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Indigenous Australians Fight Climate Change with Fire

by Scott Heckbert, Jeremy Russell-Smith, Andrew Reeson, and Glenn James



Scott Heckbert

CSIRO scientist Garry Cook collects smoke samples in Arnhem Land, Australia. The data will be used to improve estimates about levels of greenhouse gas emissions released during savanna fires. This fire was part of a field trial conducted by Indigenous rangers and scientists to demonstrate how fire management can improve landscape condition and abate greenhouse gas emissions.

In Brief

In Australia's northern savannas, Indigenous traditional knowledge is contributing to landscape fire management, reducing greenhouse gas emissions, and providing a suite of ecosystem services. The West Arnhem Land Fire Abatement (WALFA) project is a prime example of scientists, governments, Indigenous land managers, and carbon markets connecting to provide innovative solutions to resource management and economic development. The WALFA project reduces greenhouse gas emissions through prescribed burning of savannas, generating revenues by providing offsets to the regional energy industry. Under modest carbon prices, this type of fire management could be economically viable across tens of millions of hectares and could provide desirable employment and economic development in remote regions in Australia and fire-prone savanna ecosystems elsewhere.

One of Australia's greatest challenges is the persistent socioeconomic disadvantage faced by Aboriginal (Indigenous) people. This is particularly acute in the more remote regions of northern Australia, where Indigenous Australians make up most of the nonurban population. They own much of the land and have interests in most of the remainder,¹ and their populations are growing rapidly. However, the remoteness of these areas and their sparse population densities mean that mainstream economic opportunities are extremely limited.

Another key issue for Australia, as for the rest of the world, is the need to limit greenhouse gas (GHG) emissions. Nitrous oxide and methane emitted from savanna wildfires in northern Australia are a significant source of GHG emissions, averaging 3 percent of Australia's total annual emissions reportable under the Kyoto Protocol. Indigenous people have traditionally managed fire by applying prescribed burning to create mosaics of burnt and unburnt habitat. However, in many areas this traditional fire management has ceased as people have moved from their traditional homelands into settlements. As a result, large regions of fire-prone Australia have become vulnerable to very large and high-intensity or frequent fires, resulting in increased GHG emissions as well as significant adverse impacts on biodiversity,²⁻⁴ customary resources, and cultural values.

There is a desire among many Indigenous people to return to their traditional homelands and also to “rekindle” the tradition of fire management.^{1,5,6} This desire aligns with improved scientific understanding of the role of fire in savanna landscape ecology. Long-term scientific field trials indicate that different fire regimes affect flora and fauna biodiversity.⁷⁻⁹ These ideas have long been understood by Indigenous Australians, who have a specialist place-based language to talk about fire and its variety of uses.¹⁰ Field trials have also shown that GHG emissions can be lowered by using seasonally targeted prescribed burns to create firebreaks and reduce fuel loads, thereby reducing the area burnt in uncontrolled wildfires.¹¹

The emerging carbon economy offers a unique opportunity to create economic opportunities for Indigenous people in their traditional lands and at the same time reduce national GHG emissions in line with Australia’s international responsibilities. Global carbon markets were worth U.S.\$144 billion in 2009,¹² and this will increase substantially if serious efforts are made to mitigate global warming. Australia has committed to reducing emissions by at least 5 percent (compared to 2000 levels) and is developing a market for carbon offsets that will include emissions reductions from savanna burning. Unlike other commodities, carbon does not have to be physically transported to markets, so remoteness does not pose a barrier to market participation. This creates new possibilities for Indigenous people living in the isolated country in northern Australia.

This article describes the successful example of the West Arnhem Land Fire Abatement (WALFA) project, through which Aboriginal land managers are paid to practice traditional-style fire management on the Arnhem Land plateau. The

regional energy industry is funding the project to help offset its carbon emissions. The project is reducing GHG emissions; protecting and rehabilitating natural ecosystems, customary economies, and cultural heritage of the plateau; and providing much-needed employment opportunities in Aboriginal communities.

Fire Management in Northern Australia

Despite the attention that devastating bush fires in southern Australia have received in recent years, the vast majority of fires occur in the northern

kilometers if uninterrupted. The fire frequency in some areas of northern Australia is such that a given location can be expected to burn every one or two years.

Methane and nitrous oxide emitted during savanna fires accounted for 14.3 percent of Australia’s agricultural emissions in 2009¹⁴ and average 10,336 million metric tons of CO₂ equivalent (Mt CO₂-e) per year, although this varies highly interannually. The observation that GHG emissions from low-intensity, patchy, early dry-season fires are, on average, about half those emitted per unit area burnt under more intense late-season fires.¹¹ This provides powerful support for reinstatement of traditional modes of fire management, which emphasize burning under cooler conditions in the early to mid-dry season.¹⁰

Contemporary fire regimes differ from those in recent history and prehistory. This is due in large part to the movement of many Indigenous people away from their traditional homelands and the consequent breakdown of skilled fire management over large parts of the landscape.¹ Traditionally, landscape-scale fire management was done by Indigenous traditional owners. However the history of contact with non-Indigenous Australians has resulted in depopulation of vast regions, starting in the latter decades of the nineteenth century. The causes are many, including mortality from diseases introduced by contact with non-Indigenous settlers, prospectors, and traders; forced and voluntary resettlement at missions; the lure of new foods and products available in non-Indigenous centers; direct violence at the hands of newcomers; and also, more generally, disruption of social structures and access to traditional landscape resources. Some think of this process as the creation of a new “wilderness,”¹⁵ such as on the Arnhem Land plateau where, despite

Key Concepts

- **The increase in uncontrolled wildfires in northern Australia is a result of the breakdown of traditional fire management regimes.**
- **Indigenous communities in Australia are capitalizing on new opportunities to engage in carbon markets and to restore traditional land management to northern Australia.**
- **The West Arnhem Land Fire Abatement (WALFA) project uses carbon credits to generate revenues and employment in remote regions of Australia, while reducing greenhouse gas emissions from wildfires and protecting native biodiversity.**

savanna region.¹³ Savanna woodlands and grasslands cover approximately 25 percent of the continent; the cycle of wet and dry seasons makes these areas prone to fire and thus a significant source of GHG emissions. Fire frequency is generally much greater in the wetter northern latitudes. The savanna is typically composed of a broken canopy of fire-resistant eucalypt trees over understory grasses. The grass grows quickly in the intense five-month wet season and cures during the dry season to form a continuous vegetation layer that can carry fire for thousands of

evidence of continual habitation for tens of thousands of years, the region is today very sparsely populated (~250 residents over 30,000 km²). Presence of past custodians is evident from rock paintings at thousands of sites scattered across the plateau, some depicting now extinct species and historical events such as first contact with non-Indigenous explorers.¹⁵

In traditional economies, Indigenous people in many parts of Australia used fire for hunting and habitat management. There is considerable evidence that burning created habitat mosaics that promoted vegetation types and animal species adapted to fire and also maintained species assemblages in habitats protected from fire.¹⁶ Contractions of fire-sensitive species and declines in native mammal populations followed the withdrawal or relocation of Aboriginal people to settlements.¹⁷ Large regions of Australia became vulnerable to very large and high-intensity or frequent fires, or both, with significant impacts on biodiversity.^{2-4,18} On the Arnhem Land plateau, important and extensive ecosystems such as sandstone heaths and stands of native pine are under threat from adverse fire regimes.¹⁹ Many animal species have suffered declines in distribution and abundance even in the most widespread forest and woodland types in the north.^{20,21}

As part of the homeland movement of the 1980s, many Indigenous people left diasporas in regional towns for remote outstations (small and sometimes seasonal settlements, typically on land areas customarily belonging to family or clan groups). The movement also reinvigorated Aboriginal fire management in limited parts of northern and central Australia.^{5,6} In places where Aboriginal occupation and fire-management practices have been maintained, many dimensions of ecological integrity have also been sustained.²²⁻²⁴



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An Indigenous ranger lights a prescribed burn on the West Arnhem Land plateau, Australia. Prescribed burning in Australia's northern savannas is used to mitigate greenhouse gas emissions from large, uncontrolled fires and to maintain ecosystem services such as landscape biodiversity.

Using Carbon Offsets to Restore Fire Management

The West Arnhem Land Fire Abatement (WALFA) project in Australia's Northern Territory generates GHG emission offsets through Indigenous fire management. Instigated in 1997, WALFA was developed on a foundation of traditional and western ecological knowledge and research, assessing impacts of fire on vegetation dynamics. Senior Indigenous landowners were seeking to reestablish effective fire management across customary lands. Importantly, Aboriginal partners saw an opportunity to bring fire management back to "orphaned country"²⁵ by reinvigorating cooperation amongst land-owning clan groups in sustained cultural and land management activities.

In the WALFA project, Indigenous rangers apply prescribed burns across 28,000 square kilometers of Indigenous-owned land on the Arnhem Land plateau to create firebreaks and increase vegetation patchiness, thus

reducing the incidence of large, uncontrolled wildfires. In 2005, a natural gas processing facility agreed to pay the project AUD\$1.1 million per year over 17 years to offset some of its carbon emissions. The agreement set an initial target for annual reductions of 100,000 metric tons relative to a ten-year baseline. The project is substantially overachieving this goal. Renewed fire management on the Arnhem Land plateau has been estimated to reduce emissions by approximately 147,000 metric tons per year.²⁵

After 15 years of substantial investment by Indigenous communities, governments, land councils, and industry in training, capacity building, and operational activities, Indigenous ranger groups now take full responsibility for the operation of the WALFA program. The program itself draws on two tool kits: Indigenous land managers' traditional knowledge, which informs the way they manage the land over the burning cycle with respect to cultural obligations and ecological requirements,¹⁰ and contemporary



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Author Glenn James (center) and senior Indigenous rangers from the WALFA project examine satellite data to describe their plan for upcoming prescribed burns on the Arnhem Land plateau. To create fire plans, rangers use GIS to examine topography and plan fire breaks around areas of sensitive vegetation.

planning and management tools (e.g., fire history mapping, associated spatial analyses using GIS technologies, and aerial prescribed burning using helicopters).

Beyond reducing GHG emissions from wildfires, the project protects sensitive ecosystems, cultural and customary economic resources, and provides much-needed employment for Aboriginal land managers. The sandstone plateau of western Arnhem Land supports an unusually diverse array of endemic plants and animals, distinctive vegetation types, and many threatened species.²⁶ However, inappropriate fire management in past decades, as well as invasive plants and animals, have damaged the health of this ecosystem and have caused biodiversity to decline. Managing the incidence, extent, and severity of fire through prescribed burning—in short, reimposing traditional forms of regional fire management—will aid in

the recovery of this ecosystem. In addition, the WALFA project has created jobs for 20 rangers as well as 20 positions for elders and other experts in traditional ecological knowledge. The success of WALFA has sparked interest in setting up similar projects with Indigenous groups in other regions.

Future Solutions for Indigenous Fire Management

Growing recognition of the value of Indigenous land management has resulted in the creation of Australian government-sponsored ranger programs that provide employment opportunities for Indigenous people, many living in remote areas. The provision of ecosystem services can offer an alternative economic development pathway beyond standard private-sector industries like mining, tourism, local retail, raising livestock, or publicly funded jobs. There are significant opportunities

for the provision of ecosystem services by Indigenous Australians, for example, with GHG abatement projects, weed and feral animal management, quarantine services, water resource management, coastal surveillance, and wildlife and fire management.²⁷ A 2009 study by Heckbert and colleagues²⁸ estimated employment opportunities related to fire management alone to be roughly 490 full-time jobs across all northern savannas, albeit with simplistic assumptions based on potential revenues generated through GHG offsets. Due to the seasonal nature of the jobs, this equates to approximately 1,400 seasonal positions. Projects will necessarily be regionally based, and much of the savanna will not be suitable for projects for various reasons. Considering this, a 2010 study²⁹ reported that roughly 100 full-time positions could be created for Indigenous people over existing proposed project areas. This area has since doubled and the expected number of jobs is now approximately 200 full-time positions.

Community-based Indigenous ranger groups have formed across northern Australia, supported by Indigenous land councils and regional agencies and coordinated across jurisdictions through forums such as the North Australian Indigenous Land and Sea Management Alliance. The number of participants and ranger groups has grown from 5 ranger groups with 50 participants in 1996 to 35 ranger groups with over 400 participants in 2006.²⁷ Their activities are often based at outstations, which are an important investment in infrastructure for promoting delivery of land-management services, for which there is growing demand both nationally and internationally.²⁰

Currently, little is known about the potential economic value of fire management projects across Australia's northern savanna, including the costs of abatement, the level

of potential employment opportunities, and the locations where management might be economically viable. Initial attempts to address this have been made in a study that performed a spatially explicit benefit-cost analysis under different price and cost assumptions.³⁰ This study suggests that fire management in the northern Australian savannas has the potential to abate over 2.25 million metric tons of CO₂ equivalent a year, which could generate significant economic opportunities, particularly for Indigenous communities. The actual quantity of abatement would depend on the price available in the carbon offset market. At a price of AUD\$23 per metric ton of CO₂ equivalent (the starting level at which prices are proposed to be fixed in Australia's forthcoming emissions trading scheme), fire management would, conservatively, be economically viable across 41 million hectares of northern Australia, abating 1.3 million metric tons of GHG emissions per year.

Beyond GHG offset revenues, the nonmarket benefits from programs like WALFA are significant, particularly for Indigenous communities. These benefits include conservation of areas sensitive to wildfire; easier hunting and harvesting; reinvigoration of customary activities, language, and knowledge; and increased biodiversity through promotion of heterogeneous vegetation communities. Indigenous fire management plays a key role in the functioning of the Australian landscape, with ample evidence supporting the role of Indigenous landscape burning regimes in ecosystem health.³¹

For Indigenous communities, savanna burning is particularly attractive because it involves Indigenous people in traditional land management activities. This is spiritually important³²⁻³⁴ and enhances physical and mental health and well-being,^{35,36} as land managers feel that their

connections with traditional homelands are being maintained and that traditional responsibilities for land management are being fulfilled. Although there is interest in generating revenues from GHG offsets, the many nonmarket and cultural values are deemed of greater importance, and participation in carbon markets is seen as a way to underwrite the cost of achieving a suite of goals. Additionally, Aboriginal land managers consider sourcing long-term funding from private industry or carbon markets far more desirable than past experience with haphazard government-supported funding and employment programs.²⁰

Conclusions

The cultural and biophysical landscape of northern Australia is poised for major change. In recent history, economic development has been hindered by remoteness and harsh conditions not conducive to typical development pathways like

agriculture or forestry. The cattle and mining industries have been the predominant market-focused land uses, while local retail, education, health, and government programs focus employment "off-country." Collaborative projects such as WALFA set the example of a pathway toward economic development that recognizes and sustains traditional values and maintains ecosystem services.

A challenging divide persists in the understanding of fire management in Australia and the important role of Indigenous fire management, and this is likely the largest challenge to be overcome. Perspectives on fire in Australia are dominated by the occasional destructive "megafires" in the southern states, where ecological, sociological, and fire management considerations are fundamentally different from those confronting the annually fire-prone North. In southern Australia, population densities are higher and fire management is



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Indigenous rangers at the Arafura wetland in central Arnhem Land conduct a mammal survey to measure changes in biodiversity.

focused on property protection and safety, creating challenges often exacerbated by rural residents who wish to live in forested areas where fuel load conditions can become extreme. In these regions, residential land values, the ecology of dense eucalypt forests, and the general absence of fires compared to the North make generating GHG offsets through fire management in southern Australia an impractical option.³⁷

The combination of scientific rigor, the desire of Indigenous Australians to engage in fire management informed by traditional knowledge, and the emergence of carbon markets has led to a new economic development pathway for a commodity that requires no shipping, can be generated in even the remotest areas, and connects ancient traditions with multiple contemporary social and environmental goals. In the words of Australian climate change policy adviser Ross Garnaut, “The potential is transformative for northern Australian communities.”³⁸

Other Indigenous communities around the world are also engaging with carbon markets, seeing an opportunity to pursue conservation goals while generating new revenues. Reforestation projects spearheaded by local communities have been certified by the Climate, Community and Biodiversity Alliance and include projects in Brazil, Indonesia, Cambodia, El Salvador, Kenya, and Peru, among others,³⁹ with other examples in renewable energy and energy efficiency.⁴⁰ These efforts will require support by researchers who can quantify changes in landscape greenhouse gas emissions and sequestration under traditional land management practices. In the case of fire management in Australia, the rekindling of traditional fire management will continue to address both climate change and Aboriginal disadvantage, benefitting the region and the international community alike. **S**

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Garry Cook of CSIRO Australia collects smoke samples in a recently burned area in Arnhem Land, Australia. The smoke is pumped into his specially-designed “ghost-buster” backpack and taken back to the lab, where the chemical content of the smoke is analyzed.

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