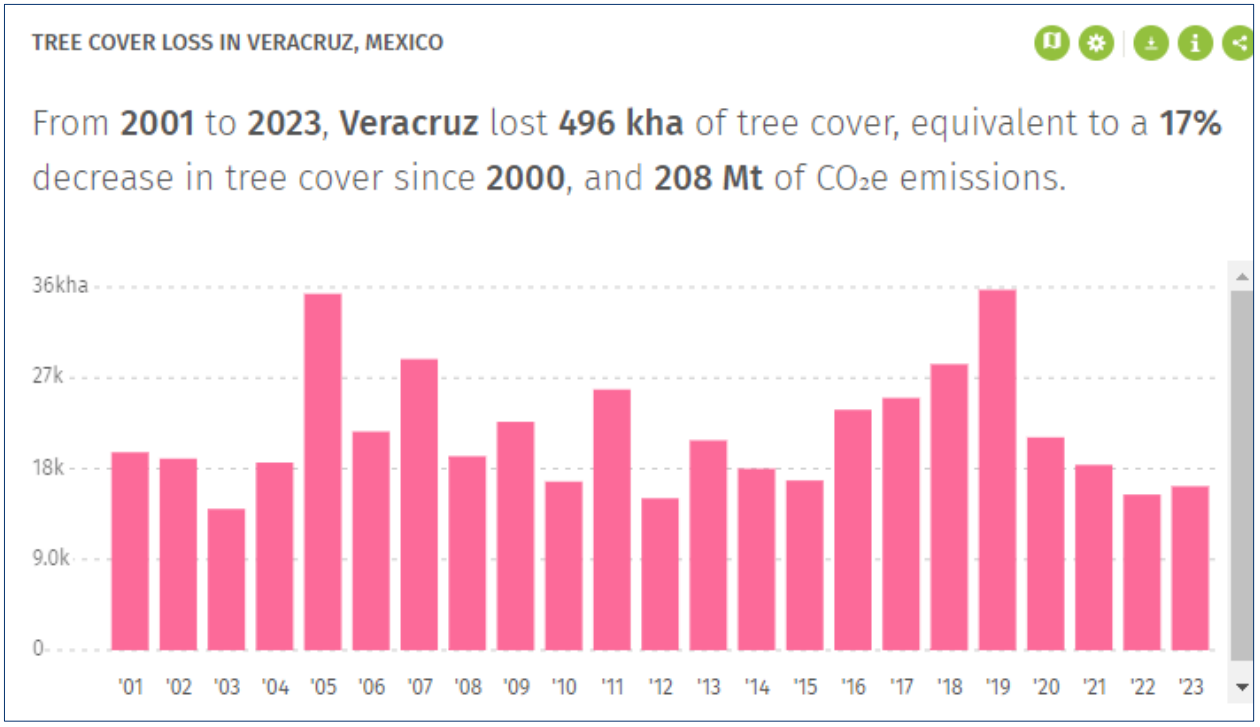

Figure 5. 2001-2023 annual tree cover loss in the state of Veracruz, Mexico.

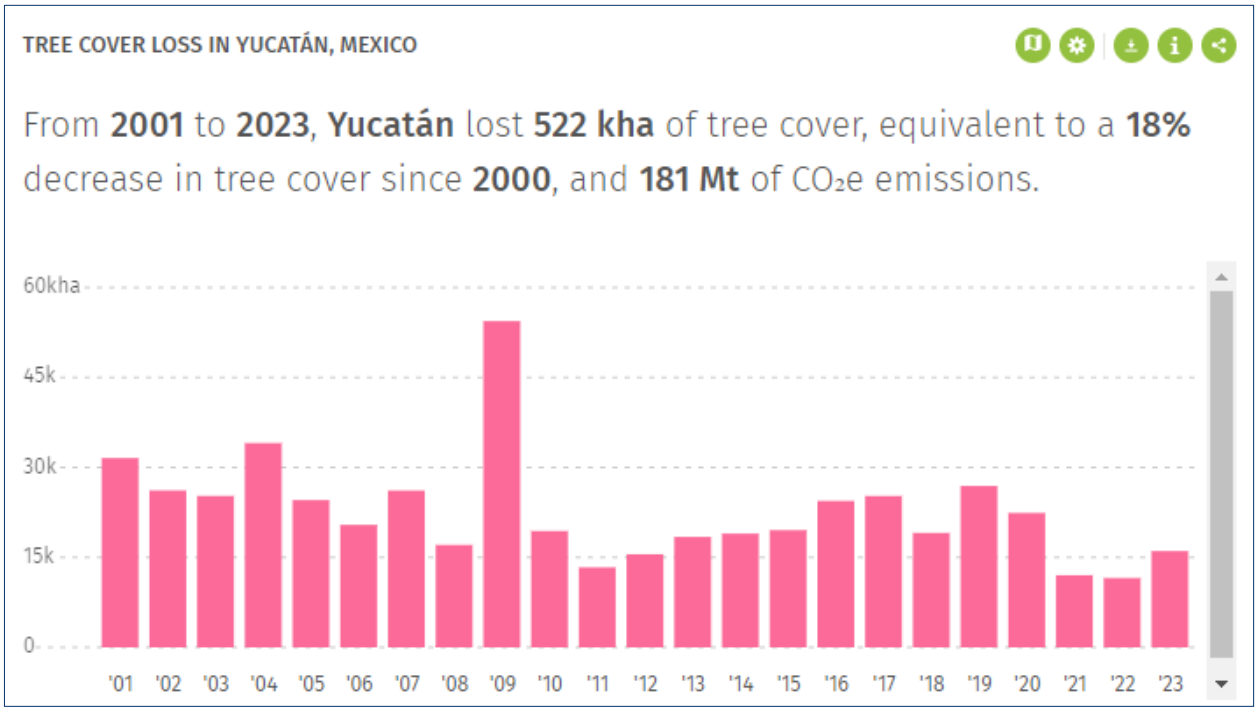

Figure 6. 2001-2023 annual tree cover loss in the state of Yucatán, Mexico.

Example Articles on the Causes of Fires on the Yucatan Peninsula

Numerous articles document fires in Mexico that are not controlled agricultural burning and are not recurring. Examples include:

- A March 29, 2024, article in Yucatan Magazine entitled Fires Rage Out of Control In And Around Merida[12] notes the extreme heat of early 2024 has caused many more fires than usual such as:
    - Fires starting from glass bottles on the side of the road that act as magnifying glasses when hit by the sun.
    - Fires at several warehouses along Meridas Periferico attributed to faulty wiring.
    - Fires started by fireworks at a wedding.
    - Agricultural fires that get out of control due to winds carrying sparks into nearby dry areas.
- A May 16, 2024 article in the Yucatan Times reported that a forest fire consumed 250 hectares of jungle in Cancún.[13]
- A July 2022 article about Modernización Sustentable de la Agricultura Tradicional (MasAgro) program, states that MasAgro has implemented practices that had reduced the area subjected to slash and burn in Mexico by 200,000 ha. The article states how agricultural fire is not a sustainable practice and lists several alternatives that have reduced agricultural burning in Mexico in more recent years.[14]

Conclusions From Articles on Fires in Mexico: Numerous publicly available articles reference fires in Mexico, and in particular on the Yucatan Peninsula, that are wildfires that are not recuring at the same location.

[12] https://yucatanmagazine.com/fires-rage-out-of-control-in-and-around-merida/

[13] https://www.theyucatantimes.com/2024/05/forest-fire-consumes-250-hectares-of-jungle-in-cancun/

[14] https://www.gob.mx/agricultura/articulos/el-fuego-ya-no-es-una-alternativa