Executive summary

Fire is a regular and widespread feature across many Australian landscapes, including the vast desert regions. Its occurrence and impact in desert regions is as variable as the region itself, and attitudes towards fire vary both locally and regionally, between and within community groups.

During the three-year period 2000–2002, fires were common in the central and northern regions of Australia's desert lands, following a period of above average rainfall that created exceptional grass growth and fuel production. This raised the awareness of fire but has also led to conflicts among sectors of the rural community.

The Desert Knowledge Cooperative Research Centre (DKCRC) attempted to address some of the key issues in managing fire in desert Australia through an initiative called 'Desert Fire'. Desert Fire was a collaborative project. It involved key partners of the DKCRC, including the Northern Territory Department of Natural Resources, Environment, The Arts and Sport (Bushfires NT, Biodiversity Conservation Division, Parks Division); the Central Land Council; Charles Darwin University; Adelaide University; key stakeholder groups and collaboration with the Bushfire Cooperative Research Centre; and the Australian National University. Desert Fire was made up of ten subprojects, linked together to meet the common goal to 'adapt and maintain appropriate fire regimes and their management based on robust research, planning, review and communication to support the diverse users and managers of desert lands to achieve a balance of their ecological, social and economic priorities'.

This report is the main technical scientific report of Desert Fire. The report chapters each form stand-alone final accounts of aspects of an individual subproject of Desert Fire. Chapter 1 provides an introduction and overview of Desert Fire. Chapter 2 explores the fire regime of the Tanami Desert and associated regional issues in respect of fire management on pastoral lands. Chapter 3 examines Aboriginal use of fire as perceived by non-Aboriginal fire professionals and by Warlpiri and Pintupi people living in the Tanami Desert. Chapter 4 provides pastoralists' perspectives on the costs of the widespread fires of 2000–2002 in the pastoral lands of the southern Northern Territory. Chapters 5 and 6 explore issues associated with the management of fire on conservation reserves in central Australia.

Chapter 2: Managing fire in the southern Tanami Desert

A comparison of two periods of widespread fires, 1974–1977 and 2000–2002, in central Australia showed a change in the patterns of fire, which are associated with changes in land use, population mobility and distribution. Re-evaluating the link between fire occurrence and antecedent rainfall confirmed the correlation between area burnt and two-year cumulative rainfall in sub-regional areas in central Australia. The opportunity to burn and the potential for large wildfires increased when the 24-month cumulative rainfall exceeded 120% of the average two-year rainfall for July to June rainyears.

A more detailed investigation of fires in the southern Tanami Desert region, based on Landsat satellite images, highlighted the number of fires that occur. Nearly 3000 fires were mapped in an area of only 34 000 km² during the period from July 1997 to March 2005. The majority of fires were small, and nearly 63% of all fires were less than 1 km² in size. Only 2.5% of the fires were greater than 1000 km² but they represented 72% of the total area burnt. The largest area burnt by a single fire exceeded 5700 km². The occurrence of fires was fairly evenly distributed throughout the year, but August to October was the period when fires burnt the largest areas, with September being the peak of fire activity.

Pastoralists in the southern Tanami Desert region supported the development of a regional fire management strategy and expressed a willingness to participate in this endeavour. Importantly, they stated that it needed to be a collaborative approach developed through cross-sectoral engagement, and they identified the need for improved communication and an advocate to champion the cause of fire management.

A southern Tanami Desert fire management strategy would need to address the following:

- implementing effective fire management in remote areas without roads or tracks
- dealing with the issue of roadside ignitions without eliminating the importance of most ignitions as signals for assistance
- documenting the benefits of improved fire management in both economic and non-economic terms and exploring the opportunities for funding
- improving training and skill development in active fire management throughout the community.

Chapter 3: Aboriginal burning issues in the southern Tanami: towards understanding tradition-based fire knowledge in a contemporary context

Interviews with non-Aboriginal professionals revealed a diverse range of views in relation to Aboriginal fire practices and beliefs, both past and present. The general perception was that Aboriginal burning of country has dramatically reduced since pre-colonial times. Changed fire regimes resulting in large, high intensity fires were regarded as a contributing factor to the reduction of native fauna and flora biodiversity. Reduced movement of people over their land in time and space was thought to have accompanied a dramatic decline in traditional Aboriginal burning practices and fire knowledge. While roadside ignitions were regarded as one of the major fire issues in central Australia today, it was also pointed out that there is no coherent picture of who is lighting fires, where and why.

Despite changes in the Aboriginal subsistence economy and society over the last decades, there are substantial continuities in Warlpiri and Pintupi beliefs and practices concerning fire. Moreover, there has not been uniform decline in people's fire knowledge. Factors such as age, gender, life experience and history of land use (both Aboriginal and non-Aboriginal) contribute to variation in people's practical fire knowledge. Older men and women who led relatively traditional lives in their youth are most knowledgeable about fire today, and there are still such people living at Nyirrpi, Yuendumu and Willowra in the Tanami Desert. This knowledge and these beliefs are best explored with reference to local cultural geography, *Jukurrpa* (Dreaming) narratives, dance, song and ritual. These practices contain cultural references to fire that inform contemporary understandings and as a result are not easily translated to people outside of that culture.

Fire remains important in Aboriginal people's lives today, both practically and symbolically, with people retaining many fire uses. The proper use of fire is regarded as a way of looking after country. For Warlpiri, this involves interrelated physical, spiritual and human dimensions which, though often for different purposes, significantly relate to environmental outcomes. People burn for various reasons: they perceive a relationship between lack of burning and absence of small animals; burning country is said to increase productivity of native plants and animals; burning is a tool for hunting; burning increases visibility and access; burning attracts attention.

In general, Warlpiri see burning at any time of the year to be more important than not burning at all. However, decisions of when and where to burn are informed by numerous environmental and social considerations: some burn as the opportunity arises whenever they are hunting and gathering; some burn in the dry 'change of season' times (which in desert Australia is around March–April and August–September) when there is enough wind to carry the fires and often just before the rains; some burn when fuel loads, wind direction and strength, temperature and time of day are right.

Social factors were perceived to be just as important as environmental ones in relation to burning, with Warlpiri land-based activities being structured by a complex system of social organisation and land tenure. The Tanami is not merely an open space over which anyone can burn; rather, it is comprised of different countries, with places of religious significance for which different groups of people have rights and responsibilities. Burning is carried out by traditional owners who have customary rights to that land. When burning is undertaken, it is influenced by the opportunity to burn and by the likelihood of the right people being in that area again at a more appropriate time.

Many Warlpiri have concerns about fire on their lands similar to those of their pastoral neighbours and of scientists. Inappropriate burning that leads to damage to infrastructure, cattle and cattle feed is of great concern to many Warlpiri who are involved with pastoral enterprises. Similarly, many Warlpiri consciously protect certain areas for cultural, economic and social reasons.

Warlpiri receive mixed messages about fire. On the one hand, non-Aboriginal people involved in land management encourage Warlpiri to burn in a customary manner, while on the other, many non-Aboriginal people – including some pastoralists, police and wildfire personnel – discourage Warlpiri from burning. In general, people respect not burning on pastoral lands, particularly people who have worked with cattle. With regard to wildfires allegedly lit by Aboriginal people in these areas, Warlpiri attributed blame to drunks or potentially to other Aboriginal groups visiting the area, though this was speculation. No evidence was found of Aboriginal people deliberately using fire to threaten non-Aboriginal people or their properties.

For Aboriginal people, major conflict over fire arises when the 'wrong' people burn their country, thus risking damage to cultural and natural resources, including sacred sites and other places of cultural significance. Violation of cultural protocols concerning Aboriginal land management can lead to serious social conflict. Many Warlpiri acknowledged the need for more frequent burning of the more remote regions to meet their cultural obligations. When Warlpiri were shown fire history maps based on remote sensing, many voiced their concern at their country being so extensively burnt. Generally, there was little that people could do to extinguish many fires, because they lack fire-fighting equipment.

People expressed interest in the following fire-related activities:

- burning for land management using tradition-based strategies
- work-based training and employment in fire prevention and burning strategies from a non-Aboriginal perspective
- sharing of tradition-based and scientific fire knowledge with non-Aboriginal researchers
- transfer of Aboriginal fire techniques to younger generations
- having support to burn for subsistence purposes in more remote regions.

Apart from needing support to purchase their own properly equipped fire-specific vehicles, people also identified the need to increase networks of graded tracks. At the same time, some senior people were worried that increased road access would diminish their ability to maintain control over people's behaviour on their country.

Chapter 4: Pastoralists' perspectives on the costs of widespread fires in the pastoral lands of the southern Northern Territory region of central Australia, 2000–2002

The majority of the direct costs of fire to the pastoral industry were associated with fire suppression activities and damage to infrastructure, but they also included the cost of risk minimisation procedures, such as fire-break maintenance. A few pastoralists were also able to estimate some of their indirect costs, such as loss of pasture.

Direct economic costs experienced by individual pastoral businesses due to the 2000–2002 wildfires ranged from $0 (where properties remained unburnt and unaffected by the wildfires) to more than $420 000. One property badly affected by numerous wildfires over the entire wildfire period estimated that additional costs due to stock turn-off and lost potential production amounted to more than $2 million.

Post-fire rainfall was identified as a significant factor associated with the impact of fires, especially in relation to subsequent grazing and stock management.

Chapter 5: A review of fire management on central Australian conservation reserves: towards best practice

It is widely agreed that current fire regimes on all land tenures in central Australia are unfavourable for some species and communities due to the prevalence of large intense wildfires. It is also widely agreed that the extent of prescribed burning on parks and reserves needs to be increased.

We have developed guidelines for using fire as a management tool for conservation reserves in central Australia to protect key assets, including infrastructure and biodiversity values. The recommended approaches are broadly applicable to other land tenures, including pastoral and Aboriginal freehold land, where periodic wildfires are of concern to managers.

In most years, the majority of the areas deliberately burned should be in fire-tolerant vegetation characterised by the presence of spinifex and the absence of long-lived woody obligate seeders (trees and shrubs that do not resprout when their canopies are killed by fire). Prescribed burning in these areas should be a combination of patches (aimed at diversifying post-fire vegetation age, with presumed benefits for fauna) and burnt fire breaks (lines, aimed at limiting the spread of and damage from wildfires).

Burnt fire breaks should include strategic fire breaks, which are primarily aimed at stopping or reducing the spread of wildfires and thus block up (divide) reserves into distinct fire management areas. Strategic breaks must connect with each other or with natural fire breaks to form networks. Strategic breaks on or near property boundaries are typically important parts of these networks and contribute to the development of cooperative arrangements with neighbours. Other linear fire breaks should be burnt to protect infrastructure and fire-sensitive vegetation. Fire-sensitive vegetation is characterised by the presence of long-lived woody obligate seeders, many, but not all, of which are overstorey dominants.

Another recommended use of fire is low intensity burning of ground fuels with minimal damage to overstorey plants (low intensity scattered burning). This is done to reduce risk of damaging wildfire and to promote fresh growth to increase food availability for fauna. This method of burning will generally not produce running fires and, with care, can be applied under and around fire sensitive overstorey species.

Mechanical and chemical methods of fuel management are also important. They are mostly used around infrastructure and to create control lines for containing both prescribed burns and wildfire suppression back-burns.

In many circumstances, prescribed burns should be of moderate to low intensity. Weather and fuel conditions must both be chosen to influence intensity, which is also strongly influenced by topography and ignition patterns. Optimal weather conditions can be infrequent, and efficient fire management should take advantage of these conditions when they occur.

In most years spinifex is the major component of ground fuels in many parts of the landscape. However, management must be responsive to changing fuel conditions. When flushes of annual fuels occur, more burning may be required in non-spinifex vegetation types. Such flushes typically follow rainfall that is well above average for periods of 3–24 months.

Introduced grass species present difficult challenges for fire management. Buffel grass has altered long-term fuel loads in some environments, particularly in alluvial flats and rivers, promoting hotter and potentially more frequent fires. Couch grass has altered long-term fuel loads in most rivers and many swamps. Both species rapidly re-establish by both seed germination and resprouting, and the effects of prescribed burning on these fuel loads can be short-lived. Mechanical and chemical means are important for managing strategic breaks in these fuels.

Effective and efficient application of fire requires good planning. Planning must be informed by adequate resource information and knowledge of fire history. Good records must be kept of the extent of and nature of wildfires and prescribed fires. This should be done using geographic information systems (GIS). Analysing resource data in a GIS is an important part of planning and requires time and a level of expertise beyond what can be generally expected of park-based rangers.

Currently, rangers employed by the Northern Territory Government face great challenges in fire management. Typically, much less burning is done each year than is desired. In many instances records are not well kept, and planning and implementation are inefficient. Key difficulties are associated with competing work priorities and a lack of knowledge and experience in various aspects of fire management. An associated problem is fear of fires burning out of control. Experienced rangers, scientists and GIS support staff are unable to deliver sufficient training and mentoring under current arrangements, and high levels of staff turnover add to the challenge. Operational budgets can also be limiting and it is frustrating, but not unusual, that emergency funds are made available for fighting large wildfires but much less money is available for proactive management which could prevent such fires. Many parks have large inaccessible areas due to rugged terrain. Increased use of aircraft to light fires (Aerial Prescribed Burning – APB) may be necessary, but developing experience and guidelines requires specific funding.

Park managers face a challenge of balancing courage with caution. Rangers must be bold enough to learn fire management by doing fire management. Rangers in central Australia should also enjoy the freedoms they have to undertake fire management with relatively few legal and administrative restrictions compared with many other parks and wildlife services. In many instances rangers should have confidence to let prescribed fires, in fire-tolerant vegetation, burn without excessive efforts to contain them to a precise area. This proactive use of fire must be balanced by understanding of the potential long-term impacts on fire-sensitive biota.

Chapter 6: The fire history of Rainbow Valley Conservation Reserve 1984–2005

Based on prescribed burning reports and maps it would appear that active fire management on the Rainbow Valley Conservation Reserve has been restricted to three main periods: 1984, 1989–1993 and 2001–2005. However, it is likely that some prescribed fires were not mapped or recorded in the past.

There has been more prescribed burning in parts of the Reserve that are accessible by vehicle (spinifex sand plain and sand dune), but there has also been some burning in the rocky hills. The earlier periods of prescribed burning created both large and small patches, some of which have a strategic value for limiting potential wildfires. The recent burning (past five years) has focused on strategic burns, mostly relatively narrow ‘linear’ burns, but also including extensive off-reserve burns adjacent to the boundary.

Large parts of the Reserve have moderate to high fuel loads of spinifex grassland, mostly greater than 20 years old. Despite plans for strategic breaks around and within the Reserve, the implementation of these burns is far from complete. Therefore there is still a strong possibility that large parts of the Reserve could be burnt in a single wildfire, whether the ignition is inside or outside the Reserve boundary and whether started by lightning, accidental or deliberate human ignition. The Reserve was not affected by the extensive wildfires of 2002, which did not come close to the boundary and therefore did not 'test' the fire breaks that had been established recently along sections of the boundary.

Records from this and other conservation parks and reserves show that it is extremely difficult to implement an extensive network of burnt fire breaks with the current staffing levels and training processes within the Northern Territory Parks and Wildlife Service.

Work is now required to produce a fire management strategy that will guide fire management on the Reserve over the next decade, based on new resource information and ecological understanding.

Key recommendations

Monitoring

- Maintain timely two- and three-year cumulative rainfall records to help more accurately monitor seasonal conditions and fuel loads in association with fire history information.

Collaboration and planning

- Encourage a representative from the Central Land Council (CLC) to be a regular guest at the Alice Springs East and West Bushfires Council Regional Committee biannual meetings and to present a summary of CLC fire-related activities
- Improve communications between all stakeholders to encourage greater community participation in regional-scale planning and increase awareness of both positive and negative effects of fire
- Develop a fire management strategy for the southern Tanami Desert region
- Incorporate Aboriginal perspectives and protocols about management of country into the planning processes to enable effective collaborative fire management in the southern Tanami region
- Develop and adhere to effective cross-cultural communication strategies in planning and implementing a collaborative regional fire management strategy in the southern Tanami region
- Establish community-based fire advisory committees to advise on fire management strategies and activities
- Foster better communication between rangers and neighbouring land holders in respect of fire management
- Improve the level of planning associated with fire management on parks
- Foster the involvement of Aboriginal people in park fire management
- Develop a new fire management strategy for the Rainbow Valley Conservation Reserve.

Livelihoods

- Provide support to increase fire-related livelihood opportunities for Aboriginal people.

Knowledge transfer, knowledge gaps and training

- Develop and hold fire technology workshops to improve land manager awareness of the advantages and limitations of fire information available via the Internet
- Provide greater support to Aboriginal people to facilitate tradition-based fire-related knowledge transfer

- Improve the fire knowledge of rangers
- Promote existing training materials and develop new training materials pertaining to fire management
- Address key knowledge gaps through research, including the management of fire in buffel grass dominated areas.

Best practice fire management

- Encourage all land managers to record fire information immediately after fires so that information is not lost
- Encourage all land managers to develop individual fire management strategies and include response plans for unscheduled fires
- Encourage more active and timely burning of spinifex to reduce the impact of widespread fires on isolated mulga communities
- Establish a combination of strategic burnt breaks and extensive patch burns to improve fire management on parks
- Reduce the high level of turnover in park ranger staff
- Increase the priority of fire management within the Northern Territory Parks and Wildlife Service
- Increase the level of flexibility in work-hour arrangements on parks to allow a greater focus on fire management at the appropriate time of day and as opportunities arise
- Improve the standard of fire record-keeping on parks
- Create a regional fire management team with responsibility to address the above points and implement best practice fire management on parks and reserves in central Australia.

Synthesis

A synthesis of the work presented in the chapters of this report is in Edwards et al. (2008).[1]

1 Edwards GP, Allan GE, Brock C, Duguid A, Gabrys K, Vaarzon-Morel P. 2008. 'Fire and its management in central Australia'. *The Rangeland Journal* 30, 109–121.