Wildfires in Latin America

A preliminary analysis, messages and resources for RC/UNCT

Issued-based Coalition–Climate Change and Resilience
Latin America and the Caribbean
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REGIONAL COLLABORATIVE PLATFORM
LATIN AMERICA AND THE CARIBBEAN

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Introduction

In 2020, similarly to other regions globally, Latin America has experienced a wildfire season marked by major wildfires in particularly important natural areas such as the Amazon, the Pantanal and El Chaco. Uncontrolled forest and rural fires have significant impacts on the societies, the economies, and the environment of Latin America and the Caribbean. Inadequate resources and lack of financial and technical capacities limit the possible measures to reduce fire impacts, fire suppression and post-event humanitarian aid to affected populations. The adoption of standardized internationally agreed methodologies to record and analyse historical wildfires and their impacts on environment and society could be instrumental to develop robust statistics and, in turn, to inform policy and decision-making in order to prevent wildfires and reduce their impact.

The 2019 Intergovernmental Science-Policy Platform on Biodiversity and Ecosystems (IPBES) report[1] describes the emerging situation in terms of the stress that global warming is producing on vegetation and the increasing levels of fire propagation and fire risk occurrence. Many species are threatened by global temperature rising with direct impacts on key ecosystem functioning, including extended water stress periods. Some areas in the Latin American region show a high seasonal susceptibility to wildfires, including biotas that suffer recurrent annual wildfires of significant sizes and impacts[2]. In the last 50 years alone, 17 % of the Amazon rainforest was lost irrevocably (WWF 2017). While wildfires are part of the functioning of some ecosystems, socioeconomic drivers as well as climate change are contributing to making them more frequent, larger, and more widespread where fire is part of ecosystem functioning. The increase of forest fires has a dual impact on biodiversity[3] and climate[4]. In addition, it is worth noting the increasing recognition of the impact of wildfires on health, agriculture, critical infrastructure, human settlements and the economy.

According to the Intergovernmental Panel on Climate Change (IPCC), climate change increases the likelihood of extreme weather-related events, including wildfires induced by extreme temperatures and anomalously dry conditions. Based on the IPCC, we are moving towards an increasing frequency of wildfires in a variety of vegetation types. When driven by deforestation and degradation processes, fires also have a double impact in the concentration of greenhouse gas (GHG) emissions in the atmosphere as they both increase it and decrease the ability of natural systems to capture carbon.

In a context in which risk is increasingly systemic and its cascading effects can have devastating social, environmental, political and economic impacts, it is therefore important to double up efforts to improve the understanding of risk and strengthen risk governance. These efforts can include measures to establish early warning systems using impact-based meteorological forecasts, increase monitoring capability and related response structures and the assessment of both on-site and off-site damage caused by fires. These systems would help countries

1 https://ipbes.net/global-assessment

2 Latin America is not the only region to have experienced serious wildfires recently. Widespread and damaging wildfires have occurred in the past few years in forests in Australia, Indonesia, Portugal, California, Oregon and even the Arctic.

3 The world's terrestrial biodiversity is concentrated in forests: they are home to more than 80 % of all terrestrial species of animals, plants and insects. So, when forests burn, the biodiversity on which humans depend for their long-term survival is also at risk. With over 1 million species currently facing extinction if we continue with business as usual, weather events—from fires to severe droughts, to marine heat waves that are causing mass destruction of corals—are become an increasing matter of concern for species survival.

4 The climate crisis is with us now and getting worse. UNEP's Emissions Gap Report 2019 warns that unless, global greenhouse gas emissions fall by 7.6 % each year between 2020 and 2030, the world will miss the opportunity to get on track towards the 1.5°C temperature goal of the Paris Agreement.

to be better prepared when such fires occur. They would help them strengthen their readiness capacity and their ability to review and analyse wildfires to understand fire sources, causes and motivations, thereby enabling the development of targeted risk reduction efforts and investments.

Many countries in Latin America have developed their own capacity to calculate the risk of occurrence of wildfires using weather forecasts and fuel moisture modelling. Thanks to a growing collaboration between those public research centres in charge of forest monitoring and space agencies, the region has also advanced in the development of operational tools for active fire monitoring and for measuring burned areas, as well as in remotely assessing the environmental damage caused by wildfires.

About this document

The **Issue-Based Coalition on Climate Change and Resilience** seeks to enable UN agencies to work together to support a coherent and aligned implementation of the global agendas, in particular the 2030 Agenda, the UNFCCC including the Paris Agreement, and the Sendai Framework for Disaster Risk Reduction 2015-2030. Coalition aims to strengthen and streamline inter-agency coordination and UN system accountability on sub-regional and DRR work at the regional and sub regional levels.

The IBC is co-led by UNDRR and UNEP and counts on the participation of 17 additional agencies[5]. In the framework of this Coalition, and in response to the increasing intensity of wildfires in the region, a taskforce has been formed to analyse and articulate a coherent approach to the issue of wildfires, providing tools and resources to UN agencies and "UN Country Teams (UNCTs) of the region. Given its experience over the years in fire management, FAO was asked to lead the taskforce and coordinate the finalization of this document.

United Nations (UN) system capacities exist in several agencies in the area of wildfires and fire-related services and products, as well as in related prevention and response efforts.

Nevertheless, there has not been a common approach to this issue that could guide consistent communication and advocacy efforts or proactive initiatives at regional and country levels.

Therefore, the IBC on Climate Change and Resilience has identified the need to advance with a task team in developing joint work in this regard, including:

- Analyse the driving forces (causes), the state (e.g. frequency and spatial distribution), the trends, the impacts and the national/regional response to this issue, as a transboundary matter to support the elaboration of the Common Country Assessment and the overall work of the group of regional directors and the UN Country Teams.
- Define a common interagency approach on wildfires, its implications, risks, impacts, policy engagement and recommended actions. A proposed approach are the 5Rs, based on the Sendai Framework (see section 2).
- Identify common technical and advocacy related to the state and trends of wildfires in the region, implications for the achievement of the SDGs and other international agreements and needed action.
- Identify UN assets available at the regional and country levels to support, to support possible country demands in this regard.

5 ECLAC, FAO, ILO, IOM, OCHA, UNDP, UNESCO, UNFPA, UNICEF, UNHCR, UNIDO, UNOPS, UN Women, WFP, DCO, PAHO/WHO, WMO.

1. Outlook for wildfires in Latin America: a preliminary analysis of the status

1.1 Methodology of the analysis and data sources

Monitoring wildfires occurrences and analysing their causes, frequency and spatial dynamics is crucial to understand past, current and future fire regimes and their impacts on the environment and societies. Satellite information the most robust and accessible tool for global analysis offers a limited scope for investigation in this regard, as the available data is obtained from sensors and algorithms not able to capture the full extent of such phenomena, especially in tropical or sub-tropical areas[6]. Such instruments are usually not suitable for data extraction on single events, which would allow to characterize fires by their dynamics over time and space. For instance, they are not able to monitor specific fire typologies, such as smouldering fires, which might be the largest and longest burning fires on Earth, responsible for 15% of global GHG emissions, as they often occur in or below the ground, with no smoke or volume change[7]. As a result, satellite analysis can generate over- or underestimations of burned areas, and their potential to capture the actual number, size and spread speed of fires is limited. These variables are usually collected locally, though a global approach is still to be introduced[8].

On this basis, these notes provide an overview of the current wildfire situation in Latin America, based primarily on information from the European Commission's Joint Research Centre. Global Wildfire Information System (GWIS). We acknowledge the possible existence of more detailed and updated data at other institutions. Such as the National Institute for Space Research (INPE) in Brazil, or the National Institute of Statistics and Geography (INEGI) in Mexico[9]. However, with an aim to produce a quick picture of the wildfire situation in Latin America and prioritizing the use of data consistently produced over time for the entire region, we decided to use a single source of data based on a robust and validated methodology.

Another aspect included in this first part concerns the causes of wildfires. Fires have always been part of many ecosystems´ dynamics. Globally approximately 10% of wildfires are attributed to natural sources, such as lightning and volcanic eruptions. However, current wildfire regimes are mostly related to human intervention whether as deliberate actions or as a part of (complex) socio-economic processes[10]. Such differentiation will not be directly addressed in this section, hence discussion here presented does not mention one or another type of wildfire. A further proposal to develop such analysis to characterize the sources, agents and motivations of fires is under

6 Satellites' sensors are usually calibrated in boreal forests and mid-latitude climate conditions, so their use in other areas require careful post-processing and interpretation.

7 Huang, X. and Reing, G., "Upward-and-downward spread of smouldering peat fire" *Proceedings of the Combustion Institute*, vol. 37, n° 3 (2019), pp. 4025-4033

8 Artés, T. and others, "A global wildfire dataset for the analysis of fire regimes and fire behaviour", *Scientific Data*, vol. 6, n° 296 (2019).

9 In their original languages: Instituto Nacional de Pesquisas Espaciais (for INPE) and Sistema Nacional de Información Estadística y Geográfica (INEGI).

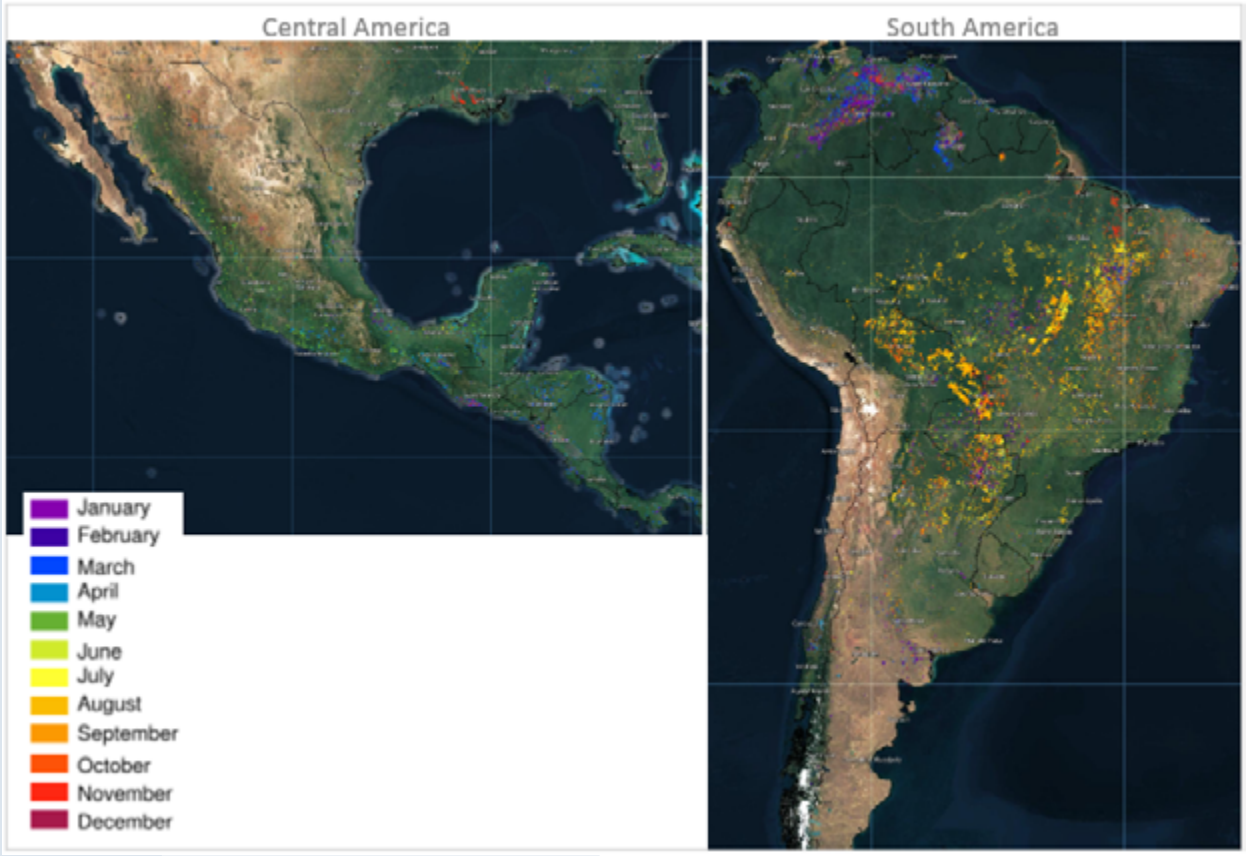
10 Shikwambana L. and Kganyago M., "Observations of Emissions and the Influence of Meteorological Conditions during Wildfires: A Case Study in the USA, Brazil, and Australia during the 2018/19 Period", *Atmosphere*, vol. 12, n° 1 (2021), p. 11; and UNEP, *Governments, smart data and wildfires: where are we at? News and Stories*, 2020 (https://www.unenvironment.org/news-and-stories/story/governments-smart-data-and-wildfires-where-are-we)..

development by the Issue-Based Coalition task team. In the following section, an analysis is provided for Mesoamerica[11] (MA) and South America (SA) separately. Some national and ecosystems-related highlights complete these notes.

1.2 General overview of wildfires

For the period 2009-2019, an average 33 million hectares (Mha) of land are estimated to have been affected by wildfires in Latin America every year. If we ignore the fact that a significant portion of these fires may have burned the same areas multiple times, the total area affected over these years would be equivalent to the sum of Argentina's and Chile's territories: more than 360 Mha. As a parameter, around 400 Mha are estimated to burn every year in the world[12]. In the region, the historical trendline of events is found to be irregular and apparently with no significant up or down trend (Graph 1): 2010 was the year with the highest value, over 56 Mha, while 2009 and 2018 recorded the lowest annual values, with estimates lower than 24 Mha. In 2019, fire events were most densely distributed in the outskirts of the Amazon basin and El Chaco region (Figure 1).

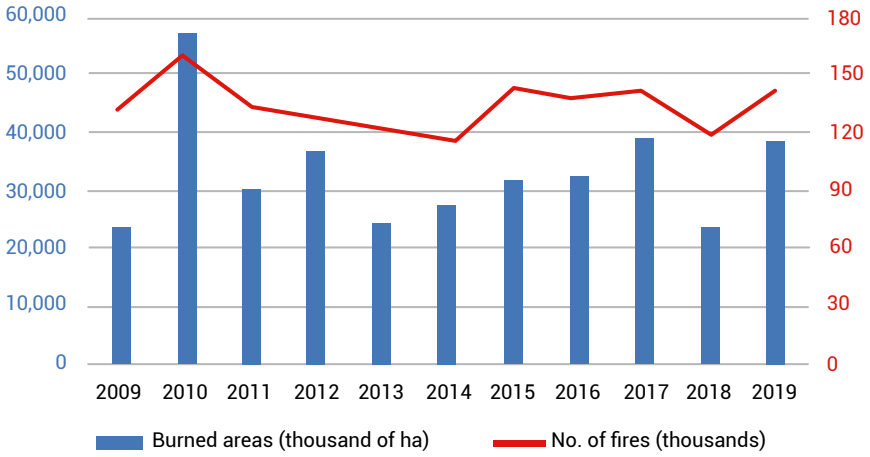
Figure 1 – Cumulative burned areas for Latin America in 2019.



11 The term Mesoamerica is used in this document to represent the land territory comprised by Mexico, Belize, Guatemala, El Salvador, Honduras, Nicaragua, Costa Rica and Panama.

12 Chuvieco E. and others, "Historical background and current developments for mapping burned area from satellite Earth observation", *Remote Sensing of Environment,* vol. 225 (2019), pp. 45-64.

Graph 1 – Annual wildfires in Latin America, 2009-2019.



Source: GWIS, 2020.

Brazil alone registered over half of these affected lands, totalling almost 200 Mha of burned area during this period, followed by Argentina and Bolivia, with roughly 35 Mha of burned area each. However, in terms of burned area with respect to total national territories, Paraguay and Bolivia appear as the most affected countries, with 0.5% and 0.3% of affected areas respectively. In contrast, Costa Rica and Peru record the lowest ratios, with less than 0.01% of their lands being impacted by fires over the period.

With regard to the number of fires, the other primary parameter used in fire-related studies – the same graph shows a trend quite similar to that of burned area. In the period 2009-2019, there were an estimated 1.47 million fires in Latin America. 2010 again hit the peak with over 160,000 events, while 2014 and 2018 reported the lowest estimations: less than 120,000 events per year. As a comparison, in 2019 Europe registered roughly 24,000 fire events, versus 142,000 in Latin America. A pattern of increasing fires can be inferred for Latin America, with particular attention to humid tropics, where slash-and-burn crops are being replaced by vegetation that is more flammable[13].

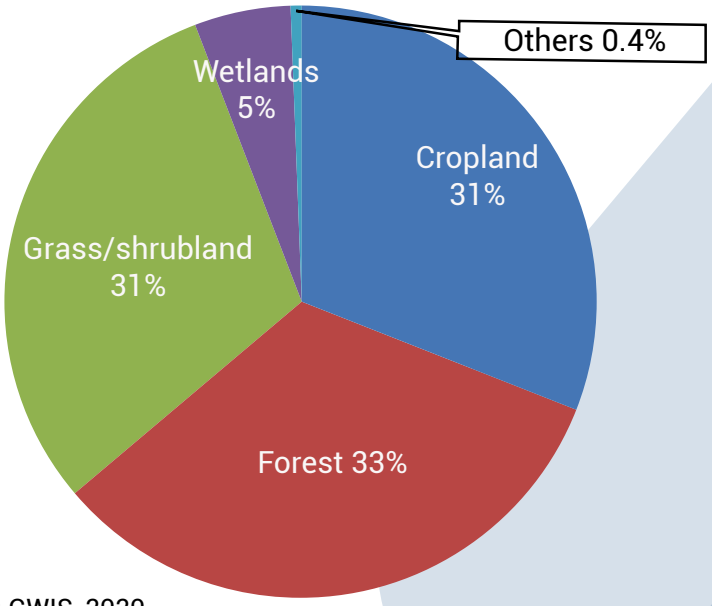
A quick country by country analysis reports again Brazil and Argentina as the most affected countries in the region, with 600,000 and 200,000 recorded fires respectively, while the lowest values were found in El Salvador and Suriname, with just over a thousand wildfire events each during all those years.

1.3 Natural systems affected and fire-related emissions

Three major kinds of vegetation are equally affected by wildfires in Latin America: forests, featured mostly by the Amazon region; croplands, basically representing agricultural area; and open grass areas, mostly associated to arid environments (Graph 2). Usually, Mesoamerica (MA) countries seem to experience (proportionally) higher impacts on forests and cultivated lands, while in South America (SA) impacts are distributed among the three major vegetation types. Bolivia and Paraguay are the countries that suffer most from fires on wetlands, with almost a fifth of the events being felt on these systems, while Colombia and Venezuela present the highest proportion of impacts on grasslands (a full per country chart can be found in Annex 1).

13 Bastarrika, A. and others, "Mapping Burned Areas in Latin America from Landsat-8 with Google Earth Engine", Preprints.org, 2018 (DOI:10.20944/PREPRINTS201805.0480.V1).

Graph 2 - Land cover affected by wildfires in Latin America, 2009-2019 (per type of land cover).



Source: GWIS, 2020.

From another perspective, wildfires are responsible for the emission of the greenhouse gases CO2, CH4, and N2O, and also modify the environment by emitting aerosols and ozone. Although wildfires are not usually considered a net CO2 source[14], they impose profound impacts on climate, weather, carbon budget and public health[15]. As a large part of fire emissions in Latin America are believed to be driven by tropical deforestation and degradation – about 44%, versus 16% globally[16] negative impacts tend to be more significant.

The calculation of fire-related emissions is derived from the multiplication of burned area and fuel consumption per unit burned area, derived from satellite data streams[17]. In the period 1997-2016, wildfires in Latin America and the Caribbean emitted an estimate of 7.2 Gigaton[18] Carbon (Gt C) to the atmosphere. More intense emissions in the region come from central portions of South America and in the proximity to the Mexico-Guatemala border (Figure 2). In the north portion of South America, savannahs are the major emitter among fire categories, while in Central America and central and south zones of South America, emissions are similar between savannahs and forests. The south hemisphere zone within South America is by far the major source of emissions in the region, with over 80% of emissions[19]. As a parameter, global wildfires in 2014 are estimated to have released about 2.2 Gt C into the atmosphere, corresponding to approximately one quarter of global fossil fuel carbon emissions in that year[20].

14 Only fires that are not balanced by regrowth are a net CO2 source (Van der Werf, G. and others, "Global fire emissions estimates during 1997-2016", Earth Syst. Sci. Data, vol. 9 (2017), pp. 697-720; Landry, J.-S. and Matthews, H. D., "Non-deforestation fire vs. fossil fuel combustion: the source of CO2 emissions affects the global carbon cycle and climate responses", Biogeosciences, vol. 13 (2016), pp. 2137-2149

15 Li, F. and others, "Estimation of biomass-burning emissions by fusing the fire radiative power retrievals from polar-orbiting and geostationary satellites across the conterminous United States", *Atmospheric Environment*, vol. 211 (2019), pp. 274-287; Van der Werf, G. and others, 2017.

16 Van der Werf, G. and others, 2017.

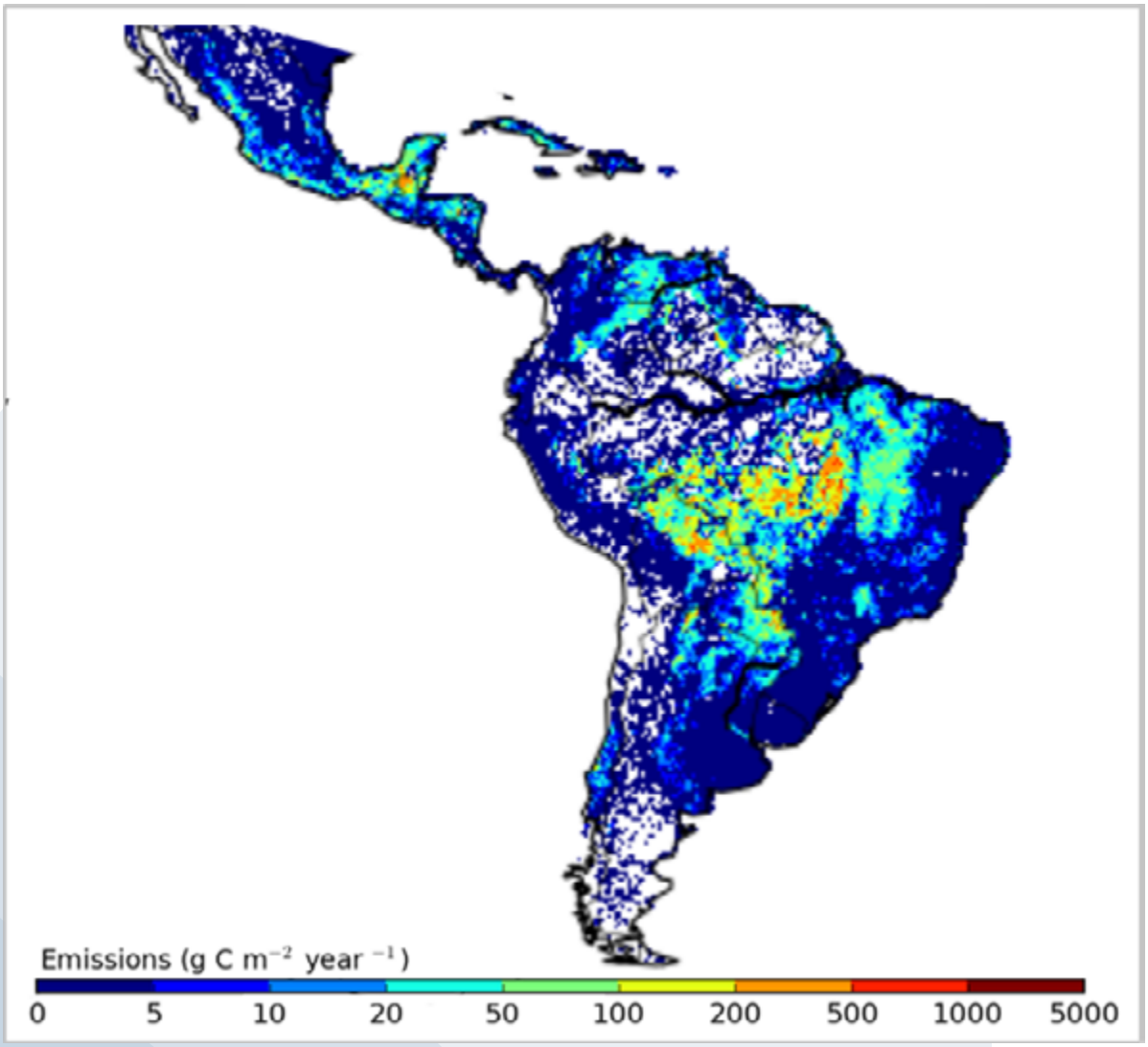
17 Satellite observations of Fire Radiative Power (FRP) enables the estimative of the biomass-burning emissions (BBE) coming from wildfires (Li, F. and others, 2019).

18 The author uses the term Pentagram, usual unit in dealing with Carbon. It is equivalent to the Gigaton, or 1 billion tonnes.

19 Van der Werf et al. 2017. Global fire emissions estimates during 1997–2016. Earth Syst. Sci. Data, 9, 697–720.

20 Li, F. and others, 2019.

Figure 2 – Latin America fire-related emissions, 1997-2014 (mass of carbon per unit area per year).



Source: van der Werf and others, 2017

Wildfires have a decisive role in the natural equilibrium and landscape regeneration. Apart from their emissive feature, they usually have the power to trigger strong local-scale vegetation regrowth responses, which can last years or even decades, depending upon local natural conditions, and have the potential to sequester a roughly equivalent amount of the antecedent GHG emissions[21]. Moreover, ecosystems affected by wildfires can also have their land, atmosphere exchanges of energy enhanced, which may lead to a regional-scale cooling with effects at a global scale[22]. As such, wildfires per se should not be perceived as net CO2 emitters, as in some cases they can potentially support nature's balance and climate coping.

21 Landry, J.-S. and Matthews, H. D., "Non-deforestation fire vs. fossil fuel combustion: the source of CO2 emissions affects the global carbon cycle and climate responses", Biogeosciences, vol. 13 (2016), pp. 2137-2149.

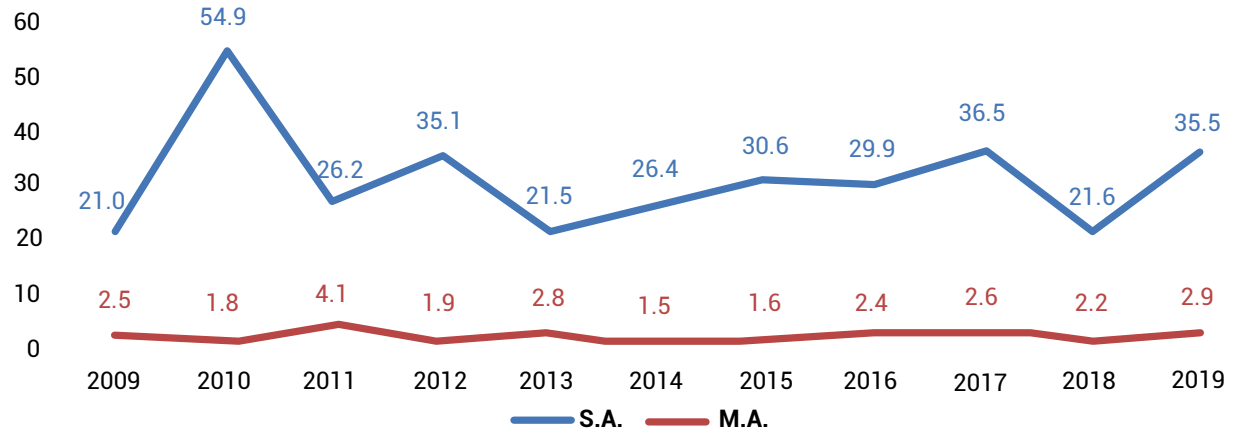
22 Besides a short-term decrease due to surface blackening, local albedo generally increases after a fire event (Ward, D. S. and others, "The changing radiative forcing of fires: global model estimates for past, present and future", Atmos. Chem. Phys., vol. 12 (2012), pp. 10857-10886).

1.4 Mesoamerica and South America perspectives

For the period 2009-2019, Mesoamerica (MA) registered a total of 26.2 Mha of burned area, with over 180,000 fires registered, while South America (SA) reported about 340 Mha of burned area, caused by almost 1.3 million wildfire events.

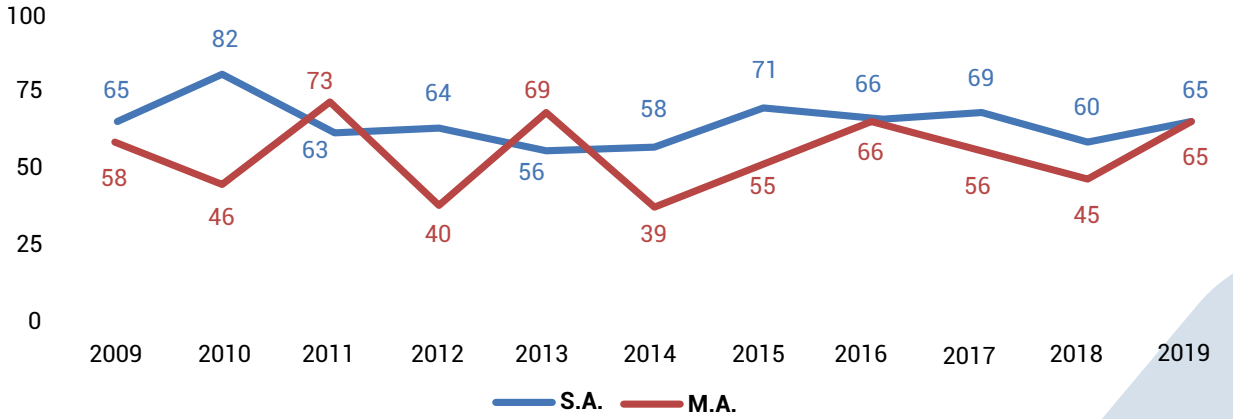
Other data from FAO over the period of 2003-2012 show a total of 356 Mha of burned forest areas for South America. The same study indicated a decreasing trend of forest area burned over that period[23].

Graph 3. Burned area in Mesoamerica and South America, 2009-2019 (millions of hectares).



Source: GWIS, 2020.

Graph 4. Number of fires in Mesoamerica and South America, 2009-2019 (100,000).



Source: GWIS, 2020.

23 van Lierop, P. and others, "Global Forest area disturbance from fire, insect pests, diseases and severe weather events", *Forest Ecology and Management*, vol. 352 (2015), pp. 78-88.

Sub-regional graphs show steady trajectories (as Latin America) with no clear trend for the variables, and with no clear and straight connection among sub-regional curves (Graphs 2 and 3). Peak values of burned area in SA were found to have happened in 2010 and in 2017, while in MA they occurred in 2011 and 2019. In the same vein, most fires per Mha were registered in 2010 and 2015 for SA, and in 2011 and 2013 for MA.

Over 90% of the burned area and 87% of the number of fires in Latin America occurred in South America. However, a comparison between sub-regions based on number of fires per Mha provides a clearer picture of the situation where values range within the same order of magnitude, 721 in SA and 611 in MA for the whole period, and again curves follow irregular trendlines (Graph 4). The same approach for burned areas shows that about 19% of the SA territory is affected, against 9% for MA (again, we ignore the fact that more than one fire event might have occurred in the same area). A common feature for both regions is that 2019 registered higher figures than those observed in the previous 5 to 6 years. The breakdown by country provides more information on this subject.

1.5 Country analyses

The evaluation of country annual values against the average for the referred period might help to capture the incidence of years with statistics under or above expected values (averages), which could suggest the tendency of improvement or worsening of scenarios. As a matter of fact, the analysis of both parameters shows that a preliminary look at existing data does not seem to show specific patterns even when national scales are scanned (Tables 1 and 2). The number of years under and above the average are heterogeneous and extreme negative and positive values show no clear sign of tendency, except for 2019, which can be considered an outlier in such context.

Table 1. Country statistics on burned areas.

Burned area 2009 -2019 (1,000 he)			Annual values against the average (red: higher values, green:lower values)										
	Total	Annual average	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Argentina	34,507	3,137	6%	-16%	8%	-6%	-6%	-26%	-23%	9%	75%	7%	-28%
Belize	422	38	-60%	-20%	198%	-85%	84%	-62%	-14%	-21%	-6%	-46%	32%
Bolivia	36,135	3,285	-35%	185%	0%	-17%	-47%	-66%	-29%	7%	-22%	-44%	67%
Brazil	194,420	17,675	-49%	106%	-20%	36%	-45%	-10%	14%	-10%	16%	-51%	11%
Chile	1,459	133	-40%	-42%	28%	-17%	-76%	12%	72%	38%	268%	-72%	-14%
Colombia	19,743	1,795	2%	4%	-16%	-19%	-4%	36%	-21%	12%	-27%	40%	-7%
Costa Rica	432	39	-30%	-30%	-58%	-13%	45%	9%	30%	39%	-16%	9%	15%
Ecuador	438	40	8%	-74%	60%	28%	-23%	-59%	-28%	116%	-56%	-36%	64%
El Salvador	139	13	-63%	-86%	-85%	-57%	118%	-28%	95%	-73%	95%	39%	45%
Guatemala	3,179	289	44%	0%	-7%	-14%	20%	-33%	-2%	29%	7%	-37%	-7%
Guyana	957	87	-20%	-21%	-40%	-12%	-16%	12%	101%	-6%	0%	-15%	17%
Honduras	2,810	255	-2%	-30%	72%	-73%	7%	44%	-36%	12%	-47%	32%	20%
Mexico	16,878	1,534	5%	-35%	103%	-9%	13%	-65%	-42%	-10%	25%	-15%	29%
Nicaragua	2,037	185	-44%	29%	-21%	-41%	33%	64%	-32%	23%	-51%	24%	14%
Panama	379	34	88%	-54%	-76%	-17%	-25%	-31%	95%	29%	-48%	-54%	93%
Paraguay	21,512	1,956	-19%	-17%	3%	-15%	26%	-31%	-37%	-7%	83%	-14%	29%
Peru	1,154	105	-41%	122%	-58%	21%	-27%	-36%	-24%	77%	-35%	-28%	29%
Suriname	291	26	46%	-76%	-23%	44%	-51%	47%	39%	-55%	-11%	-38%	78%
Uruguay	256	23	36%	53%	-1%	45%	-30%	-62%	43%	-26%	-35%	-31%	8%
Venezuela	28,411	2,583	7%	3%	-39%	-31%	2%	11%	-6%	3%	-13%	25%	38%

Note: highlighted cells indicate extreme values per country. Source: GFIS, 2020.

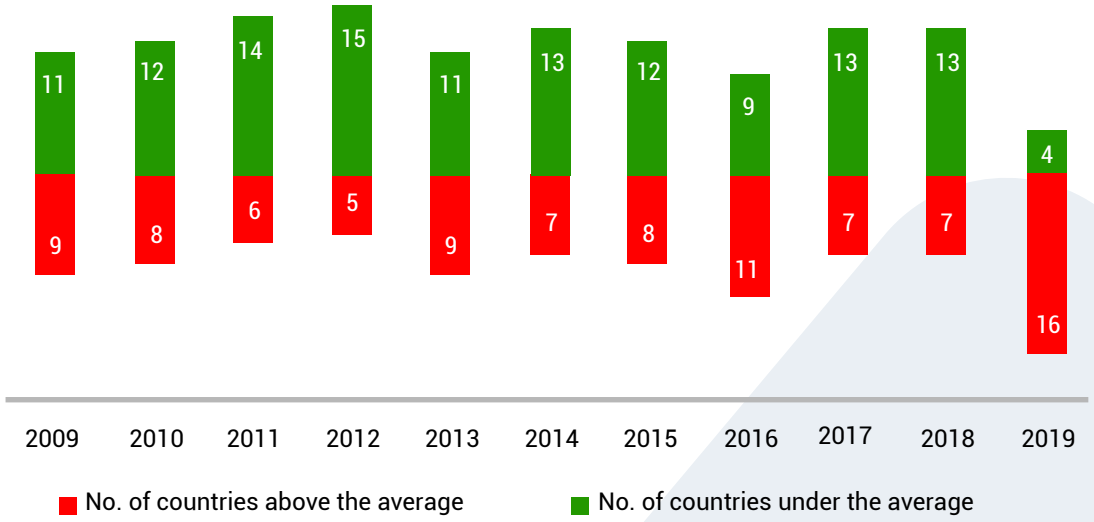
Table 2. Country statistics on number of fires.

No. of fires 2009-2019			Annual values against the average (red: higher values, green: lower values)										
	Total	Annual average	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Argentina	206,181	18,744	1%	7%	30%	6%	2%	-34%	-15%	2%	9%	3%	-10%
Belize	3,467	315	-55%	-29%	92%	-79%	142%	-57%	0%	-1%	-4%	-57%	49%
Bolivia	85,777	7,798	5%	108%	-9%	-28%	-36%	-26%	-13%	25%	-14%	-8%	-4%
Brazil	604,699	54973	-2%	37%	-10%	6%	-30%	-5%	30%	-1%	6%	-30%	0%
Chile	5,317	483	-17%	-10%	-16%	23%	-37%	18%	40%	-9%	-3%	-33%	43%
Colombia	75,228	6,839	25%	-21%	-6%	-4%	-12%	14%	-8%	5%	-13%	27%	-7%
Costa Rica	2,600	236	-9%	-18%	-41%	-15%	48%	1%	37%	10%	-14%	4%	-4%
Ecuador	4,445	404	30%	-64%	100%	10%	-28%	-61%	-42%	146%	-51%	-33%	-8%
El Salvador	1,072	97	-46%	-72%	-68%	-47%	86%	-17%	71%	-60%	72%	60%	20%
Guatemala	27,153	2,468	13%	-8%	-9%	-4%	39%	-31%	6%	52%	-3%	-44%	-11%
Guyana	6,708	610	-11%	-31%	-49%	-14%	-15%	12%	82%	4%	0%	-15%	36%
Honduras	22,411	2,037	-13%	-41%	85%	-71%	13%	27%	-13%	24%	-41%	16%	15%
Mexico	105,676	9,607	10%	-16%	40%	-23%	18%	-54%	-3%	11%	19%	-23%	22%
Nicaragua	14,596	1,327	-36%	0%	-13%	-35%	42%	52%	-14%	28%	-51%	14%	14%
Panama	3,764	342	111%	-58%	-76%	-1%	-28%	-23%	72%	7%	-56%	-59%	111%
Paraguay	159,690	14,517	-22%	-5%	10%	-16%	24%	-23%	-24%	0%	34%	9%	12%
Peru	11,902	1,082	-30%	96%	-53%	50%	-22%	-29%	-13%	43%	-45%	-14%	19%
Suriname	1,212	110	57%	-34%	-55%	-26%	-19%	15%	53%	-35%	-50%	6%	86%
Uruguay	2,922	266	25%	61%	6%	3%	-14%	-56%	59%	-27%	-27%	-36%	7%
Venezuela	128,229	11,657	8%	2%	-44%	-26%	1%	8%	-4%	-14%	-4%	25%	48%

Note: highlighted cells indicate extreme values per country. Source: GFIS, 2020.

Sixteen countries (80%) registered a burned area higher than their average in 2019 (Graph 5). This is by far the highest number, as in previous years the number of countries above the average ranged between 5 and 11. Nevertheless, the record of extreme negative figures in the same year was found in 2010, when 4 countries had their highest values regarding burned areas (Table 1).

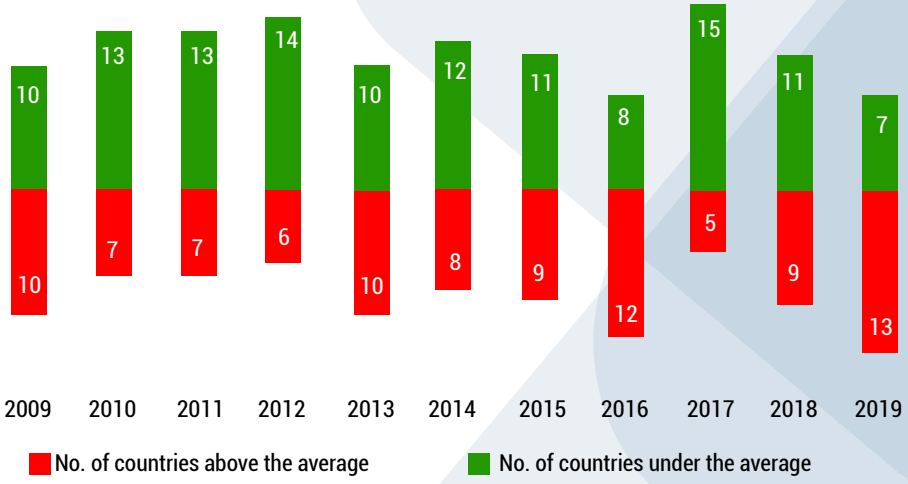
Graph 5. Countries under and above their annual burned areas average, per year (2009-2019).



Source: GWIS, 2020.

In the same vein, the analysis on number of fires shows that in 2019, 13 countries reported data higher than their mean value, again the highest values for the period (Graph 6). Furthermore, 2019 also recorded the highest concentration of negative values for countries, i.e. 5 countries had their highest number of fires in 2019 (Graph 6).

Graph 6. Countries under and above their annual number of fires, per year (2009-2019).



Source: GWIS, 2020.

Notwithstanding such insights, with the data analysed so far it is not possible to conclude whether wildfires dynamics in the region are subject to a variation in terms of frequency and magnitude. To this end, more information would be required — including socio-economic and fire seasonality inputs, to find out if variances are due to natural variations or any other extra-factor, possibly related to human action. To provide additional elements to the matter, specific analyses for 2020 and for the Amazon region are presented.

1.6 The 2020 panorama

As statistics for 2020 are not yet available at GWIS at this time, data from other institutions may provide a glance of what has been happening in Latin America in recent years. To this end, the Cumulative Daily Fire Count (CDFC) was used as the parameter, using both data derived from the Global Fire Atlas (GFA) and Brazil's National Institute for Space Research (INPE). The former, which brings data by countries, registered a total of about 905,000 CDFC in 2020 for Latin America; while the latter, whose data are only available for South America, estimates that 459,000 CFDC occurred in South America in 2020.

Despite differences on the statistics, a clear uptrend arises from the comparison with previous figures (Table 3). GFA data for 2020 is 12% higher than 2019 and 28% higher than the 2009-2019 average, while INPE data for 2020 is respectively 28% and 37% higher. Over the next months, a more solid evaluation of the 2020 scenario will be possible as more and better data are consolidated. Meanwhile, a deeper look through the Amazon situation can also offer further visions.

Table 3. Cumulative Daily Fire Count (CMDF), 2020 against previous values.

	CMDF 2020	Compared to 2019 value	Compared to the 2009-2019 average
GFED (Latin America)	904,919	+12%	+28%
INPE (South America)	458,954	+28%	+37%

Source: GFED, 2020; INPE, 2020.

2. A Sendai-based approach for fire management: of (Integrated) Fire Management

Fire Management – Concepts, Context and System

Dealing with fires around the world has often been interpreted as putting out fires or increasing capacity to put out fires. This approach is not working. The messages conveyed to decision-makers and the public often present a very simple picture of a complex situation:

- All forest fires are harmful (not true)
- All fires need to be prevented and extinguished (not true)
- Forest fires are periodic events best dealt with by suppressing them when they occur.

It is becoming evident that more sophisticated firefighting technologies are not likely to solve the problem of destructive wildfires, nor re-establish ecologically appropriate fire regimes in places that need to burn. There is a need to "integrate" socio-cultural realities and ecological imperatives.

In the past decision-makers and the public have tended to the view that firefighting is the main solution to wildfires and so they react to recurring wildfire crises with more firefighting. This is only one element of what is needed. Beyond that, it is likewise imperative to focus resources on long-term and sustainable solutions, by integrating fire management into land management and the routines of planning and operations. To date, inadequate attention has been paid to addressing underlying causes of fires and to preventing a damaging pattern of recurrent fire and degradation in burned areas.

Integrated Fire Management (IFM) is the term for the integration of science and fire management approaches with socio-economic elements at multiple levels for the planning and implementation of a balanced approach to managing fires. IFM includes "all activities associated with the management of fire prone land, including the use of fire to meet land management goals and objectives". This implies a holistic approach to addressing fire issues that considers biological, environmental, cultural, social, economic and political interactions[24].

Integrated approaches to fire management place greater emphasis on addressing underlying causes and seek long-term, sustainable solutions that incorporate five essential elements (the 5Rs). These elements are the same as the globally adopted characterization of the Sendai Framework for Disaster Risk Reduction 2015-2030, used in dealing with disasters and their management:

1. REVIEW – Analysis of the fire issue and identification of options for positive change;
2. RISK REDUCTION, Prevention – focusing resources on the underlying causes of fires;
3. READINESS – Preparing to fight fires;
4. RESPONSE – Ensuring appropriate responses to unwanted or damaging fires; and
5. RECOVERY – Community welfare, repairing infrastructure and restoration of fire-damaged landscapes.

As noted in the present report, resources need to be directed to support fire data collection and analysis that improves the understanding of fire causes,

24 Myers, L. R., Convivir con el fuego: *Manteniendo los Ecosistemas y los Medios de Subsistencia Mediante el Manejo Integral del Fuego, Iniciativa Global de Manejo del Fuego* (Thallassee, Florida, The Nature Conservancy, 2006).

identifies existing management practices that encourage harmful fires and promote management systems that take advantage of well-established fire use. Analysis in fire prone areas needs to start before a fire begins.

Integrated fire management includes social, economic, cultural and ecological evaluations for planning and operational systems in order to minimize the damage and maximize the benefits of fire. Identifying and mapping areas at risk of fires is crucial to integrated fire management in the region. This includes areas presenting significant fire risks and potential for generating transboundary haze pollution events. This mapping should be transparent and shared between all actors involved in the region.

Fire early warning systems are a key component to increase readiness and resilience in the face of the increasing severity of future fire regimes under climate change[25]. Fire danger rating systems rely on weather variables to assess fire danger. Under the Global Fire Early Warning System and the Global Wildfire Information System (GWIS), progress is being made on enhancing fire weather and fire danger information using weather data inputs from satellites under NASA's Group on Earth Observations Work Programme. There are also efforts on extending the prediction to seasonal lead times by merging weather and climate forecasts as showcased by the ongoing joint WMO World Weather Research Programme (WWRP) – World Climate Research Programme (WCRP) Sub-seasonal to Seasonal Prediction Project (S2S).

Importantly, people are pivotal. Humans are the cause of ~90% of fires globally. Local people are also the most knowledgeable about their landscape, its history, fire use in land uses, those who use fire and why it is used. The fire review can analyse these factors in consultation with local people and relevant actors to engage with them and develop approaches that will sustain existing social values and perhaps create new values to strengthen community participation in sustained management of the landscape. Key stakeholders, especially local communities, need to be involved in fire management planning.

25 de Groot, W. and Flannigan, M., "Climate change and early warning systems for wildland fire", in Singh, A. and Zommers, Z. (eds), *Reducing Disaster: Early Warning Systems For Climate Change* (Springers, 2014), pp. 127-151.

Table 4. A Framework for Fire Management[26]

System Process Components	System Tools
REVIEW - ANALYSIS OF THE FIRE PROBLEM 1. Fire Likelihood Ignition history 2. Consequence of Fire on Assets ↓ ↓ ↓ Economic Intensity Value Social Spread Rate Vulnerability Environmental Duration 3. Ecological context of fire	• Maps (vegetation, topography, tenure, assets, roads, ignition distribution etc.) • Fire behaviour prediction tools • Spatial databases • Demographic information • Cultural & social context of fire • Ecological response to fire (fire histories, fire effects information, fire regimes)
RISK REDUCTION - PREVENTION 1. Ignition Reduction Strategies • Regulate fire use, educate fire users, alternatives for fire use, technology improvements, development planning controls 2. Impact Mitigation Strategies • Fuel reduction (e.g. by burning, grazing & other means) • Reduce asset vulnerability (e.g. construction standards) • Establish/maintain containment features (e.g. fuel breaks) 3. Fire Use Strategies - Ecosystem maintenance - Fire regime restoration	• Fire use laws/regulations, enforcement • Planning controls • Education programs • Fire behaviour guides, ignition & control resources, planning & reporting tools. • Firebreak construction guides • Building construction codes • Ecological fire training • Fire use education
READINESS - PREPAREDNESS TO FIGHT FIRES 1. Strategies: • Early Warning/Predictive systems • Community warning mechanisms • Detection and response infrastructure • Communications systems • Mobilisation & co-ordination plans • Response triggers and levels • Competent fire control staff	• Climate, weather monitoring & prediction • Fire Danger Rating system • FDR public notification means • Detection/suppression needs assessment • Fire detection, suppression & communications resources • Fire training systems and tools
RESPONSE - FIRE FIGHTING OPERATIONS 1. Detection and Reporting 2. First Response 3. Containment and Control 4. Mop Up and Patrol 5. Command and Control	• Response mobilisation plans • Operational responsibilities & procedures. • Strategic information access tools • Decision support tools • Operational management systems
RECOVERY POST FIRE 1. Community Welfare assistance 2. Economic loss reduction (e.g. salvage logging and replanting, infrastructure repair) 3. Environmental repair	• Damage assessment tools • Recovery assistance plans

26 Developed by Metis Associates in 2000, presented at the World Forestry Congress, Quebec, in 2003, and updated since.

3. Comments and messages related to wildfires that can be used by the UN system

A critical component of effective wildfire prevention policies and strategies is a long-term wildfire information system and a risk assessment, based on robust methods accounting for the spatial and temporal nature of wildfire risk[27, 28]. On a local scale, such wildfire risk information could be used for areas to be targeted for wildfire risk reduction, fuel treatment practices implementation and fire readiness (such as fire towers and water tank construction). This information is extremely useful in implementing efficient preventive strategies and measures, since fire prevention is not only a preferable but also a more cost-effective way to manage forest fires, compared to fire fighting and suppression (i.e. response measures). Availability of information on wildfire risk assessment on a regional scale supports optimal allocation of firefighting personnel and the protection of critical infrastructure[29]. It is critical and also urgent to have an integral approach to the problem that focuses on Reviewing, Risk reduction, Readiness, Response and Recovery and resilience strengthening – instead of relying solely on direct fire suppression. On the other hand, comprehensive wildfire risk management has tactical, operational, strategic and financial/economic dimensions. Risk assessments inform a range of decisions at all phases, including evacuation decisions, resource allocation decisions and land use (zoning) decisions, in addition to tactical and operational decisions in case of emergencies.

3.1 Some comments regarding the 5Rs in Latin America and the Caribbean

Review capacity Analysis of the fire problem

- Available data shows a pattern of fires in Latin America, which in the context of climate change and agro-industrial advances can be further exacerbated. More information is needed to better understand this trend and further analyse its drivers and root causes.

- Data should include impact on livelihoods and lives.

- Special attention should be devoted to South America, where wildfires are concentrated recently and are further tempered by socio-economic and political aspects.

Risk reduction or prevention

- Wildfire risk reduction needs a multi-level approach in order to effectively support decision-making processes; from the national disaster risk management agencies to the firefighting teams in the field.

- The issue of wildfires needs to be understood in the context of increasing risks and the complex interaction of human, political, economic and natural systems.

- DRR plans and strategies, both at national and local levels, need to establish clear coordination, roles and responsibilities fort the different stakeholders and sectors (e.g. agriculture, environment, economy, etc.) involved in understanding, reducing and

27 Chuvieco, E. and others, "Development of a framework for fire risk assessment using Remote Sensing and Geographic Information System technologies", *Ecological Modelling*, vol. 221 (2010), pp. 46-58.

28 Jones, T. and others, "Quantitative bushfire risk assessment framework for severe and extreme fires", A*ustralian Meteorological and Oceanographic Journal*, vol. 62 (2012), pp.171-178.

29 Kalabokidis, K. and others, "Decision support system for forest fire protection in the Euro-Mediterranean region", *European Journal of Forest Research,* vol. 131 (2012), pp. 597-608.

addressing wildfire risks through a multi-hazard and comprehensive approach.

- The coordination mechanisms are critical and must include the participation of the public and private sectors as well as civil society organizations.

- Wildfire prevention can only be based on knowledge of the underlying causes of fires.

- Wildfire prevention needs meaningful and long-term political engagement with plans of action (with responsibilities, financial and coordination mechanisms). Big fires are often quickly forgotten, and new fires take everyone 'by surprise' (again).

- Rural development policies and plans must integrate measures to prevent wildfires.

- Strategies to raise public awareness on wildfire risk and on reducing this risk must be established, based on sensitization and educational activities.

- Land management and soil use strategies must be informed by wildfire causes and integrate adequate planning and mitigation actions[30].

- Fire problems are often related to inadequate, or lack of, land and forest management. So there is a clear need to consider fire risk and management in the overall land and forest policies.

Readiness or being prepared to fight fires

- Tools, services and resources for wildfire forecasting, warning, monitoring, response and recuperation must be promoted, and technical capacity transfer to the national actors must be assured. This includes the capacity for damage and loss assessments as first actions in the recovery/restoration process.

- Among the requirements are:

  - Climate, weather monitoring and prediction
  - Fire Danger Rating systems
  - Public notification and information including warnings but also education and advice
  - Fire detection, suppression and communications resources
  - Fire training systems and tools
  - Response mobilisation plans
  - Clear and agreed operational responsibilities & procedures
  - Access to information products and tools
  - Decision support tools
  - Operational management systems

Response or the firefighting operations

- International mechanisms supporting wildfire emergency response issues must nominate authorized users in each country.

- The human mobility consequences in terms of evacuations, displacement and possible loss of livelihoods are important parts of wildfire response and recovery. Appropriate protocols for humanitarian assistance during and after wildfires should be in place.

Recovery of burned areas and economical losses and strengthening community resilience

- The human mobility consequences in terms of evacuations, displacement and possible loss of livelihoods are important parts of wildfire response and recovery. Appropriate protocols for humanitarian assistance during and after wildfires should be in place.

30 Headwater Economics, *Land use planning to reduce wildfire risk: lessons from five western cities*, 2016 (https://headwaterseconomics.org/wp-content/uploads/Planning_Lessons_Full_Report_Web.pdf).

- At the level of community resilience, building back better should lead the action. Recover in such a way that new fire events are limited or prevented and communities' resilience to such events is increased.

- There is a critical need for assessments of damage, loss and other impacts once a wildfire has taken place. The purpose of these assessments would be to evaluate impacts on ecosystems and affected populations to inform stakeholders and underpin risk reduction .

- Landscape and ecosystem conservation and restoration actions should be included as a key element in post-wildfire rehabilitation plans. These plans must be predefined and implemented right after the disaster and in some cases during the fire response efforts if feasible and necessary.

3.2 Preliminary messages

Specific key messages should not be developed until we have a stronger understanding of the fire situation in the region, including the politics of it.

Some more general messages are:

- An Integrated Fire Management (IFM) approach, which integrates science and fire management approaches with socio-economic elements at multiple levels for the planning and implementation of a balanced approach to managing fires, is needed "All activities associated with the management of fire prone land, including the use of fire to meet land management goals and objectives". This implies a holistic approach to addressing fire issues that considers biological, environmental, cultural, social, economic and political interactions[31].

- An integrated approach to fire management places greater emphasis on addressing underlying causes and seeks long-term, sustainable solutions that incorporate five essential elements (the 5Rs) These elements are the same as the globally adopted characterization of the Sendai Framework for Disaster Risk Reduction 2015-2030, used in dealing with disasters and their management:

  - REVIEW. Analysis of the fire issue and identification of options for positive change;
  - RISK REDUCTION. Prevention – focusing resources on the underlying causes of fires;
  - READINESS – Preparing to fight fires;
  - RESPONSE – Ensuring appropriate responses to unwanted or damaging fires; and
  - RECOVERY – Community welfare, repairing infrastructure and restoration of fire-damaged landscapes.

31 Myers, L. R., 2006.

4. Agencies and tools to support countries in fire management

4.1 Existing capacities at UN level

UN system capacities exist in several UN agencies in the area of wildfires and fire-related services and products, as well as the related prevention and response efforts. Some of these capacities are placed at a global level, while capacities also exist in support of regional and country efforts.

A preliminary table that summarizes the expertise of UN agencies participating in the Issue-Based Coalition on Climate Change and Resilience on fire management is presented in Annex 3. This table summarizes UN agencies expertise at regional and global level on fire management and has been structured under the 5Rs of (Integrated) Fire Management. The expertise-experience table is still being updated and remains subject to the reception of new inputs from UN agencies.

4.2 Guidelines by different UN organizations/agencies

No.	Tool	Objective	Link	Agency	Observations
1	Health Guidelines for Vegetation Fire Events	To determine best practices, disseminate this knowledge worldwide and support development and implementation of the Regional and National Haze Action Plans.	https://www.who.int/docstore/peh/Vegetation_fires/Executive_Summary.pdf	WHO / UNEP / WMO	
2	Fire Management Voluntary Guidelines: Principles and Strategic Actions	To provide guidance to establish, review and implement national and international policy and planning in fire management.	English: http://www.fao.org/3/j9255e/J9255E00.htm Spanish: http://www.fao.org/3/j9255s/j9255s00.htm	FAO	English, French, Spanish, Russian, Korean
3	Forest Fires and the Law	A guide for national drafters based on the Fire Management Voluntary Guidelines.	http://www.fao.org/3/i0488e/i0488e00.htm	FAO	English
4	Words into Action Guidelines: National Disaster Risk Assessment Hazard Specific Risk Assessment	Conduct Wildfire Hazard and Risk Assessment.	https://www.preventionweb.net/files/52828_06wildfirehazardandriskassessment.pdf	UNDRR	English
5	Words into Action Guidelines on Disaster Displacement	Facilitate the integration of displacement in DRR plans.	https://www.undrr.org/publication/words-action-guidelines-disaster-displacement-	UNDRR	English and Spanish
6	International Handbook on Forest Fire Protection	Reinforce the national capacities of forest fire prevention in Mediterranean basin.	http://www.fao.org/forestry/27221-06293a5348df37bc8b14e24472df64810.pdf	FAO	Technical guide for the countries of the Mediterranean basin
7	Capacity building) for fire detection and hazard delineations, impact and damage assessment and monitoring of wildfires	Delivering satellite imagery analysis as well as training for capacity development on the use of geospatial information technologies to governments and relief organizations.	https://unitar.org/sustainable-development-goals/satellite-analysis-and-applied-research	UNITAR / UNOSAT	On demand training packages

4.3 Available tools and services by other international entities

No.	Tool	Objective	Link	Agency	Observations
1	Global Wildfire Information System (GWIS)	Bringing together existing information sources at regional and national levels in order to provide a comprehensive view and evaluation of fire regimes and fire effects at global level, and tools to support operational wildfire management from national to global scales.	https://gwis.jrc.ec.europa.eu/	GEO / NASA / COPERNICUS EU	
2	International Charter Space & Major Disaster	Through the International Charter, various satellite images have provided valuable information including, quick statistics and the locations of these extensive disasters, especially for fires that are fast-growing and offer limited site visits.	https://disasterscharter.org/web/guest/news-item/-/article/fire-monitoring-through-the-charter	International Charter Space & Major Disaster	English, French, Spanish, Russian, Korean
3	ITTO Guidelines on Fire Management in Tropical Forests	The Guidelines aim at: • Assisting the ITTO producer and consumer countries to develop programs for reducing damage caused by fire. • Helping tropical forest managers and rural residents to safely use and take advantage of the beneficial effects of fire in land use systems.	https://www.itto.int/direct/topics/topics_pdf_download/topics_id=1500000&no=4&disp=inline	ITTO	English
4	Global Fire Monitoring Center	The GFMC website provides links to useful information like • Background information on the ecological, social and cultural fire environment. • Fire intelligence data (satellite imageries available from various sources). • Early warning of fires, fire-weather predictions.. • Fire management guidelines and online trainings. • Contact persons in the countries affected, as well as liaison with regional and international fire experts.	https://gfmc.online/	The UNEP / OCHA Joint Environment Unit (JEU) has joint interface procedures with GFMC for international wildfire emergency assistance	The GFCM has regional chapters, notably the Regional South America Wildland Fire Network A specific study on “Challenges to landscape fire management during the COVID-19 pandemic” has already been developed.
5	Regional groups of experts and networks	The regional project of the EU includes an expert group on forest fires. There also exists a the regional network on forest fires		JRC	

4.4 Available tools and services of national entities

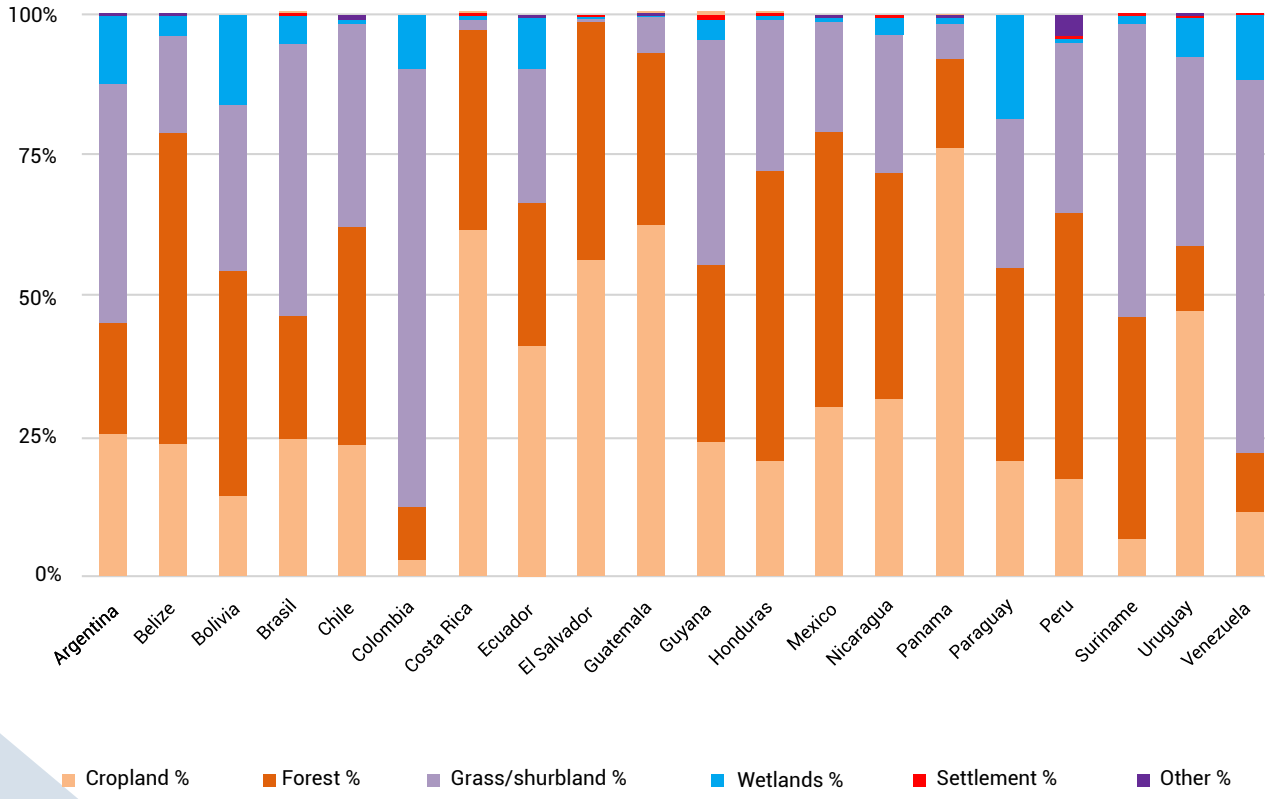
No.	Tool	Objective	Link
1	Funding: NASA Gordon and Betty Moore Foundation & The Netherlands Organization for Scientific Research (NWO)	Combined satellite information on fire activity and vegetation productivity to estimate gridded monthly burned area and fire emissions, as well as scalars that can be used to calculate higher temporal resolution emissions. Most of the resulting datasets are downloadable from this website for use in large-scale atmospheric and biogeochemical studies. The current version is 4, which has a spatial resolution of 0.25 degrees and is available from 1997 onwards. The most recent year is 2016 but monthly emissions are available for the period after 2016 (article in review).	https://www.globalfiredata.org/
2	(INPE), National Institute for Space Research from Brazil	The occurrence of fire in vegetation is the theme of this portal, developed at INPE. It includes the operational monitoring of outbreaks of active fires and forest fires detected by satellites, and the calculation and prediction of vegetation fire risk, in addition to mapping scars in the burned areas. The data for America, Africa and Europe are updated automatically every day of the year. Access to information is free for anyone interested through maps, tables and graphs.	http://queimadas.dgi.inpe.br/queimadas/portal
3	Ministerio de Ciencia, Tecnología e Innovación Comisión Nacional de Actividades Espaciales de Argentina	Fire Risk Index Forecast: This fire index forecast, Forest Fire Danger Index (FFDI), is an operational implementation, at the regional level, of a meteorological index of fire risk based on the Australian system developed by McArthur. This implementation is an early warning tool for the prevention and management of forest fires for decision-makers. It is also a source of information for researchers in the academic environment since it allows the download of data.	https://www.argentina.gob.ar/ciencia/conae/aplicaciones-de-la-informacion-satelital/pronostico-de-indice-riesgo-de-incendio
4	Comisión Nacional de Actividades Espaciales de Argentina	UEAT is the CONAE unit in charge of Emergencies and Early Alerts including their Applications, where the term applications implies a wide range of contributions to users including: (i) Processing of data acquired by satellites and generation of value-added products used in environmental emergencies; (ii) Design of web-based geographic information systems; and (iii) Scenario modelling. Meteo-UEAT is a space dedicated to achieving accessibility to atmospheric and environmental information for users of the scientific community, emergency management and the general public.	http://meteo.caearte.conae.gov.ar/wrf/fuego.html
5	Viceministerio Defensa Civil – VIDECI de Bolivia	DEWETRA is a “multi-risk” forecasting and monitoring platform that is in charge of collecting and systematizing all the data registered in an automatic or manual way and of producing elaborations with added value: ground observations and forecasting models are integrated with data from vulnerability and exposure to produce risk scenarios in real time. The platform is currently used at the national level by civil protection authorities.	http://www.defensacivil.gob.bo/web/pagina/sistema-dewetra.html

No.	Tool	Objective	Link
6	Sistema Nacional de Información y Gestión Forestal de México	Forest Fire Hazard Prediction System of Mexico: It is a tool to support decision-making for the prevention and combat of forest fires in Mexico. The system makes it possible to evaluate the dry conditions of the fuel and the associated fire hazard in real time. It integrates meteorological variables in real time, vegetation maps and human factors (such as roads and towns) to show daily meteorological conditions of dry fuel, fire danger, and number of expected fires.	https://snigf.cnf.gob.mx/incendios-forestales/
7	Corporación Nacional Forestal (CONAF) de Chile	System that presents the daily situation of forest fires. As well as a national summary of relevant active fires and statistics accumulated to date. Includes the Probability of Ignition Index: indicator measured in percentage for the most critical hours of the afternoon. It is obtained from a matrix made with the afternoon solar radiation, the temperature and the humidity of the dead fine fuel. It also includes the Dead Fine Fuel Moisture Index: indicator that represents the moisture content in dead vegetation with a diameter less than 0.5 cm.	https://www.conaf.cl/situacion-nacional-de-incendios-forestales/ https://www.conaf.cl/incendios-forestales/combate-de-incendios-forestales/indice-de-probabilidad-de-ignicion/ https://www.conaf.cl/incendios-forestales/combate-de-incendios-forestales/indice-de-humedad-del-combustible-fino-muerto/

Further reading: MapBiomas initiative on the understanding of the land use dynamics in Brazil, mapbiomas.org/en

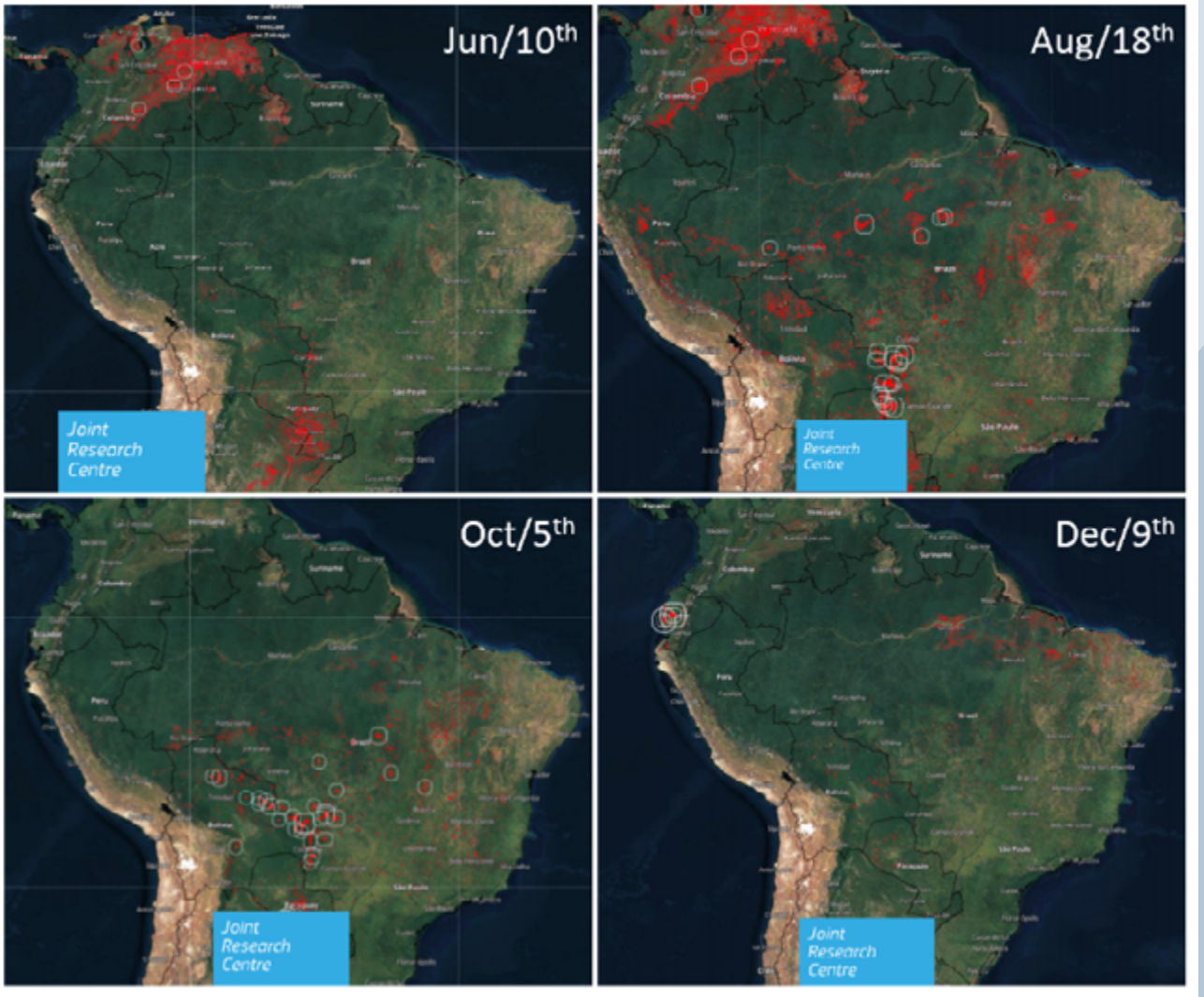
Annexes

Annex 1. Land cover affected by wildfires in Latin American countries, 2009-2019



Source: GWIS, 2020.

Annex 2. Maps of wildfires in the Amazon region in 2020



Source: GWIS, 2020 Amazon Weekly Reports.

Annex 3. UN Agencies Expertise-Experience on fire management

	UN Agencies	Expertise-Experience in the region	Expertise-Experience globally
REVIEW	WFP	Livelihoods and food security vulnerability, Risk and impact analysis	
	FAO	Reviews on legal and policy framework regarding use of fire and wildfires.	• Development of a systematic approach for fire management review and analysis that has been applied in Timor Leste, Sudan, Cambodia, Myanmar has been proposed for Iran and Jordan. The approach has been improved/adapted as experience is built up. • Development of some field data collection methods for assessing the fire management context at the local level through consultation with communities, focus groups and government and agency staff at local level. • Collaboration with the JRC of the EU for the design of Country Profiles that are now available as a valuable starting point for the key fire statistics including vegetation and land use. • An overall guidance document for review and analysis of fire management is being considered.
	UNDRR	• Alignment with national disaster risk reduction and risk management practices and policy frameworks evidence-base: historial and current data on hazardous wildfire events (losses and damages databases including localized events). • Evidence base analysis of the drought regional trends; wildfires could be one of the exacerbated effects of this hazard (GAR Special report on drought).	Analysis of the output of a Global Risk Model (GRM) that estimates the disaster risk associated with different kinds of hazards (including wildfires) faced by national economies throughout the world (GAR Atlas).

	UN Agencies	Expertise-Experience in the region	Expertise-Experience globally
REVIEW	UNDP	* Under the UN-REDD Programme, in collaboration with UNEP and FAO, UNDP supports governments to assess the main drivers of deforestation. This is a preliminary exercise that provides the basis for developing REDD+ National Strategies/Action Plans. Specific measures to address forest fires are included in those cases where fires were indentified and prioritized as a relevant driver of deforestation (Argentina, Chile, Costa Rica, Paraguay). * From a perspective of ecosystems-based adaptation, measures are identified to increase resiliency of ecosystem services towards climate change impacts (such as extended droughts and fires).	
	UNEP	* UNEP's GEO approach (https://www.unep.org/global-environment-outlook/findings-and-data/assessment-data-and-tools), through its causal framework methodology, can provide a better understanding of drivers, pressures and impacts concerning wildfire events in the region. A project proposal has already been presented on this matter. * At the request of national governments, UNEP is available to carry out post-disaster environmental assessments, based on fieldwork, laboratory analysis and state of-the-art technology, including the use of the Flash Environmental Assessment Tool (FEAT) that helps to identify existing or potential acute environmental impacts that pose risks to humans, human life-support functions and ecosystems, following sudden-onset disasters. In the region the tool has already been applied to a fire-related event in Paraguay, for instance.	* The initiative has so far published 6 versions of its Global Environmental Outlook, not to mention a couple of further country-, region- or theme-specific reports. * The Flash Environmental Assessment Tool (FEAT) has been developed by the National Institute for Public Health and the Environment of the Netherlands (RIVM) at the request of OCHA, and is supported by the UNEP/OCHA Joint Environment Unit (JEU).

	UN Agencies	Expertise-Experience in the region	Expertise-Experience globally
RISK REDUCTION	IOM	• Integration of migrants in disaster risk reduction using the MICIC guidelines. • Experience in MICIC training in various countries.	
	FAO	• Training on prescribed burning. • Alternatives for the use of fire, like conservation agriculture. • "In the Dominican Republic, FAO is providing technical support to UNDP for establishing a fire early warning system and for planning fire management and control. It ensures that integrated fire management (IFM) is applied to the target areas, including prescribed burning, supported by technical training and equipment.	• Training on mosaic burning. • All of the work FAO does on Analysis and Analysis creates the identification of the underlying causes of hazards and the opportunities to reduce the risks of damaging fires. The strategies, plans and tactics to reduce specific risks are then prepared with stakeholders.
	UNDRR	• Disaster risk knowledge evidence base, national multihazard DRR strategies, national databases on losses and damages.	• Specific guidance for wildfire hazard and risk. • Assessment, with key studies analysis (Words into Action Guidelines: National Disaster Risk Assessment).
	UNEP	• The REDD+ Programme can be an economically viable alternative to promote the preservation of natural ecosystem in the region, and thus reduce the risks of wildfire events	• The mechanism offers tools to tackle the advance of harmful practices and therefore mitigate fire risks (https://www.un-redd.org/post/reducing-global-wildfires-key-to-fighting-climate-change).
READINESS	FAO	• Training community based Fire management . • Equipment and building of watchtowers. • FAO is co-leading a CEOS Wildfire Pilot that is to conduct satellite systems inventories, suitability assessments and a present and future gap analysis for each phase of fire monitoring (pre-, active-, post-fire), with detailed user requirements for each application. Fire readiness across land holdings, backed by farm-level plans and technical support, including equipment. • Under a GEF proposal for Biodiversity Conservation and Agroecological Land Restoration in Productive Landscapes of Trinidad and Tobago. FAO will support Integrated wildfire management system development, that will include an initial focus on Review and Analysis to better understand the fire management context, its interaction with factors and influences that are enabling land degradation and biodiversity loss.	• FAO is co-lead of a CEOS Wildfire Pilot that is to conduct satellite systems inventories and suitability assessments, a present and future gap analysis for each phase of fire monitoring (pre-, active-, post-fire), and detailed user requirements for each application. This Pilot could interact with fire management and remote sensing agencies, as well as with the LAC region UN agencies interested in integrating the fire context in their stakeholder consultations. • In Indonesia FAO is undertaking a review of Fire Danger Rating Systems and preparing a report to be presented to the government and stakeholders to identify the current status, strengths, gaps and steps to address any needs identified by the stakeholders.

	UN Agencies	Expertise-Experience in the region	Expertise-Experience globally
READINESS	WMO	Under the WMO Global Atmosphere Watch (GAW) Programme, the WMO Southeast Asia Regional Centre and the Meteorological Service Singapore have started the implementation of a regional Vegetation Fire and Smoke Pollution Warning and Advisory System (VFSP-WAS): http://www.weather.gov.sg/vfsp-was/home	• WMO is developing the High-Impact Weather Project (HIWeather), including wildfires as one of the five hazards within its scope. In its "Readiness" component this research project works on improving capabilities to predict the propagation and impact of active fires, as well as fire risk. http://hiweather.net • Under the WMO Global Atmosphere Watch (GAW) Programme, WMO and partners developed a concept note for a Vegetation Fire and Smoke Pollution Warning and Advisory System (VFSP-WAS) containing the expert recommendations resulting from discussions at an international workshop on Forecasting Emissions from Vegetation Fires and their Impacts on Human Health and Security in South-East Asia. Arising from the keen interest of WMO Members in several impacted regions, the note provides guidance for addressing the issues of vegetation fire and smoke pollution. It also proposes the establishment of a VFSP–WAS to develop, implement and harmonize fire forecasting across the globe, providing a better picture of fires and related impacts and hazards everywhere, as well as supporting the potential foundation of regional centers on the topic. https://library.wmo.int/doc_num.php?explnum_id=4519
	UNDP	* Funding and support to implementation of fire prevention measures, including readiness activities, in the context of implementing REDD+ National Strategies (Costa Rica) (UNEP will do the same in Paraguay, and FAO in Argentina). * Integration of gender and safeguard considerations in forest fire programmes (Costa Rica).	

	UN Agencies	Expertise-Experience in the region	Expertise-Experience globally
RESPONSE	IOM	• Shelter management toolkit to facilitate the role of agencies supporting the shelter response for displaced populations. • Displacement Tracking Matrix to monitor the displacement of populations in disaster scenarios and assess their needs, implemented in various countries of the region.	
	WMO		As part of its "Response" component, the HIWeather project seeks to improve the early warning information that can provide emergency responses, and the communication and usability thereof. The delivery of such information is crucial for decisions on evacuations and fire fighting. http://hiweather.net
RESTORATION	FAO	Several projects working on restoration of fire-affected areas, including the GCF Results-Based Payment projects in Chile.	
	UNDRR	* Build Back Better in national policy frameworks and recovery planning. * DRR actions for recovery online with NAPs (with emphasis on nature-based solutions as a mitigation element for wildfires risk).	
	UNDP	Funding and support to implementation of forest restoration, in the context of implementing REDD+ National Strategies (e.g. Chile).	
	UNEP	The XXII Meeting of the Forum of Ministers of Environment of Latin America and the Caribbean agreed on an Action Plan for the Decade on Ecosystems Restoration agreed by the 33 countries of the region.	The United Nations Decade on Ecosystem Restoration is developed globally by UNEP and FAO to support governments and civil society and develop the appropriate skillsets for catalysing and successfully implementing restoration initiatives.

UN environment
United Nations Environment Programme

UNDRR
UN Office for Disaster Risk Reduction

WORLD METEOROLOGICAL ORGANIZATION

UNITED NATIONS ECLAC

International Labour Organization

IOM UN MIGRATION

OCHA
Office for the Coordination of Humanitarian Affairs

UNDP

UNESCO
United Nations Educational, Scientific and Cultural Organization

UNFPA

unicef

UNHCR
The UN Refugee Agenc

UNIDO

UNOPS

UN WOMEN
United Nations Entity for Gender Equality and the Empowerment of Women

WFP
World Food Programme

Pan American Health Organization

World Health Organization