"Challenges and solutions for sustainable fire management in Australia's fire-prone northern savannas"

Submission prepared for
Parliament of Australia: Senate Select Committee on Agricultural and Related Industries

"Inquiry into Bushfires in Australia"

July 2009

by

Tropical Savannas Management Cooperative Research Centre

and the

North Australian Indigenous Land & Sea Management Alliance (NAILSMA)
Representing land and sea management policy and research interests of the Balkanu Cape York Development Corporation, Carpentaria Land Council, Kimberley Land Council, and Northern Land Council

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29 July 2009

1. Background

Despite recurring periodic bushfire disasters in more densely populated southern Australia, research undertaken under the auspices of the Tropical Savannas Management Cooperative Research Centre (TSCRC) since the mid 1990s has clearly established that annually recurrent fire is a particularly northern Australian savannas problem. On the basis of continental mapping of large fire-affected areas (> ~2–4 km^2) for the period 1997–2004, it has been observed that 76% of national mean fire extent (508 000 km^2 p.a.) occurred in the northern savannas[1]. Expressed as a proportion of continental land area defined by rainfall classes: a mean of 0.6% of southern Australia (53% of continental land area) was affected by fire each year; 5% of central Australia (25% of continent); and 23% of northern Australia (22% of continent). These general patterns are reflected also in updated (1997–2007) continental mapping of the frequency of large fires (Fig. 1).

A critical salient feature of contemporary savanna fire regimes concerns the predominance of fires occurring in the latter part of the seven month dry season typically under severe fire weather conditions (periodically strong south-easterly winds, high temperatures, low humidities and fully cured fuels). For example, of the annual mean 351 000 km^2 of the tropical savannas region affected by large fires over the period 1997–2007, 67% occurred in the late dry season months of August–November. Fire regimes dominated by frequent, large, late dry season fires are commonplace in many regions of northern Australia, especially the Kimberley region in the north-west, the Top End of the Northern Territory, and western Cape York Peninsula (Figure 1). Contemporary north Australian fire regimes are recognised as having significant impacts on regional communities and economies, respiratory health, biodiversity and pastoral production values, soil erosion[2], and globally significant implications for greenhouse gas emission estimates and related carbon dynamics[3].

These impacts are influenced and often exacerbated by human actions. A particular problem arises from the introduction of exotic plant species that dramatically increase fuel loads and have high weed potential. Gamba (*Andropogon gayanus*) and mission grass (*Pennisetum polystachion*) were introduced to increase pasture production in northern Australia but have now both become weeds. Gamba establishes dense monocultures which cure later in the season and burn with more than eight times the intensity of than native species.[4] In addition to having a profound impact on native landscapes, this weed also threatens the lives of firefighters and the people and property they seek to protect. With the potential to spread to 380,000 km^2 of the Northern Territory alone[5], the effective management of these grassy weeds will be a key focus of future wildfire risk mitigation in northern Australia.

Gamba grass has now been declared a weed in all three north Australian jurisdictions in the last two years. Nevertheless extant infestations cover large areas of the Darwin rural area and Cape York and are now recognised as a major threat to life, property and the environment as well as dramatically increasing the costs of fire management. Unless considerable direct action is taken in the immediate future to eradicate

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[1] Russell-Smith (*et al.*) 2007, 'Bushfires down under: patterns and implications of Australian landscape burning', *International Journal of Wildland Fire* **16**: 361-377.

[2] Dyer *et al.* (2002) 'Savanna burning: understanding and using fire in northern Australia'. (Tropical Savannas Cooperative Research Centre: Darwin); Ellis *et al.* (2004) 'National Inquiry on Bushfire Mitigation and Management'. (Commonwealth of Australia: Canberra) (http://www.coag.gov.au/); Johnston *et al.* (2002) Exposure to bushfire smoke and asthma: an ecological study. *The Medical Journal of Australia* **176**, 535–538; Russell-Smith *et al.* (2009) 'Culture, ecology and economy of savanna fire management in northern Australia: rekindling the *Wurrk* tradition'. (CSIRO Publications: Melbourne); Woinarski *et al.* (2007) 'The nature of northern Australia: natural values, ecological processes and future prospects'. (Australian National University Press: Canberra);

[3] Kondo *et al.* (2003) Effects of biomass burning and lightning on atmospheric chemistry over Australia and South-east Asia. *International Journal of Wildland Fire* **12**, 271-281; Shirai *et al.* (2001) Emission estimates of selected volatile organic compounds from tropical savanna burning in northern Australia. *Journal of Geophysical Research—Atmospheres*, **108**(D3), 8406 ff.

[4] Rossiter *et al.* (2003) Testing the grass-fire cycle: exotic grass invasion in the tropical savannas of northern Australia. *Diversity and Distributions* **9**, 169-176; Rossiter-Rachor *et al.* (2008) *Andropogon gayanus* (gamba grass) invasion increases fire-mediated nitrogen losses in the tropical savannas of northern Australia. *Ecosystems* **11**, 77-88.

[5] Douglas & Setterfield (2005) Impacts of exotic tropical grasses: lessons from gamba grass in the Northern Territory. In: *8th Queensland Weed Symposium Proceedings*. (ed W. Vogler), pp 69-73. Queensland Weeds Society, Brisbane.

this pernicious grass, the potential for spread will threaten not only fire management, but the sustainable occupation and exploitation of northern Australia generally. Both the increasingly densely occupied urban rural fringes of the larger centres and the remote districts will be severely impacted upon by the spread gamba. Its impact on savanna burning greenhouse emissions projects are potentially catastrophic.

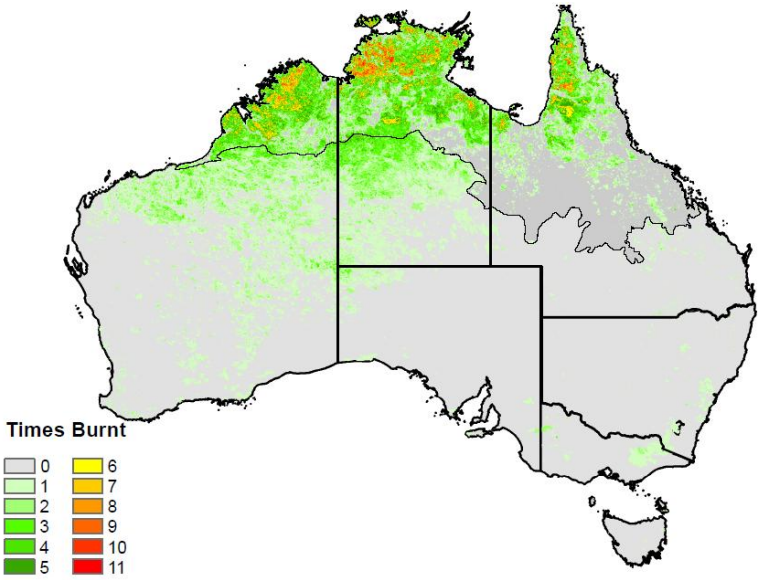


Figure 1: Frequency of large fire-affected areas (>~2–4 km²) derived from AVHRR imagery, 1997–2007. North of the line indicates the tropical savannas region as defined by the Tropical Savannas Management Cooperative Research Centre.

The purpose of this submission is to:

(1) draw attention to the significance of the contemporary impacts of bushfires in the fire-prone savannas of northern Australia, especially since those issues typically are overlooked by southern-centric boards of inquiry;

(2) highlight the particular requirements of addressing ecologically, economically and culturally sustainable fire management for remote northern Australian stakeholders, especially the Indigenous (Aboriginal) community;

(3) highlight the significant opportunities derived from, and the substantial work already undertaken towards, developing sustainable fire management enterprises for remote Indigenous communities through savanna burning greenhouse gas (GHG) emissions abatement projects; and importantly

(4) to inform, and seek the support of the Senate, towards the ongoing development of sustainable fire management initiatives across northern Australia.

2. Sustainable fire management for the tropical savannas—understanding the social demographic and land use context

By way of introduction, to understand the nature and context of fire management issues confronting the tropical savannas it is useful first to consider pertinent regional socio-demographic and land use characteristics. Our focus here is particularly concerned with Indigenous socio-demographic and land use issues since, as described below, that sector of the population comprises (a) a major and fast-growing proportion of the northern population outside of urban centres, and (b) holds very substantial interests in land. Importantly, and as detailed in sections following, the development of market-based opportunities through the delivery of GHG emissions abatement projects has significant and particular potential for providing culturally appropriate economic and employment opportunities for disadvantaged remote Indigenous communities.

The section below is taken from parts of the introductory chapter by Russell-Smith, Whitehead, Cooke & Yates in the forthcoming book, *Culture, ecology and economy of savanna fire management in northern Australia: rekindling the* Wurrk *tradition*, due to be published by CSIRO Publications in September 2009. Citations included in that text are included here—but, for full references, the reader is referred to the original chapter.

Social fabric: A comprehensive statement of the social and economic character of the savannas [is difficult to collate since] most routinely produced demographic and socioeconomic data are presented to jurisdictional or regional boundaries that do not align with biophysical domains. The outline we present here is therefore based on a number of individual studies and one-off estimates made over the last few years.

The human population of the savannas is relatively small (495 000 in 2006), widely dispersed and 18.7% Indigenous. Average population density of 0.29 persons.km^{-2} is low by Australian (2.5 persons.km^{-2}) and global standards, and lower still away from major centres. Excluding the larger centres of Darwin and Townsville, there is 1 person for each 700 ha (0.14 persons.km^{-2}). By any standard, the tropical savannas of Australia are sparsely inhabited (Taylor *et al.* 2006) and the scope to marshal human resources for intensive land management correspondingly weak.

The proportion of the population that is Indigenous is much greater outside the major centres. In the Kimberley, nearly half of the population is Indigenous; in the Northern Territory savannas outside Darwin, it is more than 70%; and in very remote regions generally, more than 90%. Nationally, 45.4% of the population living in areas classified by the Australian Bureau of Statistics as very remote is Indigenous (Taylor 2006). In the Northern Territory, most indigenous people (70%) live on lands held under Aboriginal communal title (Taylor 2003). As highlighted by Taylor (2006), this means that Indigenous people and their institutions predominate over most of the Australian land mass, and the northern savannas in particular. The closeness and durability of association between people and place, and connected obligations to land and dependence on it, are recognised in use of terms like "on country" and "caring for country" to indicate much more than location.

The savanna population is growing, with an increase of 8% between the 1996 and 2001 Censuses. The rate of increase is higher among the Indigenous population, which grew by 14.9% compared with 6.5% in the non-Indigenous community. Non-Indigenous population growth is confined largely to the major centres. Projections to 2021 see a continuation of higher rates of growth in the Indigenous population (25.7%) over this period than the non-Indigenous population (14.8%) (Taylor *et al.* 2006).

At regional scales, rates of population growth are highly variable, both through time and by location: being strongly influenced by shifts in immigration and emigration of non-Indigenous people tracking employment and other economic opportunities. Sites of high local Indigenous population growth are often poorly matched to areas of likely job growth (Taylor 2003).

Morbidity and mortality rates are unacceptably high among the Indigenous population, and proving resistant to simple correction (Burgess *et al.* 2005; SCRGSP 2003). Educational systems have broken down in many remote areas, so that many Indigenous people suffer from poor literacy and numeracy and experience difficulty in taking advantage of any mainstream employment opportunities that may be available in the regions (Collins 1999).

Compounding this educational deficit, the savanna is subject to other knowledge deficits. The formal scientific understanding of regional environments and natural resources is weaker than in more densely settled jurisdictions because of historical and contemporary limitations on technical capacity and research investment. Our understanding of regional human demography is limited by dependence on Census data aggregated to inappropriate boundaries limits. Regional economies are weakly characterised and their dynamics poorly understood.

In contrast to these formal knowledge deficits, many Indigenous people have very detailed knowledge of the landscapes and resources for which they are responsible, but mechanisms for applying this and other local knowledge are poorly developed and often contested (see e.g. Brook and McLachlan 2005; Gilchrist *et al.* 2005).

Land use: The great majority of the northern savanna is used ostensibly for pastoral production, especially the grazing of cattle (*Bos taurus* and *Bos indicus*), and also sheep in parts of western Queensland (Figure 2). Most of this land is leasehold; that is, leased from state and Northern Territory governments. Despite the very small area used for mining purposes, such land use constitutes by far the greatest economic return to the regional economy.

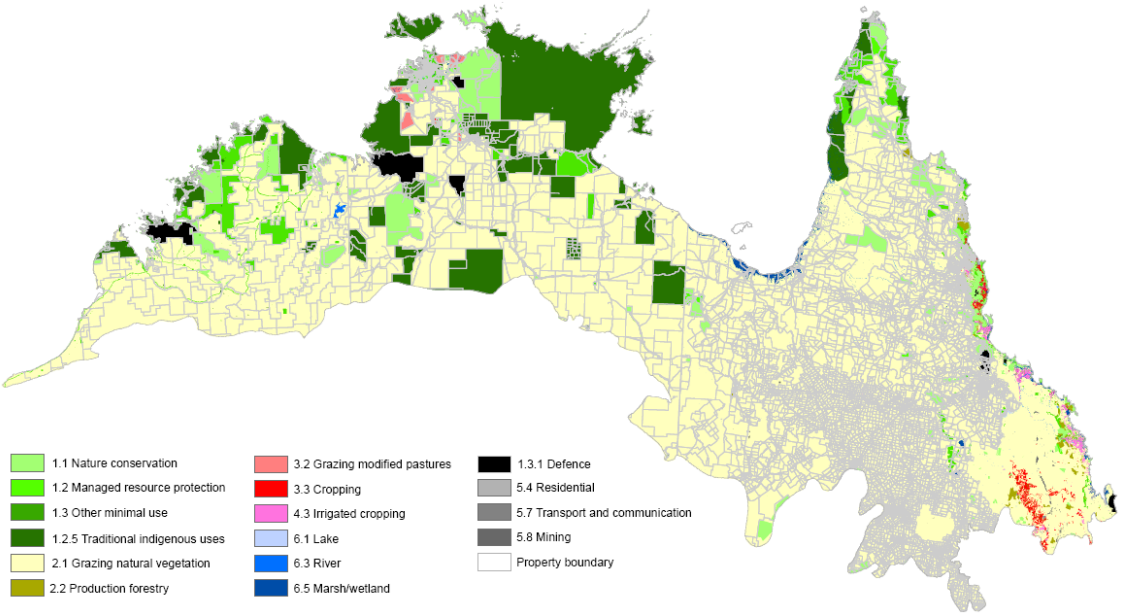


Figure 2: Generalised land use (Commonwealth of Australia 2007)

The predominance of Indigenous people living outside the major towns and associated rapid population growth is reflected increasingly in changing patterns of legal ownership of, and interests in, land. Recent available data indicate that around 19% of the tropical savannas region is presently owned or managed by Indigenous people (Figure 3a): ranging from 35% of savannas in the Northern Territory, to 6% in Queensland. Additionally, Indigenous interests in land – as expressed through determinations of and applications made for Native Title under the Commonwealth of Australia's *Native Title Act 1993* – indicate that, as of May 2007: determinations of Native Title have been granted for a further 7%, predominantly in Western Australia (Figure 3b); and Registered or Scheduled Native Title applications (i.e. still to be determined) cover more than 50% of the tropical savannas region, ranging from 41% of Western Australian savannas to 59% in Queensland (Figure 3c).

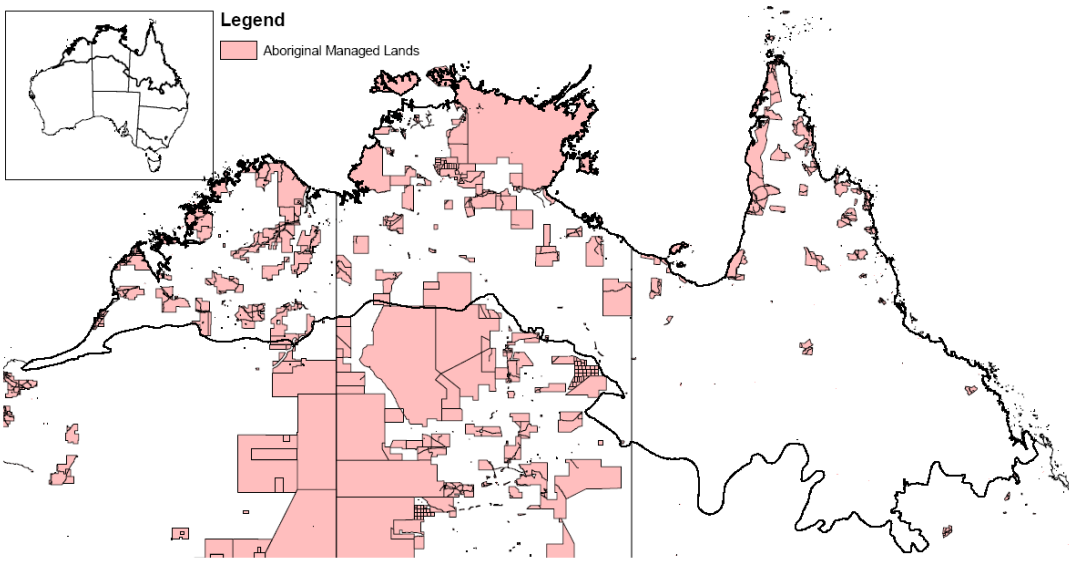
These facts are in part responsible for actions initiated by the Australian and Northern Territory governments in particular. The Australian government's "Intervention" into Northern Territory Aboriginal communities has faced the stark reality of low levels of infrastructure while the Northern Territory Government's "Working Future's" strategy seeks to establish 'normal' levels of infrastructure at 20 regional communities across the Territory. These infrastructure projects have some potential to lead to improved fire management at the regional level. In the shorter term however they will themselves be threatened by the presence of an annual wildfire regime in regions with no current fire management capacity.

Summary: These observations, although sketchy and incomplete, illustrate some important features of land and resource management in northern Australia. Low human population density and weak infrastructure compromise capacity to manage pervasive damaging processes such as wildfire that require active intervention to manage their impacts (Whitehead 1999; Whitehead et al. 2002). However, the north Australian jurisdictions have historically found it hard to fund interventions demanding coordinated action over large areas, because their funding sources and models for allocating funds are often based on population.

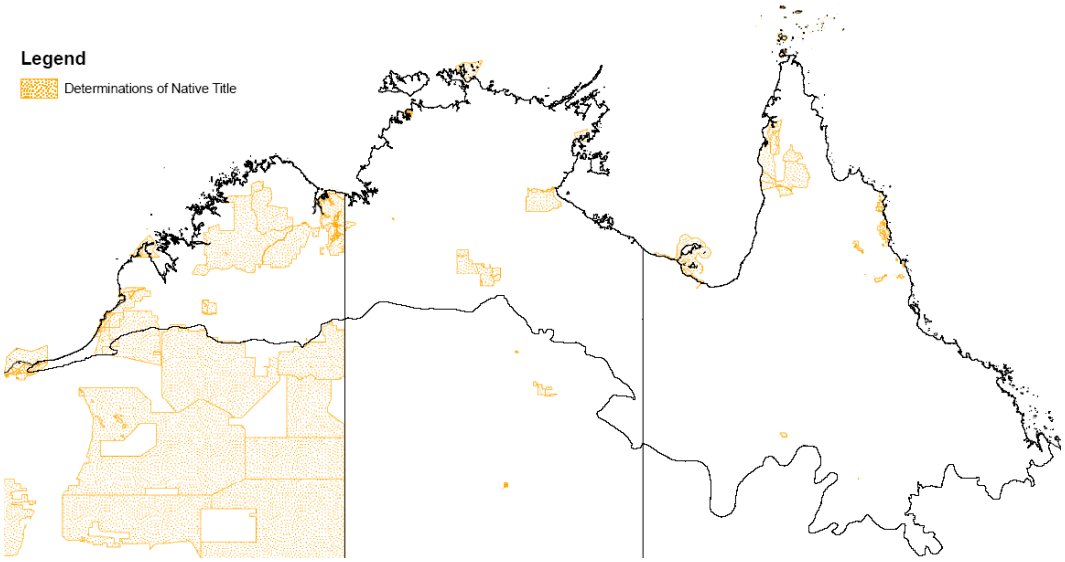
Mainstream economic developments are rarely capable of complementing or substituting for government intervention. Developments such as mines are patchy in space and time and local or regional interests often find it difficult to connect to them. Immigrants responding successfully to development opportunities may stay for relatively short periods and export benefits as savings. As a consequence, the economic and related social benefits and environmental costs of savanna development can be inequitably distributed, with many Indigenous people remaining severely disadvantaged, especially in the regions, and despite being 'land rich'. Disadvantage for Indigenous people is compounded because distinct 'cultural' values may not be easily communicated and so receive inadequate consideration in areas subject to development. In most parts of the savannas, it is possible to identify people with particular ties to, and obligations to care for, sites subject to development. It is nearly always necessary to deal with complex cross-cultural issues and competing interests. Despite the sparseness of population, there is no *terra nullius*.

Figure 3: Current status of Aboriginal interest in land.

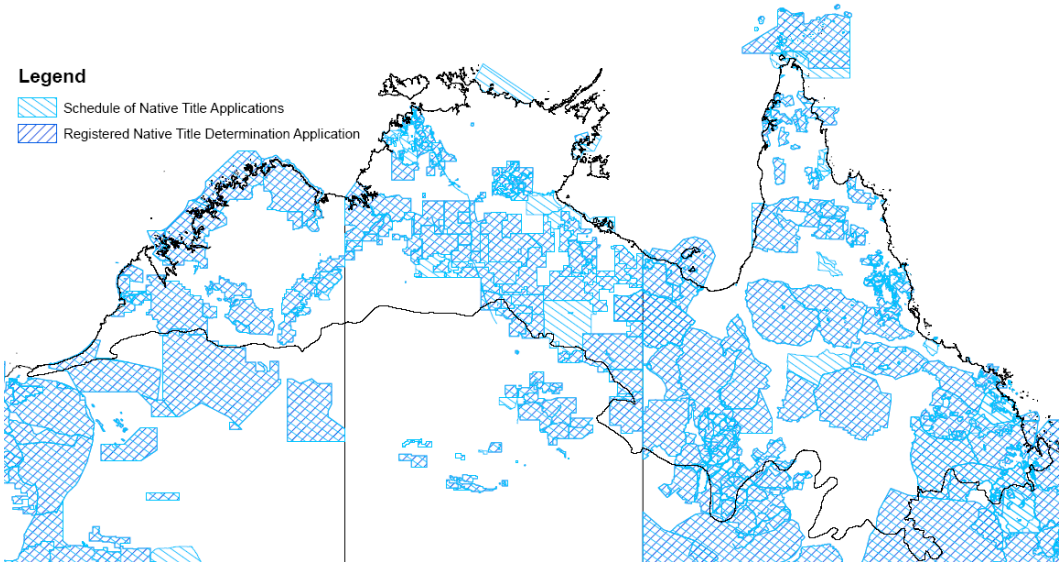
(a) Aboriginal-owned or managed lands (Source: Indigenous Land Corporation. 2008)



(b) Determinations of Native Title (Source: National Native Title Tribunal, version 1.16. May 2007)



(c) Native Title Applications (Source: National Native Title Tribunal, version 1.16. May 2007)



3. Savanna burning and GHG emissions from northern Australia

Contributions from savanna burning to Australia's NGGI amount to ~1-3% annually, depending on the magnitude of respective fire seasons. Recent assessment of the extent of burning derived from satellite imagery shows that, over the period 1997-2004, an average of approximately 370,000 km^2 (19%) of the 1.9 M km^2 tropical savannas was burnt annually, mostly under severe late dry season (Aug-Nov) conditions (Figure 4). This comprises ~70% of national fire extent over the same period. In annually reliable high rainfall (generally >900 mm) savanna regions, available fuel accumulation (mostly grass, litter) is sufficient to carry fire on an annual basis—human ignition patterns are the main drivers of recurrent fire extent. With declining rainfall, and associated decreasing annual reliability, antecedent rainfall accumulation over a number of growing seasons becomes increasingly important[6].

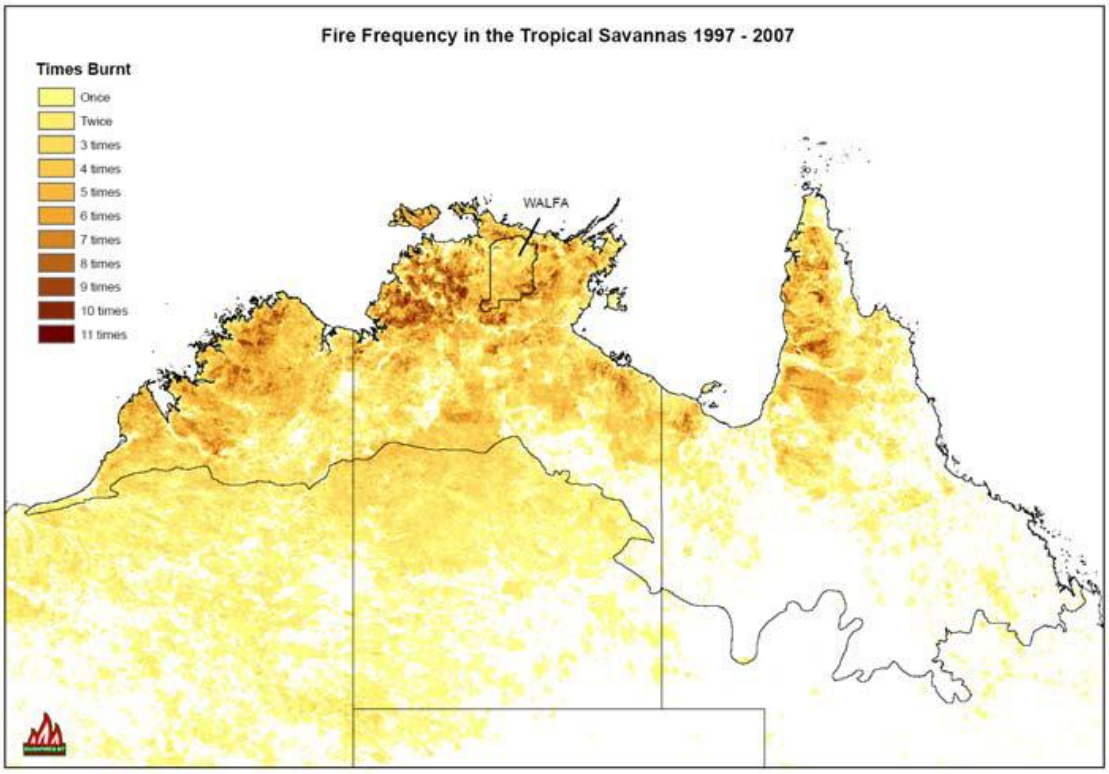


Figure 4: Fire frequency in the tropical savannas, with fire mapping derived from coarse resolution (~1 km^2 pixels) AVHRR imagery. Tropical savannas region north of line, derived from IBRA regionalisation.

The seasonality of savanna fire extent by jurisdiction is given below in Figure 5. These fire mapping data are derived from MODIS imagery (pixel size 250 m X 250 m), averaged for the period 2004-2007. The early dry season (EDS) is defined here as comprising the months Jan-July. The late dry season (LDS) comprises the months Aug-Dec. The figure clearly illustrates the current predominance of LDS fires across the savannas.

[6] Meyer (2004) 'Establishing a consistent time-series of greenhouse gas emission estimates from savanna burning in Australia.' Report to the Australian Greenhouse Office, Canberra. (CSIRO: Melbourne); Russell-Smith (*et al.*) 2007, 'Bushfires down under: patterns and implications of Australian landscape burning', *International Journal of Wildland Fire* **16**: 361-377.

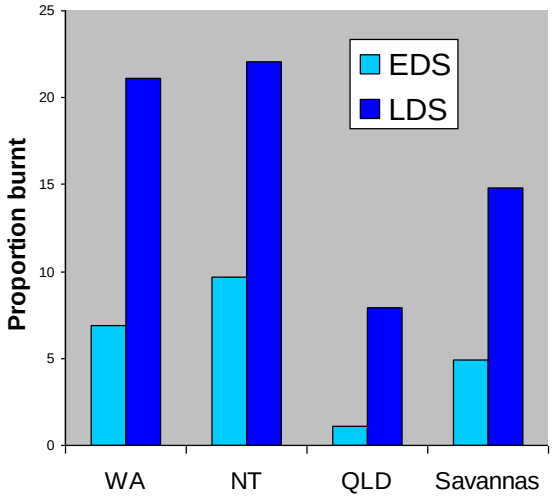


Figure 5: Seasonal extent of burning by jurisdiction, 2004-2007, for 1.9M km² tropical savannas region, derived from MODIS satellite imagery

Taking these same fire extent data, and applying the current NGGI GHG accounting methodology[7] modified for seasonality[8], we can estimate that total GHG emissions for the four-year assessment period were 12.2 Mt CO_2-e p.a., with ~80% contributed in the LDS period (Figure 6). More than half the GHG emissions from savanna burning emanate from the NT.

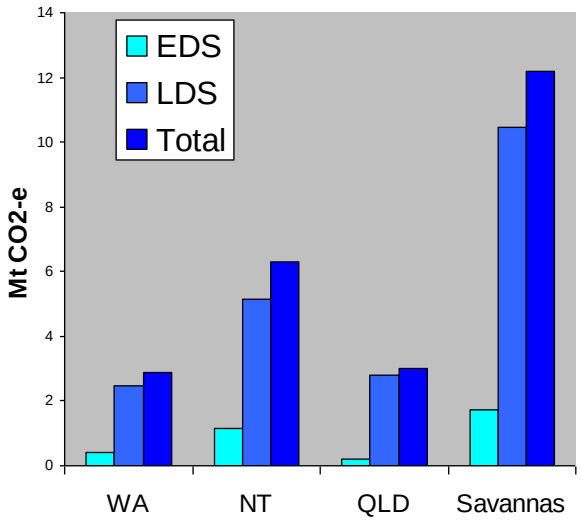


Figure 6: Seasonal extent of GHG emissions from savanna burning by jurisdiction, 2004-2007, for 1.9M km² tropical savannas region

3.1 GHG emissions from savanna burning

Fire is a dominant conservation and land management issue for the Australian tropical savannas. Reliable monsoonal (summer) rainfall and sustained high temperatures drive periods of rapid plant growth

[7] AGO (2007) 'Australian methodology for the estimation of greenhouse emissions and sinks 2005—Agriculture.' (Australian Greenhouse Office Canberra), available at http://www.greenhouse.gov.au/inventory/methodology/pubs/methodology-agriculture2005.pdf

[8] Russell-Smith *et al.* (2009) Improving estimates of savanna burning emissions for greenhouse accounting in northern Australia: limitations, challenges, applications. *International Journal of Wildland Fire* **18:** 1-18.

alternating with intense seasonal droughts of more than 6 months when no rain falls, evaporation rates are high and grasses cure rapidly. This regular annual cycle of several months of rapid fuel production, followed quickly by an equivalent or longer period of dry, often windy conditions that favour ignitions and fire spread, make the grassy savannas extraordinarily fire prone.

Carbon is removed from the atmosphere in rapidly growing grasses in the wet season and then much of it is released rapidly when oxidised by burning in the dry season. For the purposes of carbon accounting, the resultant annual pulse in emissions of carbon dioxide (CO_2) from burning is treated as being entirely re-captured in the next cycle of rapid growth. Savanna burning is assumed to cause no net CO_2 imbalance over timescales relevant to behaviour of the atmosphere. However, some other potent greenhouse gases (GHG) produced in biomass burning, including methane (CH_4) and nitrous oxide (N_20), have persistent effects, because equivalent volumes of these greenhouse-effective gases are not so directly returned to plants or otherwise removed rapidly from the atmosphere.

We note however, that, although CO_2 emissions from savanna burning (together with more reactive species—the ozone precursors comprising CO, volatile organic compounds and oxides of nitrogen) are excluded from national accounts of direct greenhouse gases, such emissions over a typically long burning season are likely to have a substantial impact on regional atmospheric composition, and its inter-annual variability. For example, it has been estimated that such CO_2 emissions amounted to a mean annual 218 Mt $CO_{2\text{-}e}$ over the period 1997-2004 for the 1.9 M km^2 tropical savannas region—equivalent to 38.5% of Australian net greenhouse emissions for 2004[9]. Furthermore, emissions abatement achieved through savanna burning can result in very substantial sequestration of carbon in living biomass over a century timescale[10]. Thus, current limitations in Australian and international greenhouse accounting rules substantially mask the global significance of this GHG emissions source.

Fire intensities vary markedly with season, being relatively mild and spatially patchy early in the dry season, when air temperatures are relatively lower and fuels retain some moisture. Little coarser woody fuel is consumed in most early dry season fires. But fires burn more fiercely in the late dry season, when ambient air temperatures are higher and moisture levels lower. As a consequence, more coarse fuels are consumed. Large, smouldering stems produce much higher volumes of CH_4 and N_2O than do rapidly combusted fine, mostly grassy fuels. Recent and ongoing studies demonstrate that seasonal emissions of CH_4 and N_2O are unlikely to be more concentrated in smoke plumes from fires early in the dry season compared with late season fires.

This seasonal variation in amount of GHG emissions production with timing of fire is critical, because it provides options to intervene in fire regimes in greenhouse-relevant ways. Strategic early burning helps reduce the total area and total biomass burnt, as well as the proportion of woody fuels burned, by reducing the incidence, rate of spread and extent of late dry season wildfires. Savanna fire abatement projects seek to reduce GHG emissions to the atmosphere over a specified time period, rather than to increase capture and storage (sequestration) outside the atmosphere. Partial decoupling of emissions and carbon storage occurs because fuel that is not consumed quickly by fire is removed by chiefly invertebrate consumers whose metabolic products are taken up by soils instead of being immediately released to the atmosphere[11].

It is important to appreciate that a savanna fire abatement project differs substantially and essentially from forestry-style sequestration projects established under different provisions of the Kyoto Protocol. No sequestration is involved; rather, accredited abatement projects operate against a pre-project baseline.

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[9] Russell-Smith (*et al.*) 2007, 'Bushfires down under: patterns and implications of Australian landscape burning', *International Journal of Wildland Fire* **16**: 361-377.

[10] Murphy *et al.* (2009) Fire management and woody biomass carbon stocks in mesic savannas. In: Russell-Smith *et al.* (2009) 'Culture, ecology and economy of savanna fire management in northern Australia: rekindling the *Wurrk* tradition'. (CSIRO Publications: Melbourne)

[11] Cook & Meyer (2009) Fire, fuels and greenhouse gases. In: Russell-Smith *et al.* (2009) 'Culture, ecology and economy of savanna fire management in northern Australia: rekindling the *Wurrk* tradition'. (CSIRO Publications: Melbourne)

Emissions abatement may be achieved *annually* against that baseline, both through reduction in the overall area (hence amount of fuels burnt), and also by shifting the intensity / seasonality of burning (also reducing amount of fuels burnt) through the undertaking of strategic management practices (e.g. prescribed burning of strategic firebreaks; prescribed burning earlier in the year to implement more patchy, more low intensity fires).

3.2 Western Arnhem Land Fire Abatement model and accounting methodology

The Western Arnhem Land Fire Abatement (WALFA) project has been developed since 1996 to address chronic fire management problems in Aboriginal-owned, high biodiversity savanna landscapes of western Arnhem Land. In particular, the essential problem has involved extensive impact of annual wildfires occurring late in the seven month dry season period; over the ten-year pre-project baseline period (see below) the 28,000 km^2 WALFA region was burnt ~40% on average, with 32% of this annual average occurring in the late dry season. Nearly the entire amount of this burning has been attributable to human (anthropogenic) ignitions. In the case of WALFA, such fire management practice (burning throughout the year, typically under prescribed conditions) was undertaken extensively by Aboriginal people before societal collapse and associated abandonment of traditional practices with the advent of European settlement.

To reduce emissions of greenhouse gases, key objectives of the project have been to (a) substantially increase the extent of early season burning using strategically prescribed fires, so as to (b) manage for and limit the extent of late season fires, and (c) thereby reduce overall both the area and amount of fuels which are burnt. In the four years of operation (2005-2008) of the project, WALFA partners have abated (reduced) GHG emissions by 600,000 t CO_2-e relative to the established ten-year project baseline (1995-2004). Such figures translate to reduction of GHG emissions by 40% over the three years of project operation.

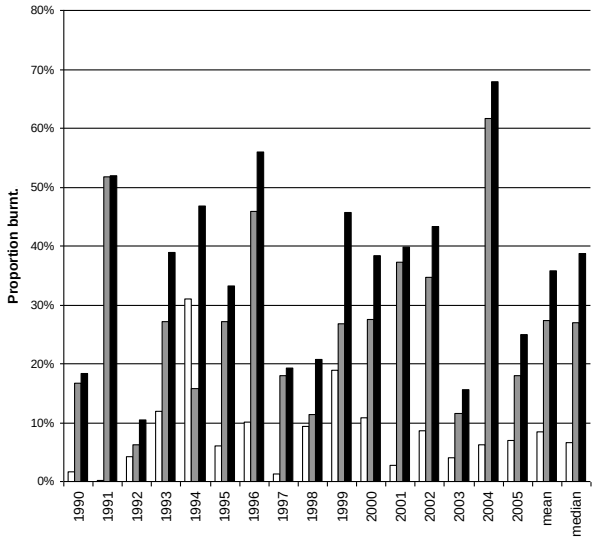

Figure 7: Fire extent in the WALFA region1990-2005, by season, where fire extent for early dry season (Apr-July) = clear bars, late dry season (Aug-Dec) = grey bars, annual = black bars. Mean and median values also shown.

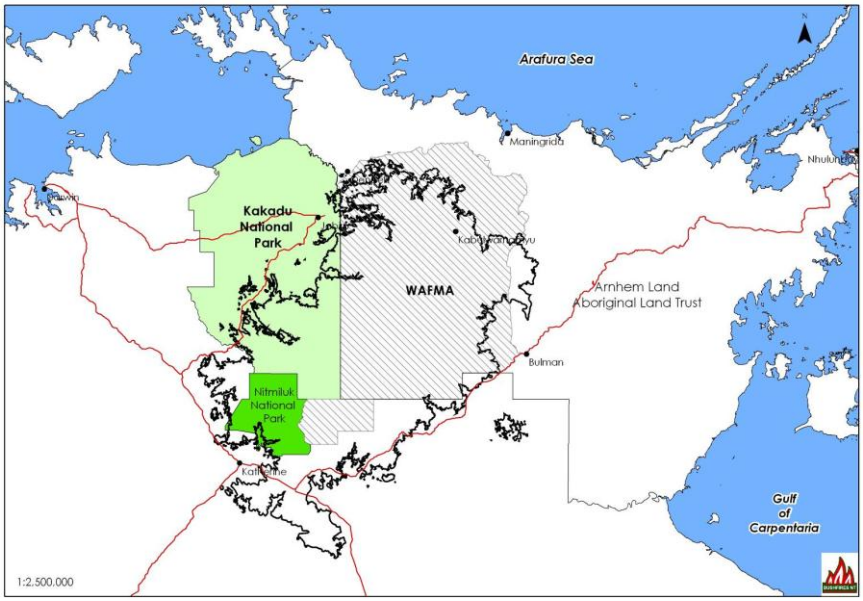

Figure 8: Location of West Arnhem Fire Management project in relation to Kakadu and Nitmiluk National Parks, and Arnhem Land generally. Note that WALFA refers to the project area, whereas WAFMA refers to the formal agreement between the NTGovt, ConocoPhillips, and Indigenous parties

These above figures are informed by a GHG accounting methodology developed by WALFA partners since 2000, derived substantially from accepted methodological procedures established under guidelines developed by the Intergovernmental Panel on Climate Change[12], and as incorporated in Australia's National Greenhouse Gas Inventory (NGGI). In fact, earlier WALFA research results are incorporated directly into current NGGI methodology. In brief, that methodology establishes annual GHG emissions from defined regions (e.g. the tropical savannas, QLD, individual properties or regions) as:

- the product of the area burnt (derived from satellite mapping of fire-scars, but typically at very coarse scale) X the assumed fuel load X a term which accounts for the amount of fuel actually consumed; and
- the product of the mass of fuel consumed (from the previous equation) X standard emission factors (concentrations) for CH_4 and N_2O from combusted fuels to estimate the amounts of GHGs emitted. Finally, the GHG potential of these two gases is converted to CO_2 equivalents using formulae based on the strength of their greenhouse activity and persistence in the atmosphere.

Research by WALFA partners has substantially refined that methodology, most significantly through the explicit incorporation of terms for fire seasonality and severity[13]. That research establishes that, on average, GHG emissions from early season fires are slightly less than half those from late season wildfires. Other refinements have included (a) fine-scale (derived from Landsat satellite imagery) mapping of fire-scars, (b) fine-scale mapping of regional vegetation / fuel types, (c) detailed assessments of the accumulation of different fuel types (e.g. grass, litter, woody debris) with time-since-fire, (d) detailed assessments of fire patchiness and fuel combusted, with season and fire severity.

Importantly, the refined WALFA savanna burning methodology sets out a robust and reliable project-level GHG accounting framework which can be applied to other fire-prone savanna landscapes in relatively high rainfall areas of northern Australia. Specific project-level research tasks include:

- developing a fine-scale ten-year pre-project fire history baseline;
- developing refined vegetation / fuel type mapping;

[12] IPCC (1997) 'Revised 1996 Intergovernmental Panel on Climate Change (IPCC) guidelines for national greenhouse gas inventories.' 3 vols. (IPCC/OECD/IEA: Paris, France)

[13] Russell-Smith *et al.* (2009) Improving estimates of savanna burning emissions for greenhouse accounting in northern Australia: limitations, challenges, applications. *International Journal of Wildland Fire* **18:** 1-18.

- validating / refining fuel accumulation parameters for respective fuel types;
- validating / refining fire patchiness and combustion parameters for respective fuel types, with respect to season and fire severity; and
- assembling and integrating above data sets, along with pertinent emission factor parameters, within a relational GIS framework, for GHG monitoring and accounting purposes

3.3 New savanna burning emissions abatement opportunities

Building on the experience of WALFA, and under the Commonwealth Government's *Indigenous Economic Development Strategy* policy commitment to assist Indigenous people engage with and development carbon market opportunities, NAILSMA partners are in the process of developing four new landscape-scale emissions abatement projects in the north Kimberley, central Arnhem Land, Gulf region, and western Cape York. While the actual boundaries of these project regions are subject to ongoing discussion and negotiation, their current preliminary configurations are given in Figure 9. Each of these new project areas involves / concerns substantial Aboriginal land holdings and interests-in-land (e.g. resolved and unresolved Native Title claims).

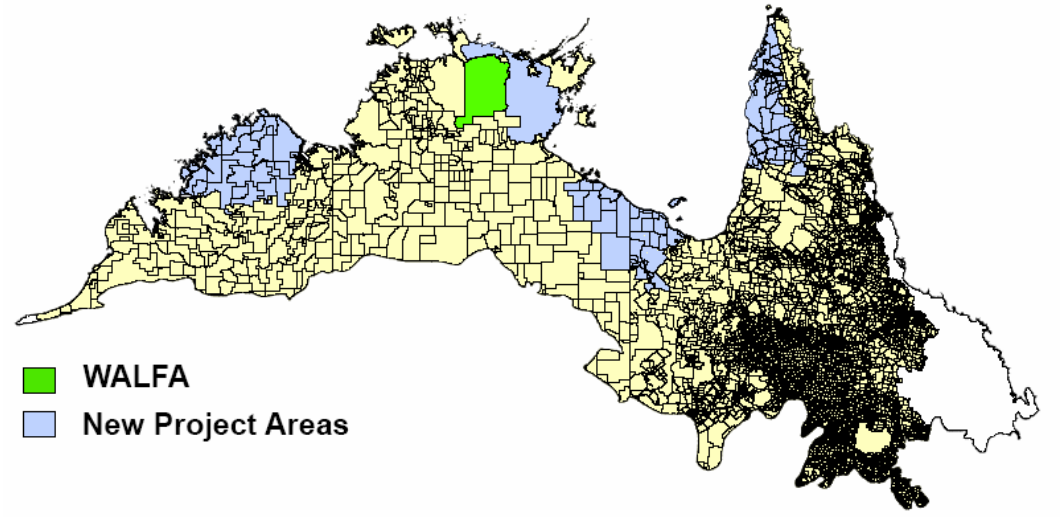

Figure 9: Location of new savanna burning emission abatement projects – note that boundaries of proposed new projects are indicative only and require much further negotiation.

4. Mixed messages—Government policy and opportunities for engagement of Indigenous fire managers with markets

The current Australian Government has signalled its intention to assist Indigenous economic involvement in savanna burning opportunities in two policy initiatives. In both instances these messages have been disjointed and confusing.

4.1 Indigenous economic development strategy

Prior to the last Federal election, the Labor Party committed to supporting development of an "Indigenous emissions trading program". That commitment included providing opportunities "for Indigenous participation in fledgling carbon markets by establishing the legal framework for creation of carbon credits for altered fire regimes and providing $10 million to build local capacity, build partnerships between the private sector and Indigenous communities, research its scientific and market potential and promote sales to growing national and international markets".[14] Subsequently, the Australian Government (principally through the Department of Environment, Water, Heritage & the Arts) has negotiated with the North Australian Indigenous Land & Sea Management Alliance (NAILSMA)[15] to implement an R&D program for addressing the above issues as these relate to savanna burning. The agreed program includes the following elements:

- ***establish a sustainable institutional foundation*** under the NAILSMA partnership for promoting culturally appropriate Indigenous engagement with, and developing Indigenous business opportunities arising from, emerging carbon and related markets specifically focusing on GHG emissions abatement from savanna burning
- ***coordinate and conduct research into aspects of policy, legal, marketing and governance frameworks*** which will inform both the active participation of Indigenous stakeholders in emerging carbon-related opportunities, as well as providing a north Australian Indigenous perspective in the development of state/territory, national and international carbon and GHG policy agendas
- with support from national (e.g. CSIRO), regional (e.g. Tropical Savannas Management Cooperative Research Centre) and state-based research institutions, ***coordinate and support the undertaking of key biophysical research activities required for developing robust savanna-scale monitoring and accounting frameworks***, particularly those involving remote sensing approaches for undertaking automated fire extent and severity mapping, and atmospheric emissions estimation
- in collaboration with regional Indigenous partners and building on the commercial precedent established with the Western Arnhem Land Fire Abatement (WALFA) project, ***support project capacity building and research activities associated with the undertaking and formal accreditation of at least four new landscape-scale fire abatement projects,*** namely in fire-prone regions of western Cape York Peninsula, the NT-QLD border region of the Gulf of Carpentaria, central Arnhem Land, and north Kimberley
- ***coordinate and support the undertaking of allied socio-economic-cultural and biodiversity benchmarking activities*** associated with above regional projects, as means both for establishing robust monitoring criteria as well as developing complementary economic benefits (e.g. cultural and biodiversity credits; targeted institutional support)

On March 20 this year, Ministers Garrett and Wong released a joint press release[16] signalling that "*the Rudd Government will invest up to $10 million to support participation by Indigenous communities in potential carbon markets….*"*This initiative will look at carbon market opportunities arising from traditional fire management in northern Australia," Minister Garrett said*." Some months later the NAILSMA partners were informed, without any prior discussion or negotiation, that the funding available would be now $7.8 million. This unilateral reduction was made despite the original costing of the research program, as submitted to the then Labor

[14] Labor Party *Indigenous Economic Development Strategy* pre-election policy announcement of 5 October 2007, Joint Statement by Peter Garrett MP, Jenny Macklin MP, Warren Snowdon MP

[15] NAILSMA represents the land and sea management policy and research interests of the Balkanu Cape York Development Corporation, Carpentaria Land Council, Kimberley Land Council, and Northern Land Council

[16] Joint Ministerial Press Release: http://www.environment.gov.au/administer/garrett/2009/mr20090320a.html

Opposition prior to the last election, being substantially more than the $10 million announced in the March press release. The Senate will appreciate the consternation such 'policy-on-the-run' has been met with by Indigenous and research partners, and the ongoing disarray this has caused to coherent research program planning.

4.2 Carbon Pollution Reduction Scheme (CPRS)

Similar confusion has surrounded the treatment of savanna burning as part of the Government's proposed CPRS. Despite assurances given in Labor's *Indigenous Economic Development Strategy*, and repeated statements in CPRS Green[17] and White[18] paper documents, the Department of Climate Change has, to date, consistently failed to undertake any substantive engagement or consultation with Indigenous stakeholders and partners. While we are informed that such consultations are planned, this situation has led to misunderstandings on the part of Indigenous stakeholders and partners as to the real intent of how the DCC proposes to treat savanna burning in the CPRS.

In the Green paper, the Commonwealth indicated that it was unlikely that emissions from savanna burning would ever be included in the CPRS along with other agriculture emissions. Elsewhere in the same document it notes that "[i]t would also be difficult to cover emissions from savanna burning because the complexity of property rights for Indigenous lands would make it difficult to identify single commercial entities that could take on scheme obligations for those emissions." [19] In the White paper document it notes also that "scientific and methodological issues still had to be resolved".[20] While recognising the legitimacy of the latter statement[21], recent communication with a senior DCC official arising out of a recent critical newspaper column in the Canberra Times[22], indicates that, contrary to statements which appear in the Green and White papers, the Government intends, subject, to the resolution of technical matters, to consider the inclusion of savanna burning as an offset to covered (polluting) sectors of the CPRS! We are still awaiting formal written advice from the DCC as to the Government's real policy intent with respect to the treatment of savanna burning in the proposed CPRS. Apparently also, the Government has accepted that supposed issues concerning 'the complexity of property rights' are no longer tenable—presumably in accord with arguments submitted by the TSCRC to the Joint Standing Committee on Treaties [23].

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[17] e.g. Department of Climate Change 2008, Carbon Pollution Reduction Scheme Green Paper, p. 19

[18] e.g. Department of Climate Change 2008, Carbon Pollution Reduction Scheme White Paper, p. XXIX

[19] Department of Climate Change 2008, Carbon Pollution Reduction Scheme Green Paper, p. 136.

[20] Department of Climate Change 2008, Carbon Pollution Reduction Scheme White Paper, p6-63.

[21] The key remaining scientific issue concerns the equivalence of GHG emissions of methane and nitrous oxide resulting from early dry season prescribed fires, and late dry season wildfires. This is the focus of current research—and results from our July field program just completed indicate low emission concentrations of both gases. Thereby it is highly unlikely that emitted concentrations of these GHGs will be greater than those from late dry season fires, due for testing in late September 2009.

[22] *Canberra Times* 5 June 2009: Rosslyn Beeby "Aborigines 'locked out' of new carbon markets".

[23] Submission from Tropical Savannas Management Cooperative Research Centre to "Parliament of Australia: Joint Standing Committee on Treaties Public hearing, Darwin 19 August 2008"

5 Summary and conclusions

This submission sets out the case that bushfire management issues across Australia's fire-prone savannas are nationally and globally significant. Those issues are little understood by denizens and policy makers resident in more densely populated, and substantially less fire-prone, southern Australia. Addressing those issues requires fundamental understanding of socio-demographic and land use characteristics of the savannas. With support, Indigenous Australians can help address those problems through the provision and development of market-based management solutions. Savanna burning GHG emissions abatement projects have a demonstrated track record in western Arnhem Land and, with the establishment of supportive policy and institutional frameworks, can be ecologically, economically and culturally sustainable.

Savanna burning abatement projects offer substantial long term community-based fire management capability in a region that currently has very little institutional support. Should the demographic projections and infrastructure objectives of governments be realised, the fire management model currently operating in most of Australia would require extensive and substantial public investment in taxpayer funded firefighters. The projects proposed here have the potential (as demonstrated in West Arnhem Land) to lead to highly successful domestic fire management as a direct corollary of the landscape-scale emissions abatement programs that are funded by private enterprise.

In order to develop community fire management projects, investment is required in capacity building at an early stage. This timely intervention in training and materiel followed up with sustainable levels of training and facilitation by government fire agencies is the only conceivable effective system for delivery of broadacre fire management and community fire safety in the foreseeable future. While not cost neutral for governments, community fire management will place more emphasis on community resilience in the face of the annual north Australian fire regime and less emphasis on capital intensive fire services paying full-time firefighters on a 24 hour roster.

In seeking to develop the potential of savanna burning projects, we would ask the Senate to consider support for:

- ***Developing an effective consultative process***—this has been clearly inadequate to date and resulted in much confusion. While we appreciate that Government, in addition to addressing various technical matters, has recognised some of the associated issues surrounding the development of savanna burning, including generous provision of Indigenous ranger positions, much more needs to be done (see below). A properly constituted dialogue with northern Australian savanna stakeholders must be developed if savanna burning issues, including the establishment of savanna burning within national CPRS and international post-Kyoto frameworks, are to be addressed effectively.
- ***On-ground infrastructure support***—as well as developing technical capacity of on-ground rangers and fire managers through programs such as Caring for our Country's "*Working on Country*", substantial investment is required towards the development of access tracks (typically these don't exist in much of remote northern Australia) to assist with strategic on-ground management, and ranger base infrastructure. While some funding is available through programs such as the Commonwealth's Bushfire Mitigation Program (administered through Emergency Management Australia, Attorney's General Department), greater recognition of the scale and magnitude of resourcing requirements for remote northern Australian contexts is needed.
- ***Research infrastructure support***—to date most of the technical research underlying the development of savanna burning has been undertaken through the Tropical Savannas CRC (TSCRC) and its partnerships. This institution is due to be wound up by the end of 2009 and although a process is commencing with regards to developing a new northern-focused CRC proposal, even if successful, such an institution would not be in place until mid-2011 at the earliest. The recent winding up of Land & Water Australia accentuates this northern research capacity vacuum. A partial solution may involve an association with the proposed Fire, Environment & Society CRC (formerly Bushfires CRC), although discussions to date have been preliminary only. Again, discussions with the Commonwealth concerning such matters would clearly be beneficial.

- ***Establishing an independent 'office' to provide high end information mapping products and technical services for northern Australia land (and sea) managers***—ultimately, CRCs are limited in that they have a mandate to undertake innovative research, and have a relatively short (up to 10 years) shelf-life. The TSCRC has helped develop a number of web-based information and mapping tools, including the North Australian Fire Information (NAFI) website (www.firenorth.org.au). This site is now widely used operationally by land managers across the savannas. To date it has been developed and maintained by the TSCRC. Despite being a core regional fire monitoring and mapping tool, and being vital to the undertaking of savanna burning projects, it continues to have no firm institutional foundation or support.

  Also, with inclusion of savanna burning as part of the CPRS, there will be a requirement for provision of independent GHG emissions abatement validation tools and services. While such products are initially legitimate R&D outputs of CRC and related programs, operationally they need to be supported (and further developed) under a different institutional framework.

  Interestingly, processes for building such arrangements already exist through the *Cooperative Framework for Tropical Science Knowledge and Innovation* signed by the Premiers of Qld and WA and the Chief Minister of the Northern Territory in 2004. Objectives of that agreement include:
  - identifying needs/opportunities for strategic investment … and, where appropriate, in joint programs and initiatives;
  - developing integrated approaches …, taking account of the interdependence of economic, social and environmental considerations impacting on quality of life and sustainability in Tropical Regions
  - developing strategies to support initiatives to address Indigenous issues and to engage Indigenous people in playing an active role in the development of tropical science, knowledge and innovation
  - recognising the Commonwealth's role in supporting tropical science knowledge and innovation in Australia and building a value-adding partnership between the Parties and the Commonwealth.

  The role of the Office of Northern Australia—above matters point to the pivotal supportive role of the Office of Northern Australia in facilitating, brokering, and establishing an appropriate collaborative policy and institutional framework ('office') for savanna burning projects across northern Australia. Such an office attached to an appropriate Australian Government agency or authority, for example, would provide a level of authority and reach that could not be matched by any one of north Australian jurisdictions acting alone. Such arrangements would be entirely compatible with the above Cooperative Framework agreement. The establishment of such an 'office' would ideally be undertaken by 2011, in conjunction with the timeframe and requirements for establishing the CPRS.