

## Introduction to Wildland Fire Management



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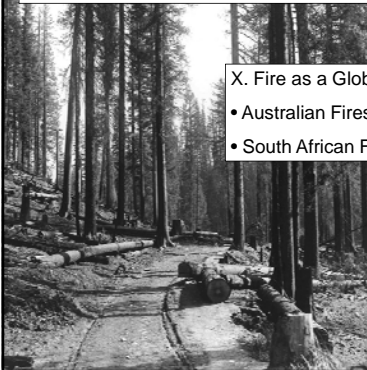
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## REM 244: Introduction to Wildland Fire Management



### X. Fire as a Global Phenomena

- Australian Fires
- South African Fires

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## REM 244: Australian Fires

Australia is often referred to as a "fire continent"; in many ways it is the twin of Antarctica (the ice continent) as Antarctica lives in the absence of fire, Australia needs fire (Pyne 1995)

By the time the Europeans arrived, bushfires were already a critical component of the environment.

Even before the arrival of the Aboriginals to the continent, fire was an ever-present process.



Fire engine during the 2009 Victoria Fires  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/foo7/fireall.html>

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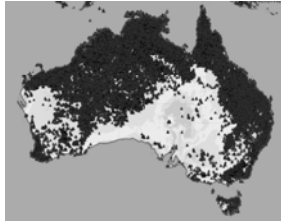
#### REM 244: Australian Fires

Fire was not an invention, but rather a discovery (Pyne, 1997). Fire is a bad master but a good tool, but like all good tools it must be handled with understanding and correctly (Van Wyk 1971).

It is generally accepted that Aboriginal Australians arrived ~ 40,000-80,000 BP.

The arrival of the Aboriginals increased the frequency of fire occurrence.

The Aboriginals employed the earliest form of Australian fire management.



Australian fires from 1997-2008  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/fo07/fireall.html>

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#### REM 244: Australian Fires

The Aborigines brought the knowledge of fire with them. They used fire as a tool to manage the food stocks, without depleting them (Gott, 2005). Few of the arriving European settlers recognized the fire management history of the Aboriginal peoples.

Curr (1883) wrote,  
*"living principally on wild roots and animals, he [the Aboriginals] tilled his land and cultivated his pastures with fire."*

Most Europeans believed the landscapes of Australia to be "pristine" and most ecologists seemed to ignore this past management until the 20<sup>th</sup> century (Gott, 2002)



Fire in Australia.  
Sources: Pyne (1995), Gott (2005)

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#### REM 244: Australian Fires

In recent years there has been a wider acceptance of the history of Aboriginal fire management.

Bowman (1998) wrote,  
*"fire was a powerful tool that Aborigines used systematically and purposefully over the landscape" ... and that there is... 'little doubt that Aboriginal burning was skilful and was central to the maintenance of the landscapes colonized by Europeans in the 19th century..."*

By 2002 many prominent ecologists were recognizing the legacy of Aboriginal fire management (Gott, 2005)



Aboriginal burning in Australia.  
Sources: Pyne (1995), Gott (2005)

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### REM 244: Australian Fires

Aboriginal fire management had multiple goals. These included hunting, path-clearing, communication, reducing insects and pests, and maintaining plant food stores – principally roots (Bowman 1998, Grot, 2005)

Early Europeans described some of the Aboriginal fire management practices:

- Burning sections of bush every year (rotations)
- Used large green branches to beat out fire that escaped prescription (Rx goals and fire beaters)
- Doused remaining fire at dusk (containment)
- Burning in mid-late summer (fire seasons)



Aboriginal burning in Australia.  
Image Source: Stanford University News  
Sources: Pyne (1995), Bowman (1998), Gott (2005)

### REM 244: Australian Fires

In a synthesis of 19<sup>th</sup> century records, Bowman (1998) concludes that

*"fire was the indispensable agent by which Aboriginal man extracted many of his resources from the environment."*

However, the question of whether the Aboriginals understood the long-term ecological implications of these fires, although suggestive, was less conclusive.



Aboriginal burning in Australia.  
Sources: Pyne (1995), Gott (2005)

### REM 244: Australian Fires

Numerous Australian plants and animals have adapted to fire. For example, fires are a necessary event in the successional process of eucalyptus forests.

When fires burn eucalyptus, the foliage may combust but the tree may not necessarily die.

Eucalyptus have the ability to re-sprout from epicormic buds. The eucalyptus epicormic buds are more protected than in other trees as they are deeper within the bark.

Eucalyptus also have the ability to re-sprout from below-ground lignotubers.



Epicormic shoots on charred eucalyptus.  
Sources: Pyne (1995), wikipedia

### REM 244: Australian Fires

The European settlers changed the fire cycle in Australia by removing Aboriginal fires. This fire exclusion led to several documented cases of floral extinctions (Pyne, 1995).

The change from Aboriginal fires to cattle and sheep grazing led to the destabilization of several ecosystems.

The fire exclusion also led to several large and extreme wildfires, fanned by strong hot winds and large fuel loads.

Pyne (1995) wrote ,

*"confronting the conflagrations transformed the Europeans into Australians."*



Fires near Victoria, Australia  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/foo7/fireall.html>

### REM 244: Australian Fires

There have been many large wildfires in Australia's history. Several of these fires are HUGE by USA standards.

6<sup>th</sup> February 1851: Black Thursday – a fire around the city of Victoria burned ~12 million acres (4 x the size of the 1910 firestorm) and killed 1 million sheep, several thousand cattle, and 12 people.

*"The fire kept enlarging its orbit, rolling about like some huge monster, destroying everything it touched."*

Eye-Witness account (1851)



Black Thursday Bushfires in Victoria 1851  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/foo7/fireall.html>

### REM 244: Australian Fires

The 1851 Victoria fire lasted only 4 days. Newspapers from the period describe it as a campfire ignition that got assisted by a 117° F in the shade and a "furious hot wind" (Melbourne "Argus" Newspaper Feb. 8.1851).

*"The year 1850 had been one of exceptional heat and drought. Pastures had withered; creeks had become fissured clay-pans; water-holes had disappeared; sheep and cattle had perished in great numbers, and the sun-burnt plains were strewn with their bleached skeletons; the very leaves upon the trees crackled in the heat, and appeared to be as inflammable as tinder."*

Annon.(1886)



Eucalyptus forest after a fire in 1901  
Sources: Pyne (1995), wikipedia

### REM 244: Australian Fires

The most “severe” bushfires in Australia typically occur in the southern regions. These regions are associated with high fuel loads and hot, dry, strong winds.

The large Australian bushfires have been named for days of the week:

- Ash Wednesday
- Red Tuesday
- Black Friday
- Black Sunday

1<sup>st</sup> February 1898: Red Tuesday – 1 million acres burned.

13 January 1939: Black Friday – 2 million acres burned and 71 people killed.



Bushfire Risk Map of Australia  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/foo7/fireall.html>

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### REM 244: Australian Fires

Many large fires have been recorded in Australia. Although the list is long, here are some of major fire events.

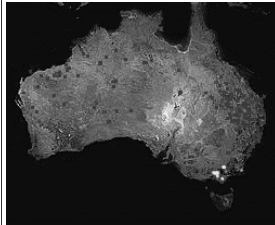
16 February 1983: Ash Wednesday – 1 million acres burned and 47 people killed.

Ash Wednesday Conditions: RH of 6%, wind speeds > 100 km/h and temperature > 110° F

In the 2002-2003 bushfire season, 100 million acres burned.

7<sup>th</sup> February 2009: Black Saturday - 173 people killed and > 1 million acres burned.

The energy released by the 2009 fires was equivalent to 1500 Hiroshima atomic bombs.



Active fires in Australia during February 2009  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/foo7/fireall.html>

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### REM 244: Australian Fires

The lessons from fire in Australia: Removal of the informed tactical fire management practices of the Aboriginals radically changed the fire regime and potentially lead to more extreme fire seasons.

The history of forest management in Australia strongly parallels the United States in that the 20<sup>th</sup> century led to an effort to suppress all fires on the landscape.

This fire suppression policy coupled with the removal of Aboriginal fire management may have contributed to the extreme fires observed since European settlement.



Contrast between frequent (left) and infrequent (right) burning in Australia (Jurskis et al.)  
Sources: Pyne (1995),  
<http://home.iprimus.com.au/foo7/fireall.html>

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### REM 244: South African Fires

The management of fire in South Africa is best charted through the experiences of range (veld) burning in Kruger National Park. These fires were originally used to promote wildlife forage.

1898: Sabie Game Reserve

1926: Kruger National Park was established. Although no official burning policy existed, the veld was burned as a "necessary evil" during February-April to provide forage in the winter.

1934: Network of firebreaks installed to prevent "escapes" from the park.

1937: Large "escape" leads to policy to burn veld every 2 years.



Prescribed fire in Kruger National Park  
Sources: Govender (2003), Du Toit et al (2003), <http://sanparks.org.za>, Van Wilgen et al (2003)

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### REM 244: South African Fires

The reasons given for the two year fire rotation were:

1. safety (by reducing escapes), 2. the long grasses did not provide good forage, 3. the long grasses were a source of ticks, and 4. the long grasses allowed predators to ambush the grazers.

1948 - 1956: Fire policy changed to burning every 5 years and only after good spring rains.

1950s: Long-term ecological burning experiments started with the goal to investigate the effects of season and frequency on four main park vegetation communities.

These experiments continue to the present day.



Prescribed fire in Kruger National Park  
Sources: Govender (2003), Du Toit et al (2003), <http://sanparks.org.za>, Van Wilgen et al (2003)

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### REM 244: South African Fires

1957 - 1980: Fire policy changed again to burning every 3 years in spring after first rains.

These burns occurred in ~480, 4000 ha blocks that were separated by a series of firebreaks and roads.

1981 - 1991: Blocks burned when optimal fuel loads and fuel moisture contents present.



Firebreak in Kruger National Park  
Sources: Govender (2003), Du Toit et al (2003), <http://sanparks.org.za>, Van Wilgen et al (2003)

In 1992, lobbying from wilderness advocates brought the rotation strategy into question (Du Toit et al 2003). These advocates felt that the park should just let the fires burn.

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#### REM 244: South African Fires

The data from the 40 years of burning rotations in Kruger National Park highlighted some concerns (Govender 2003, Van Wilgen et al 2003):

1. Grass characteristics of frequently burned pastures coupled with overgrazing was leading to poor forage potential.
2. The numbers and density of large trees has significantly declined.
3. The burning practice of "ring burning", where blocks are ignited around the edges led to high-intensity fires in the middle. This practice trapped animals and burned proportionally more area than the "patchy" natural ignitions.
4. The regular burning led to a lack of variation of fire effects (in time and space).

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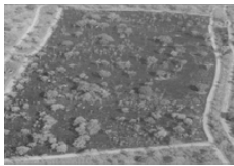
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#### REM 244: South African Fires

These concerns initially led to a Natural Fire Policy in 1993, where all lightning fires were allowed to burn freely. The aim was to promote more "natural lower intensity fires", where humans would "help" the fires across the unnatural firebreaks.



Ring burning in Kruger National Park  
Sources: University College London, NASA



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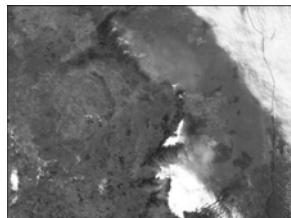
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#### REM 244: South African Fires

After 10 years of the Natural Fire Policy, it was clear that the objectives were not being accomplished (Govender, 2003).

The main reasons cited for its failure were:

1. Most fire ignited were human caused and so suppressed.
2. Lightning is predominately in the wet-season, limited number of "natural ignitions" during flammable dry season
3. Lightning ignitions only burnt more than human in 1996.



2001 fires in Kruger National Park  
Sources: NASA, Govender (2003), Du Toit et al (2003), Van Wilgen et al (2003)

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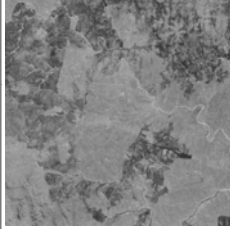
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## REM 244: South African Fires

The long term management and understanding of fire ecology in South Africa was decades ahead of the United States.

The main lessons from Kruger National Park are:

1. Fire has been recognized as a necessary "evil" for nearly 100 years.
2. Fire rotations (2-5) years have been recognized as necessary since the 1920s
3. Fire Ecology research into fire behavior and effects has been conducted since the 1950s.
4. They are still learning.



2010 fires in Kruger National Park  
Sources: NASA, Govender (2003), Du Toit et al (2003), Van Wilgen et al (2003)

## REM 244: South African Fires

Van Wilgen et al (2003) provided the following summary to the features of the different fire management approaches applied in Kruger National Park:

TABLE 7.3

Features of fire approaches that have been considered as candidates for a fire management policy in Kruger National Park.

	PRESCRIBED BURNING ON A FIXED CYCLE	LIGHTNING FIRES	PATCH Mosaic BURNING	RANDOM CONSIDERED BURNING	EXTINGUISHED FIRE APPROACH
Basic philosophy of approach	Regular fire is necessary to improve the quality of grass forage.	Lightning fires should produce the same fire regime as the one under which the park's biota evolved.	Applications should result in a heterogeneous vegetation structure at a fine scale and thereby maintain biodiversity.	Given that the desired composition, structure, and dynamics of the vegetation are known, a fire regime can be selected to produce that vegetation.	Combining patch mosaic burning and lightning fire approaches will overcome problems associated with the latter.
Method of application	Fires are ignited in fixed areas on a fixed cycle.	Any fire ignited by lightning is allowed to burn freely, and all other fires are extinguished or contained.	Random point ignitions are spread over the fire season until a target area (based on early dry season grass biomass) is achieved.	Areas are burned when sufficient fuel is present and where grass species composition meets certain criteria.	Random point ignitions are combined with unplanned fires until a target area is reached, after which only lightning ignitions are allowed to spread.
Problems associated with approach	Lack of variation, negative effects on the vegetation, and problems associated with "smothering."	In practice, most fires are ignited by nonlightning sources, and managers have to put a great deal of effort into fire control.	Safety concerns.	Perceptions that the approach is based on anthropogenic principles and is inappropriate for a conservation area.	Untested as yet.
Source	van Wilgen et al. 1990a.	Troilidge et al. 1995.	Brockett et al. 2001.	Troilidge et al. 1995.	Unpublished reports.