The maths and facts behind the Australian savanna

Adapted from *Culture, Ecology and Economy of Fire Management in North Australian Savannas*; by Jeremy Russell-Smith, Peter Whitehead, Peter Cooke, CSIRO Publishing, 2009

How much of Australia is affected by fire? Many of us living in southern Australia probably believe that we 'southerners' have to endure a large number of bushfires each year. But if we look at what percentage of land is affected by bushfires across Australia we can see that the south experiences a very low number of bushfires compared to the north. The three main regions of Australia that are affected by fire each year are:

- 0.6% of southern Australia
- 5% of central Australia
- 23% of northern Australia

How much of the Northern Territory burns?
Between April 2002 and March 2003, fires affected 28.6% of the Northern Territory. These figures include an exceptionally large area of fire in arid central Australia in 2002. In total, 210,000 km2 of the Northern Territory's tropical savannas region is affected by fire in an average burning year.

How many people?
The tropical savanna goes across northern Australia and takes up 26% of Australia's land mass. In 2006, 495,000 people lived across northern Australia. Many of these live in cities and major urban centres. In the rural areas outside the cities there is only one person for every 7 km2.

How many Aboriginal and Torres Strait Islander peoples?
18.7% of people in northern Australia are Aboriginal and Torres Strait Islander peoples. There is a greater proportion of Aboriginal and Torres Strait Islander peoples outside the major centres. For example, in the Kimberley, nearly half of the population is Aboriginal; in the Northern Territory savannas outside Darwin, it is more than 70%; and in very remote regions it can be more than 90%. All in all, about 19% of the tropical savannas region is presently owned or managed by the traditional custodians.

How many Aboriginal and Torres Strait Islander languages?
The Aboriginal and Torres Strait Islander groups (nations) across northern Australia have about 20 language families.

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How much income?

In 2006 an estimate of income for different industries in the tropical savanna was:

- Mining of minerals (excluding coal) - $6 billion
- Cattle grazing - $1.4 billion
- Tourism and fishing - $2 billion

Percentage of tropical savanna greenhouse gas emissions?

Approximately 3% of Australia's greenhouse gas emissions result from savanna fires.

Greenhouse gas reductions

In 2008 Professor Ross Garnaut prepared one of the most important climate reports for the Australian government, the Garnaut Climate Change Review. In this report Garnaut estimated that the savanna agricultural emissions from northern Australia could be reduced by 50%.

How have the Earth's greenhouse gases increased?

Gas	1750	Now	Percentage increase
Carbon dioxide	280ppm	390.5ppm	39.5%
Methane	700ppb	1871ppb	16.7%
Nitrous oxide	270ppb	323ppb	19.6%

ppm = parts per million (how many atoms or molecules per million atoms and molecules)
ppb = parts per billion (how many atoms or molecules per billion atoms and molecules)

CO_2-e of greenhouse gases

The CO_2-e is the carbon dioxide equivalent for greenhouse gases. Other greenhouse gases are measured against the warming properties of CO_2 in the atmosphere.

Gas	CO2-e
Carbon dioxide	1
Methane	25
Nitrous oxide	298
CFC-12	10900
HCFC-22	1810
Tetrafluoromethane	11200
Sulfur hexafluoride (SF6)	22800

The formula to calculate the amount of nitrous oxide and other nitrous gases is:

And for N_2O and NO_x is:

$$E_{ij} = EF_{ij} A_j^! P_j \sum_k (FL_{jk} BEF_{jk} CC_{jk} NC_{jk}) M_i$$

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Australia's biomass fires

All of Australia's bush (also called biomass) fires contribute about 6-8% of global carbon emissions from biomass fires.

What are the predicted climate changes for northern Australia in 2030?

Predicted climate changes for northern Australia by 2030 due to greenhouse gases are:

- 1 degree increase in temperature
- More days with temperatures higher than 35 degrees
- Increased evaporation resulting in the country drying out faster
- No large changes in the amount of rainfall
- Greater chance of damaging cyclones and heavy rains
- Lightning occurs more often.

Damaging cyclones

In 2006, Cyclone Monica knocked over more than 50% of trees in 700 km2 of savanna forest and woodland in Arnhem Land.

Weeds and burning

Gamba grass is an introduced tall grass from West Africa originally planted as cattle feed. It can reach 4-5 metres in height and have a standing biomass of up to about 30 tonne per hectare (about 5-7 times that of the native grasses). When it is that tall and thick, Gamba grass burns much hotter than native grasses.

Impacts on native flora and fauna

Fires in the tropical savanna are already thought to be responsible for the mainland extinction of at least one animal: a small wallaby called a mala. We can expect further hot burns to have a negative impact on other native plants and animals.

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References

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Table 12.2: A comparison of emission factors from fires in savannas in Australia, Brazil, and southern Africa and forest fire in southern Australia. Northern Australian savanna1 CO_2 CO CH_4 0.87 0.078 0.0035 Southern Australian forest2 0.85 0.091 0.0054 Brazilian cerrado3 0.94 0.05 0.002 1: Hurst et al. 1994a; 2: Hurst et al. 1996; 3: Ward et al. 1992; 4: Ward et al. 1996 Southern African savanna4 0.93 0.065 0.00375

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Formula for greenhouse gases