FutureDirections international

INDEPENDENT STRATEGIC ANALYSIS OF AUSTRALIA'S GLOBAL INTERESTS

Strategic Analysis Paper

24 September 2020

Wildfires, Greenhouse Gas Emissions and Climate Change

Christopher Johns
Research Analyst, Northern and Regional Australia Research Programme

Key Points

- Until 2019 national greenhouse gas emission inventories did not include wildfires as they were considered carbon neutral over time.
- Recent evidence indicates that as much as 10 per cent of wildfire produced carbon remains in the atmosphere, contributing to global warming.
- Even in circumstances where carbon sequestering does achieve balanced levels, for around seven months of the year the carbon released by wildfires still contributes to the total amount of greenhouse gas in the atmosphere.
- There is a growing body of evidence suggesting that, as the planet warms, wildfires are becoming more frequent and more intense.
- While measures to curb industrial greenhouse gas emissions have proved difficult and divisive, reductions achieved by the control of wildfires have been largely ignored and may provide a less controversial way of contributing greenhouse gas reductions.

Summary

Until recently, carbon released into the atmosphere from wildfires was not considered a significant component of atmospheric greenhouse gas (GHG). It was assumed that over the climatic cycle this carbon would be sequestered back into vegetative re-growth. In Australia this may well be the case. A recent report released by the Australian Government Department of Industry, Science, Energy and Resources concluded that based on existing evidence, "… bushfires release significant amounts of carbon dioxide, but generally recover over time, generating a significant carbon sink in the years following the fire."

Globally, however, a growing body of evidence now suggests that carbon produced by wildfires is making a significant contribution to the volume of GHG in the atmosphere in both the short and long

term. In the future, atmospheric carbon estimates should include wildfires as a significant GHG source and effort to reduce atmospheric carbon must include measures to curb wildfires.

Analysis

Introduction

In 2019 the United Nations Intergovernmental Panel on Climate Change (IPCC) released Refinement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Under the accounting provisions of 2006 and the Kyoto Protocols of 1997, GHG emissions from wildfires were deemed to be neutral over time and therefore not accounted for. The refinements, however, acknowledge that given the increased frequency and intensity of recent wildfires globally, they may be contributing to atmospheric GHG. Countries can now report two GHG inventories – net emissions with, and net emissions without application of natural disturbance provision (including wildfires).

In Australia wildfires may well be GHG emission neutral over time. A recent report released by the Australian Government Department of Industry, Science, Energy and Resources concluded that based on existing evidence, "… bushfires release significant amounts of carbon dioxide, but generally recover over time, generating a significant carbon sink in the years following the fire." The Report found that:

- The 2019-20 bushfires will have negligible impact on Australia's progress towards its 2020 or 2030 target.
- Bushfires release significant amounts of carbon dioxide, but generally recover over time, generating a significant carbon sink in the years following the fire.
- Under the natural disturbances provision, the Government reports the long-run trend in carbon stock change in the forests, reflecting the balance of the carbon lost in the fire and that re-absorbed by regrowth.

This may not be the case, however, with International wildfire events particularly in Africa and North and South America. Some research estimates that as much as 10 percent of carbon produced by wildfires may remain in the atmosphere where it contributes to climate change.

Greenhouse Gas

The principle cause of human induced climate change is the release of GHG into the atmosphere, largely from the burning of fossil fuels. This process was brought about by the industrial revolution and has increased exponentially with developments in technology and the spread of industrialisation. Perhaps, not surprisingly, efforts to curb the burning of fossil fuels to reduce atmospheric GHG have been largely unsuccessful. The considerable achievements of the United Nations Framework Convention on Climate Change notwithstanding, coordinated controls and reduction targets appear to be beyond the capacity of the international community at this time. Industrialised nations with highly developed capitalist economies depended upon growth driven by consumerism. Developing nations with large workforces and markets defend with vigour their right to pursue the lifestyles of the nations who were once seen as their exploiters. It is not surprising, therefore, that other sources of GHG have not received similar consideration. One significant source of GHG that, until recently,

has been overlooked in GHG emission calculations has been the carbon dioxide produced by wildfires and recent scientific research suggests this exclusion may have been a mistake.

Wildfires

Definitions of wildfires differ slightly but they are commonly defined as "**a fire that burns quickly and uncontrolled in areas of grass, bush or woodland**". The most common cause of wildfires is lightning strike. A wildfire can also be deliberately lit if it is not appropriately authorised as in the case of arson or, if control of an authorised fire, is lost. In Australia wildfires are often referred to as bushfires, a general term that refers to the woodland fires that occur in the southeast of the nation and the savannah fires of more northern regions. It is important to differentiate wildfires from the deliberate burning of stubble following the harvesting of crops and from the use of fire as a land management practice as often attributed to Australian Aboriginal culture. Under this definition, wildfires would not include the use of fire for land clearance for agriculture, as has occurred on a huge scale in South America, Africa and Asia. This practice is believed to have contributed significantly to climate change both in the direct production of GHG and in the loss of natural capacity to draw carbon back out of the atmosphere by forests. For a graphic depiction of global fire activity since the year 2000, refer to the NASA Earth Observatory link:

linkhttp://earthobservatory.nasa.gov/GlobalMaps/view.php?d1=MOD14A1_M_FIRE

For millennia fire has been a feature of the natural environment. An equilibrium existed whereby the quantity of CO_2 released into the atmosphere by burning and the quantity stored in plant material by photosynthesis remained neutral. In 1997, when the Kyoto protocols set rules for the international accounting of GHG emissions, it was assumed that much of the GHG produced by wildfires, such as CO_2, would be recycled back into vegetation as regrowth and did not significantly contribute to global warming. Accordingly, the Australian Greenhouse Office's National Greenhouse Gas Inventory estimates that the accountable, greenhouse gas emissions from wildfires contributed less than 2% of Australia's total emissions as only methane and nitrous oxide, and not CO_2, were considered.

This view, while appropriately conservative in the context of the Kyoto protocols in 1997, now still understates the importance of wildfire related GHG emission in two ways. Firstly, CO_2 released into the atmosphere by wildfires can remain there for a period of approximately seven months before it is re-captured by photosynthesis. During this time it will contribute to the warming of the planet. Secondly, and most importantly, there is compelling evidence from a number of sources that the incidence and intensity of wildfires is increasing. Research from the United States indicates that wildfires "are getting bigger, more destructive, and more expensive"[1]. A recent report by the US Union of Concerned Scientists stated "as the world warms, we can expect more seasons with higher wildfire potential, … seasons are projected to lengthen, with the Southwest's [of the United States] season of fire potential lengthening from seven months to all year long. Additionally, wildfires themselves are likely to be more severe".

Similarly, a 2014 report submitted to the IPCC, recommended wildfire emissions of CO_2 be integrated into future climate change models as the body of scientific evidence against wildfires being neutral for CO_2 GHG emissions grows. Current research indicates that even in environments where

[1] Bonnicksen, Thomas M. Texas AM University, 2009.

significant regrowth is able to occur, some 10 per cent of CO_2 is remaining in the atmosphere after sequestration. This figure is almost certainly a conservative assessment. Globally, forested areas are being burnt more regularly and are unable to sequester as much CO_2 as they have in the past. Wildfires may now, or may become, an amplifier of global warming. Higher temperatures create conditions where wildfires are more likely for longer periods and will burn with greater intensity with less capacity for regeneration of vegetation. The resultant CO_2 emissions contribute to higher temperatures and the cycle continues.

Wildfire GHG emissions vary significantly depending upon the intensity and the fuel burnt. The savannah fires of northern Australia differ greatly from woodland fires of the southeast of the country. Woodland fires are often categorised as either crown or surface fires. Crown fires are characterised by their large size and high-intensity that take out all the above-ground living material. Surface fires burn with mixed-intensity and typically burn forests with low, moderate, and high-severity burn patches. For this reason it is difficult to make accurate calculations of the quantities of CO_2 produced by a specific wildfire. This variation notwithstanding, the contribution of wildfires to Australia's greenhouse gas emission calculations, even at the lower estimates, remain significant as illustrated by the following analysis:

- Wildfires burn on average 30 million hectares per year but, on occasion, may burn up to 120 million hectares.
- Wildfires emit between 5 and 30 tonnes of carbon per hectare.
- This would be a total of between 150 and 900 million tonnes of carbon in an average year and, on occasion, between 600 and 3600 tonnes of carbon a year.
- Australia's industrial GHG emissions average 155 million tonnes of carbon per year[2].
- In an average year (30 million hectares), wildfire emissions would range from slightly less than industrial emissions (150 vs. 155 million tonnes) to 6 times that of industrial emissions.
- In an exceptional year, when 120 million hectares are burnt, wildfire emissions would range from 4 to 23 times industrial emissions.

When this calculation is applied globally, the proportion of wildfire to industrial production carbon is reduced but remains significant:

- It is estimated that annually between 350 and 450 million hectares of forest and grassland are burnt by wildfires[3].
- As stated above, wildfires emit between 5 and 30 tonnes of carbon per hectare; therefore, annually wildfires globally will produce between 1.75 and 13.5 billion metric tonnes of carbon.
- In 2012, 35.425 billion metric tonnes of CO_2 were produced from industrial sources[4] or 9.668 billion metric tonnes of carbon.
- Note: 3.664 million tonnes of CO_2 equals 1 million tonnes of carbon.

[2] This figure does not include aircraft and shipping emissions or emissions from fossil fuels exported to countries with development status.
[3] Power, Lauren. 2013. *Global Wildfires, Carbon Emissions and the Changing Climate*. FDI SAP 22 November 2013.
[4] http://www.globalcarbonatlas.org/?q=emissions

These figures clearly demonstrate the potential for significant reduction of GHG emissions by reducing the incidence of wildfires. Any measures that reduce the release of CO_2 and other greenhouse gases into the atmosphere will result in an improvement in the greenhouse gas budget[5].
One option for reducing wildfires may be to restore the former natural ecological grazing that limited fuel levels and fire impacts up to 20,000 years ago and helped regenerate unique resilient bio-systems[6]. Changing land-management techniques in savannah and scrubland could dramatically decrease the risk of large, carbon emitting fires, reducing the global GHG burden[7].
In summary, the control and reduction of wildfires is significant to the GHG equation for three reasons:

- Globally, wildfires will produce huge volumes of GHG which, from the most conservative estimates, will remain in the atmosphere for seven months contributing to global warming.
- The theory that the CO_2 produced by wildfires is ultimately GHG neutral is no longer correct. Global warming has created conditions where wildfires are becoming more intense and more frequent, producing greater volumes of CO_2 in the atmosphere, while reducing regrowth and hence the capacity to sequester carbon back into vegetation.
- By preventing wildfires, and enhancing the growth of stable vegetation, carbon is drawn out of the atmosphere and stored organically by photosynthesis and actively reduces GHG in the atmosphere.

As IPCC Assessment Report 5 states, the concentration of greenhouse gases in the atmosphere has increased to levels unprecedented on earth in 800,000 years. Future surface temperatures will largely be determined by cumulative CO_2, which means climate change will continue even if CO_2 emissions are stopped. Therefore, if the effect of climate change is to be avoided, there is a need not only to stop producing CO_2 at current rates but also reduce the levels of CO_2 currently in the atmosphere.

*****

Published by Future Directions International Pty Ltd.
80 Birdwood Parade, Dalkeith WA 6009, Australia.
Tel: +61 8 9389 9831 Fax: +61 8 9389 8803
E-mail: info@futuredirections.org.au Web: www.futuredirections.org.au

[5] http://www.savanna.org.au/
[6] Jehne, Walter. 2014. *The Role of Wildfires in the Ecology of the Australian Landscape and its Regeneration.* FDI Associate Paper 9 April 2014.
[7] Power, Lauren. 2013. *Global Wildfires, Carbon Emissions and the Changing Climate*. FDI SAP 22 November 2013.