EARTH POLICY INSTITUTE

Wildfires by Region: Observations and Future Prospects

Area	Observations	Future Prospects
WORLDWIDE		
	Around the world, somewhere between 75 million and 820 million hectares of land burn each year. The Intergovernmental Panel on Climate Change states that "climate variability is often the dominant factor affecting large wildfires" despite widespread management practices aimed at reducing flammable materials in forests. Wildfires (not including fires intentionally set to clear land) burn some 3–8 percent of total terrestrial net primary productivity annually, releasing on average 1.7–4.1 gigatons of carbon into the atmosphere.	Global warming will alter fire regimes. Climate models predict that higher temperatures and longer droughts will increase wildfire frequency, particularly in semi-arid regions. Higher rainfall in some areas could reduce fire frequency, though it could also foster more vegetation, thus providing more fuel for fires. Lightning, an important ignition source, is thought to increase in a warmer climate, and more-intense rainstorms could exacerbate post-fire runoff and landslides. Fire is expected to grow as a source of carbon dioxide.
AFRICA		
Sub-Saharan Africa	Some 54 percent of all fires occur in Africa, with hotspots in Northern Angola and the southern Democratic Republic of the Congo, as well as southern Sudan and the Central African Republic. In these areas, grasslands and fields (which have largely replaced the tropical forests that were deforested decades ago) burn more readily, prohibiting forest regrowth.	Increased fires are predicted as temperatures rise in the Sahel and southern Africa. Places affected by desertification will likely see fewer fires because of lack of vegetation to burn.
Tropical Africa	An estimated 70 percent of all forest fires occur in the tropics, with half of these in Africa. Recent El Niño events may have expanded the area burned in tropical Africa.	Some models forecast reduced fire frequency in tropical Africa because of the regional wetter conditions projected with increased global temperatures.
EUROPE		
Northern, Central, and Eastern Europe	Over much of the continent, fire frequency has been decreasing, in part due to increased suppression efforts, contributing to the carbon land sink. However, some areas have started to see a change in fire patterns. Between 1965 and 1998, for instance, England and Wales have had warmer and drier summers and more fires.	For Central and Eastern Europe, summer precipitation is projected to decline, increasing water stress. "Catastrophic" peatland fires are projected to occur more frequently during dry years. Fire danger is likely to rise, though less than in Southern Europe.
Southern / Mediterranean Europe	Large swaths of forests have burned during recent droughts and heat waves. During the record 2003 heatwave, fires consumed some 650,000 hectares of forest, mostly in the south. This hot and dry year was a record in terms of fire area but not incidence. More than 5 percent of Portugal's forest area burned, four times the 1980-2004 average, resulting in economic damages exceeding 1 billion euros. Between 2000 and 2006 an average of 50,000 fires burned each year across the Mediterranean region, compared with 30,000 per year in the 1980s.	High temperatures and drought are projected, along with an increase in the frequency of wildfires. Hot and dry summers like 2003 are likely to become more common in a warmer world; some scenarios project that by 2080 such conditions could arise every other year. For a 1.0–2.8 degrees Celsius rise in temperature above preindustrial levels, most areas will experience an 8–20 percent increase in fire risk periods lasting a week or more. Fire season across the Mediterranean region is expected to lengthen by a month, and fires are predicted to occur more frequently, changing forest ecosystems to scrubland.

ASIA		
Northern Asia	Over the last decade some 12,000–38,000 fires have burned each year in Asia's boreal forests, affecting up to 3 million hectares. Higher temperatures in Siberian peatlands and increased human activity are tied to an increase in fires (with 20 million hectares burned in 2003 alone). In Mongolia, the temperature has risen by 1.5 degrees Celsius, and springtime precipitation has fallen by 17 percent over the last 60 years. Over the last 50 years forest and steppe fires have occurred more frequently and have burned larger areas.	Climate change is likely to increase the frequency and extent of forest fires, leading to the release of more carbon to the atmosphere.
Himalayas and the Tibetan Plateau	While dry-season fires set for agricultural purposes are common, fires in Nepal in late 2008 and early 2009 became unusually severe because they followed a record dry spell of nearly six months with no precipitation.	Fire risk in high elevation areas, like the Tibetan Plateau, is projected to increase at higher global temperatures (with changes becoming more pronounced at increases of more than 3 degrees Celsius above preindustrial levels). Reduced snow and ice coverage will facilitate the spread of fires.
Southeast Asia	The severity and extent of forest fires has increased over the last two decades, associated with intensification of land use on top of higher temperatures and less rainfall. Some 3 million hectares of peatland has burned over the past decade. Some of the most extreme forest fires in recent history burned in Indonesia, the Philippines, and Laos during a major drought associated with the 1997–98 El Niño. These fires mostly were lit by people to clear land, but they spread rapidly because of the extremely dry conditions. In Indonesia alone the fires led to $9 billion in economic losses, including health damage from the smoke, and, according to NASA, "released as many greenhouse gases as all the cars and power plants in Europe emit in an entire year."	Global warming could bring more rainfall to this region, but it is uncertain whether this would outweigh the heightened fire risk from increased temperatures. It is possible that El Niño-type events could increase in frequency and duration in a warmer world, multiplying the conditions that made the 1997–98 fires so severe.
OCEANIA		
Australia	Australia's natural vegetation is fire prone, with some areas burning each year. Severe fires are closely linked with droughts and higher temperatures, often associated with El Niño–Southern Oscillation and Indian Ocean Dipole events. In the latter half of the twentieth century, Australia saw a trend toward higher temperatures, longer heat waves, and more dry periods. Drought has persisted for more than a decade in southeastern Australia, setting the stage for catastrophic fires. In February 2009, more than 400,000 hectares in Victoria burned in the country's worst "natural" disaster in over a century, killing more than 170 people, tens of thousands of livestock, and more than 1 million native animals and destroying more than 2,000 homes. In southwestern Australia the woodland area burned over the last 7 years accounts for more than half of the total 4.5 million hectares burned in the past 36 years.	Drought, heat waves, and fire are projected to increase with high certainty. Fire danger is likely to increase because of shorter intervals between fires, increased fire intensity, more rapid fire spread, and fewer fire extinguishments. Southeastern Australia, where much of the population resides, is likely to see the occurrence of extreme fire risk days increase by up to 65 percent by 2020 and up to 300 percent by 2050. Indian Ocean Dipole events, which are tied to lower rainfall and higher temperatures that lead to higher bushfire risk, are also predicted to increase with global warming.

NORTH AMERICA		
United States overall	Since 1980, some 2.2 million hectares have burned each year, almost double the 1920 to 1980 average. The area burned per fire has also risen.	Distinct regional wildfire seasons could start to blur into a year-round phenomenon throughout the United States. More fires could encourage savannas to take over forested areas.
Western United States	Across the western United States the annual wildfire season has lengthened by 78 days in the last 15 years compared with the previous 15 years, in association with higher temperatures and reduced snowpack. The increase has been the greatest at higher elevations in the Northern Rockies, areas where fire regimes are less likely to have been altered directly by people.	The U.S. Forest Service projects that a 1.6-degree Celsius rise in summer could double wildfire area in 11 western states.
Alaska and Western Canada	Tundra is burning more frequently. Between the 1960s and 1990s, the total area burned in the North American boreal region increased by a factor of 2.5 while the area burned by human-ignited fires did not change. Some of the worst fires on record have come since 2000. With higher temperatures and drought in the 1990s, damaging insects have extended their range into new territory, leaving trees more vulnerable to fire.	With warmer temperatures the trends of higher temperature, drought, and insect outbreaks are predicted to worsen. Fire may accelerate ecosystem change between taiga and tundra. By the end of the century, the area burned in parts of Canada's circumboreal forest could double, and fire occurrence could increase by 50 percent. For Alaska, the area burned could double by mid-century and triple or quadruple by 2100.
LATIN AMERICA		
South and Central America	Fire has traditionally been used to clear land, but fires can spread out of control during droughts. During the 1997–98 El Niño more than 20 million hectares across Latin America burned, resulting in damages of up to $15 billion.	More frequent wildfires are likely in much of South America, increasing by some 60 percent with a temperature increase of more than 3 degrees Celsius.
Amazonia	While the tropical rainforest is typically extremely difficult to ignite, tropical forest fires are becoming more common, extending beyond traditional land clearing. Drought is a major factor: some one third of Amazon forests were at risk of fire during the 2001 El Niño–Southern Oscillation period. Subsequent droughts in 2005 and 2007 brought major fires to the southern Amazon.	The higher temperatures and more frequent and longer lasting droughts projected with global warming could subject much of the Amazon to fire vulnerability, setting off a self-reinforcing cycle if major fires release hundreds of millions of tons of greenhouse gases into the atmosphere. Fire could accelerate the transition of forests to savanna.

Compiled by Janet Larsen, Earth Policy Institute, www.earthpolicy.org, November 2009.
Sources include the Intergovernmental Panel on Climate Change. Full citations available on request.