TOWARDS A FIRE STRATEGY FOR CALM-MANAGED KIMBERLEY LANDS

MARCH 2005, BROOME

TABLE OF CONTENTS

Towards a Fire Strategy for CALM-managed Kimberley lands
March 2005 ~ Workshop

Scope

Location Broome
Dates 09 March (Wednesday ~ afternoon)
10 March (Thursday ~ all day)
11 March (Friday ~ morning)

Focus
Managing fire for biodiversity on CALM-managed lands in savanna landscapes
(Note: In November 2004 a workshop in Perth addressed many aspects of fire management in hummock grasslands that were relevant to Kimberley hummock grasslands. Although there are some special issues associated with hummock grasslands in the Kimberley, this workshop will focus on savannas)

Objectives
Empower CALM managers to formulate a strategy for fire management on CALM lands in the Kimberley's savannas that will provide a foundation for area planning that is:

- "owned' by CALM's Kimberley staff
- ecologically sound
- practical and affordable
- acceptable to the community and
- (where appropriate) involves neighbours and the community

Format

1. Four topics each occupying a half day
2. Keynote talk(s) to introduce each topic
3. Supplementary talks to provide scope to each topic
4. Workshop and plenary sessions to tease out practical issues in the Kimberley. Workshop discussion leaders and reporters will be Kimberley people
5. Concluding workshop and plenary session to pull it together

Topics

- Perspectives (Day 1 pm)
- Principles (Day 2 am)
- Practical issues (Day 2 pm)
- Pulling it together (Day 3 am)

Outcomes
A common understanding of biodiversity considerations and a corresponding set of guiding principles to use in the formulation of a Regional Fire strategy for the Kimberley.

Participants

CALM Kimberley Region	Gae Mackay Gordon Graham Max Haste Kevin White Allan Thomson Kirsten Pearce Dave Grosse Rod O'Donnell John Abbott Lindsay Brown Lindsay Baker Ross McGill Ben Cross Ed Hatherley
CALM non-Kimberley	Neil Burrows Norm McKenzie Keith Claymore (apology from Gordon Wyre) Alan Walker Femina Metcalfe (apology from Rick Sneeuwjagt & Roger Armstrong)
Non CALM personnel	Jeremy Russell-Smith - Tropical Savannas CRC Jane Blackwood - KRFMP Tom Vigilante – Kimberley Land Council Peter Saint & John Winton – FESA (apologies)

Venue and resources

Venue, accommodation and resources will be Regional responsibilities.
Gae Mackay will delegate tasks to Regional staff

Logistical Resources requirements

- PowerPoint projector, screen, pointer, laptop etc. (and backups)
- Whiteboard, pens, eraser etc
- Butcher's paper, textas and easel/clips etc.

Reference requirements

- *Savanna Burning* published by TSM CRC, Darwin (25 copies ~ each participant should have a copy to place on his/her own bookshelf as an essential reference)
- *Grassland curing guide for the Kimberley* published by KRFMP, Broome (25 copies ~ each participant should have one)
- *Maps* for Parry Lagoons NR, Mitchell Plateau NPs and King Leopold CP
  - Topographical
  - Tenure
  - Fire history
  - Vegetation

Agenda

Day 1 afternoon ~ Perspectives ~ Facilitator *Gae Mackay*

1.30 – 1.40	*Introduction (What we want from the workshop)*	***Gae Mackay***
1.40 - 2.10	*CALM's policy framework (in the context of the Kimberley NC Review)*	***Keith Claymore***
2.10 – 2.40	*Regional Services: Fire management on CALM land and UCL*	***Alan Walker***
2.40 – 3.00	*The role of Fire Management Services*	***Femina Metcalfe***
3.00 – 3.30	Afternoon tea and stretch legs	
3.30 – 4.00	*Fire management on CALM lands today (methods, achievements, constraints)*	***Kevin White***
4.00 – 4.30	*Environmental effects of modern fire regimes*	***Gordon Graham***
4.30 – 5.00	*Summary of the session and plenary discussion*	***Norm McKenzie***

Day 2 morning ~ Principles ~ Facilitator *Gordon Graham*

8.30 - 9.00	*Principles of fire management for biodiversity conservation in savannas* (Presentation on the "notion" or benefit of principles rather than actually defining the principles them selves)	***Jeremy Russell-Smith***
9.00 - 9.30	*A pastoral perspective: Common interests*	***Jane Blackwood***
9.30 - 10.00	*An Aboriginal perspective: the original fire managers now live in a modern world*	***Tom Vigilante***
10.00 – 10.30	**Morning Tea and stretch legs**	
10.30 – 10.50	*Fuels, fire behaviour and the strategic use of fire*	***Neil Burrows***
10.50 – 12.00	Workshop session: *Generating principles applicable to fire in savanna* Discussion led by Jeremy Russell - Smith	***Jeremy Russell-Smith***

Day 2 afternoon ~ Practical issues ~ *Facilitator Max Haste*

1:00 – 1:15	*Guidelines for afternoon workshops*	***Max Haste***
1:30 – 2:30	**Workshop session: *Applying the principles*:** Groups will test the applicability of the principles to actual tenure and identify any missed or new principles that should be added to the list • Parrys Lagoon • Mitchell River NP • King Leopold CP	***Workshop Groups*** *Discussion leaders and reporters from Kimberley Region*
2.30 – 2.50	Reporting back to plenary and discussion	
2.50 – 3.15	**Afternoon tea and stretch legs**	
3.15 – 4.15	**Workshop session: *Implementing the principles*:** Groups will test the practicality (and/or constraints) of applying the principles generated earlier. Groups will focus on practical issues and constraints with fire management - • Parry Lagoons NR • Mitchell Plateau NPs • King Leopold CP	***Workshop Groups*** *Discussion leaders and reporters from Kimberley Region*
4.15 –4.45	Reporting back to plenary and discussion	

Agenda

Day 3 morning ~ Developing a Regional strategy ~ *Facilitator Neil Burrows*

8.15 – 8:45	*An example from the NT*	*Jeremy Russell-Smith*
8:45 – 9:05	*An example from Queensland*	*Max Haste*
9:05 – 9:25	*A process for the Kimberley*	*Gae Mackay*
9:25 – 9:45	Facilitator to lead questions/discussion of session papers	*Neil Burrows*
9:45 – 10:15	**Morning Tea and stretch legs**	
1015 – 11.30	Workshop. *Focus: Putting it all together.* Essential components for a **Kimberley Regional Fire Strategy**	***Workshop Groups*** *Discussion leaders and reporters from Kimberley Region*
11.30 – 12.00	Reporting back to plenary and discussion	
12.00 – 12.15	Concluding remarks	*Gae Mackay*

KIMBERLEY FIRE FORUM
9-11 MARCH 2005, BROOME
WORKSHOP GROUPS

The two wise men: (biodiversity reference!)
Jeremy Russell-Smith
Norm McKenzie

Parry Lagoons
Tom Vigilante
Kevin White
Dave Grose
Lindsay Brown
Ed Hatherley
Michelle Widmer

Mitchell Plateau Area
Gordon Graham
Allan Thomson
John Abbot
Alan Walker
Gae Mackay

King Leopold Range Conservation Park
Neil Burrows
Max Haste
Kirsten Pearce
Rod O'Donnell
Ben Cross
Femina Metcalf

KIMBERLEY FIRE FORUM

9 – 11 MARCH 2005, BROOME

Managing fire for biodiversity on CALM-managed lands in savanna landscapes

Introduction: *What do we want?* **Gae Mackay**

Thanks for coming to the Kimberley Fire Forum, and thanks in advance, for your participation! Participation will be the key to success for this forum, which has been designed to be interactive.

The Kimberley fire forum is aimed primarily at CALM staff – looking at fore management in the Kimberley. We will largely be looking at applications on CALM-managed lands, and on UCL. However, we need to be mindful of the bigger picture, in terms of non-CALM managed lands, and recognise that it is only through relationships with neighbours and other stakeholders that we will be able to influence the future fire management across all of the Kimberley.

There has been much talk about fire and biodiversity, but what does this mean? Intuitively, we often talk about fore as being too much, too hot, too late etc, but what do we really know?

I'd like to read an extract from the "Fire management in the rangelands" report:

> " In general, even where optimal fire regimes for individual species are not known, a fire regime that provides variety and variability, preferably at a fine scale, is likely to provide for the greatest variety of species, by allowing individuals to chose areas that meet their various requirements. Equally, important, in a fine-scale patchy mosaic of habitats there will always be populations that can colonise areas as the vegetation changes through time between fires. As a general rule, large areas of monotonous habitat, whether created by extensive frequent wildfire or total fire exclusion, are likely to cater for fewer species and lower abundance of many of those that are there, than would the same areas if they contained a variety of habitats generated by fire."
>
> I think this is where we would all like to head!
>
> "Desirable fire management practices depend upon desired management outcomes, not to mention climate, terrain and flora/fauna assemblages present and ecosystem mosaics. No single fire regime applied at a landscape scale can meet the needs of any one major land management objective (i.e. biodiversity conservation), let alone multiple land management objectives."

So, how do we get to this point?

The next few days will present Kimberley staff with the opportunity to hear from people who may have more experience in using fire as a tool for biodiversity. We will also have the opportunity to share our own experiences with fire in the Kimberley – what works, what doesn't, what do we know and what don't we know, and how do we find out?

We have all heard Gordon Graham's mantra "Plan, Do, Review". This is what we are here for: to get the necessary information and understanding of the principles and practices of using fire as a management tool, to be able to effectively plan, do and review our fire management strategies in the Kimberley. By the end of the forum, I would like to think that we will all have an understanding of the basic principles for fire management in savanna that we can then apply when developing our fire management strategies across the Kimberley.

I'd like to refer to page 1 of the forum outline:

Focus: Managing fire for biodiversity on CALM-managed lands in savanna.

Objectives: Empower CALM managers to formulate a strategy for fire management on CALM lands in the Kimberley's savannas that will provide a foundation for area planning that is:

- "owned' by CALM's Kimberley staff
- ecologically sound
- practical and affordable
- acceptable to the community and
- (where appropriate) involves neighbours and the community

Format:

1. Four topics each occupying a half day
2. Keynote talk(s) to introduce each topic
3. Supplementary talks to provide scope to each topic
4. Workshop and plenary sessions to tease out practical issues in the Kimberley. Workshop discussion leaders and reporters will be Kimberley people
5. Concluding workshop and plenary session to pull it together

Outcomes: A common understanding of biodiversity considerations and a corresponding set of guiding principles to use in the formulation of a Regional Fire strategy for the Kimberley.

I would also like to ask each speaker to provide some summary notes/handouts etc of their talk, which can then be collated and distributed following the workshop, for on-going reference.

This afternoon's program will involve several speakers, talking about particular perspectives relating to fire management in the Department, and more specifically the Kimberley. In a few minutes, we will begin with Keith

Claymore, who will talk about how fire from the perspective of CALM's policy framework. Alan Walker will then talk about Fire management form e Regional Services perspective. Femina Metcalf will follow on, with a look form Fire Management Services perspective.

After a break for afternoon tea, Kevin White will present the current situation for fire management in the current Kimberley environment, and Gordon Graham will follow on with a look at the environmental effects of modern fire regimes in the Kimberley. Norm McKenzie will then sum up the afternoon.

Tomorrow and Friday's program will be more interactive, with a workshop format interspersed with additional speakers. The details are in your program.

Fire Strategy – Kimberley Workshop

March 2005

Summary of Perspectives Session

Keith Claymore **Policy**

CALM policy and Legislative requirement (implicit or explicit) to manage fire as part of: NC, people/infrastructure protection, duty-of-care and PVS delivery (scenic for tourism) need range of interactive management strategies.

Need to establish active, adaptive fire management plans for sub-regions of Kimberley. Don't have one in place even at bio-regional scale in Kimberley yet.

Alan Walker **Role of Regional Services**

In this context he discussed, the need to establish appropriate fire management strategies to achieve the above obligations for each Kimberley sub-region and CALM via Regional Services, needs to provide resources to implement them.

Political support for fire management, including prescribed burning, as a tool for land management.

Council of Australia Government Report
- Stock grazing and weeds recognised as interactivity with fuel loads.
- Some fire regimes inappropriate to biodiversity conservation.
- Traditional fire management practices need to be considered in developing strategies.

EPA's identified priority areas for reviewing fire management activities; Kimberley, Pilbara and Eastern SW.

CALM has responsibility for fire management:-
- across UCL and interact with tenures,
- in detail for its own lands.

Needs to interact with Traditional Owners and Managers of other land tenures.

Alan detailed and enlarged on CALM responsibilities with regard to fire management in Kimberley.

Described imminent resourcing;
- $360K 2005/6 and $480K 2006/7 for fire management in Kimberley
- $140K for Science Division for Kimberley fire ecologist beginning July 2005 plus one fire operations position for Kimberley to be appointed (at Regional level) and additional $$ for UCL may come. As well as 'free' labour-force for 4 months of year for NC and fire suppression.

Femina Metcalf **Role of Fire Management Services**

List of their guiding principles and key result areas.
Fire management: of ↑ system.
Fire management for biodiversity
Fire safety and response readiness for suppression, etc.

List of broad management tools and plans being developed and interactions with other agencies on these.

Provide guidance, standards, support, leadership.

List of 'how' fire management is done, including risk management, information systems, tools, including aerial ignition, co-ordination and liaison.

Flow chart of 'boxes' needed to develop broad fire management frame-works for remote sub-region. But the devil is in the detail required to make the model 'real' for biodiversity. 'Adaptive refinement is crucial.' Even achieving a mosaic is problematic.

Kevin White **Methods, Achievements and Constraints on Fire Management on CALM lands in Kimberley**

Buying time until we know what to do (we don't even know where biodiversity values and hotspots are in Kimberley).

Obligations and key issues; liaise with and engage other stakeholders, protect conservation land values.

Current Kimberley fire strategies:-
Landscape mosaic and fuel reduction buffer (to confirm late dry season) and
Mosaics fire buffers (very difficult, but possible!! eg. PRRR last year.
Diversity vegetation structure and composition,
Maintain ecosystem process,
Infrastructure protection,
Where do we burn??
CALM estate and
UCL (10.8m ha now.)
Other lands by contract eg. (military, indigenous, some postoral)

Lessons
Monitoring on military cells
>100 species of plant in five years unburnt plot compared with 60 species in adjacent plot burnt every year.
32% of Kimberley burnt in dry season, mostly late dry season, etc.

Empirical data on distribution of Kimberley fires across the year spatially with regard to $120, patchiness and direction. Buffers don't have to be wall-to-wall, but >400m wide with no paths of unburnt vegetation crossing buffer. ?????is patchy so four to five passes needed if aerial ignition. Better if can get onto ground. Mostly have to use features such as creeks, mountain ranges, etc, instead. Our fire deployment needs to minimise the effect of wildfires on Kimberley biodiversity, not exacerbate it.

Development continuing in fuel models, fire weather, recovery characteristics and fire histories in different geologies, etc, biological surveys/audits to say where values are. Current data too generic for finely targeted planning.

Gordon Graham **Environmental Effects of Recent Modern Fire Regimes**

A landscape change model was presented to illustrate the dynamic interaction. Things have changed!! 'New' strategic technologies need empirical development, and what we can achieve by use of fire.

Interaction between fire and biomass, species composition, gradients, soil profile condition and erosion, productivity. Climate and soil parent material determine potential compositional patterns in biodiversity. Other factors eg stock grazing interact.

Diagram

Unimodal to bimodal

Historical perspective on tradition fire regimes – now more early dry season fires. Fire has had an impact at landscape scale on vegetation, structure, composition, fauna, resource availability, soil profiles and erosional loss, riparion fringes etc, grasslands (perennials ↓ / annuals ↑)

Cannot return to traditional burning practices.

Jeremy RS **Principles**

Fire management – Western Arnhemland, Kakadu and Nitmiluk NP and other land.
Endemic plant species diversity – hot spots?
Fire scars (maps)
Threatened communities (maps)
1:100,000 maps, vegetation maps/habitats/communities
Savanna – 4 tonnes per ha – carry wildfire
After two years – fuel loads in Kimberley > five tonnes per hectare
Monitoring plot established
Obligate seeders where, length of time between region.
eg Petraeomytis (Regalia) – 6 yr interval until produce seeds.
Assemblages and species – diverse structure/species etc.
Cypress pines - 3 years seedlings to 12cm 10 years to 2m.

Scorch height:– Early season <100cm
Mid season <200cm
Late season >250cm
Fire monitoring plots survey and analysis
Joint monitoring program established in mid 1990's
Nitmiluk, Litchfield and Kakadu.
Set up as training program - monitoring twice per year
Plots - tagged trees, permanent quadrants. Combined with satellite imagery.
Laborious effort – 2 weeks work every 5 years data collection.

ABC – one or two runs with lightening.
Mostly helicopter – only effective way of aerial control burning and footwork pinpoint.
$50,000 Western Arnhemland – collectively.
Indigenous involvement.
Communicate – planning.

Jane Blackwood **Pastoral**

Andrew Craig put together fire guidelines for pastoralists – going to workshop there in next few months – finalise.

Kimberley 3 distinct pastoral regions.
Low rainfall zone
Medium rainfall zone 350mm
High rainfall zone 700mm

Diagram

Andrew has written summary report for high and low rainfall areas.
Powerpoint presentation.

Issues in common between conservation and pastoralists
- Priority given to managing wildfire risk
- Avoiding loss of desirable perennial grasses,
  - (annual sorghum advantaged by frequent hot fires).
- Limited resources for fire management:-
  - People, equipment, dollars, time during year.
  - Terrain often rugged; limited access.
- Need workforce with practiced fire management skills.
- Need for timely and reliable information.
- Limited control over complex natural systems
  - Our understanding and responses remain limited.
- Interest in aerial control burning
- In some cases, boundaries.

Differences between pastoral and conservation
- Pastoral – greater emphasis on:-
  - End of year burning, especially in drier areas.
  - More productive parts of landscape (lowlands).
  - Larger scale mosaics preferred (? time since fire).
  - Maintain open structure of vegetation.
- Conservation – greater emphasis:-
  - Visitor safety
  - Looking after fire sensitive species/communities (sandstone, etc)
  - 'Special habitats' (rainforest patches, springs, etc).
  - Habitat diversity

Conclusion
The two sectors have much in common and much to gain from co-operation.

Tom Vigilante **Aboriginal Perspective**

PHD – Charles Darwin/CRC bushfires – Aboriginal burning Kalumburu
- Working for KLC, Land and Sea Unit – Indigenous project.
- 40,000 aboriginals occupancy in north Kimberley

Reasons for burning:–
- Hunting, cleaning country, wildlife management, plant resources,
  - (black smoke – confirms that ancestors happy and approved burn).
- Burning for rain

Right time of year for burning
- And reason and optimum conditions ie prevailing winds.

Mitchell Plateau
- High frequency = basalt (part due to environment and part due to good hunting.
- Lesser frequency = sandstone and coastal belt.

Can we return to traditional burning?
- Knowledge still exists.
- Endures elements and concepts
  - Very detailed local knowledge and expense.
- Problem
  - Population
  - Access
  - Landscape change

Need for indigenous involvement
- Demographics (50% population)
- Tenure/land holder – UCL, ALT, native title, conservation estate.
- More than a stakeholder
  - Custodial rights to land
  - Knowledge holders

Potential conflict of values and ideology
- Are long unburnt landscapes healthy?
  - Eg offshore islands and peninsulas
- Need to build on existing and ongoing collaboration

Neil Burrows **Fuels, Fire Behaviour and the Strategic Use of Fire**

Adaptive Management Framework
- Learning by doing
  - Clear objectives
  - Develop prescriptions
  - Implement
  - Monitor

Hypothetical Scenario **Fire Management for Biodiversity Conservation**
- Led by Jeremy; scribed by Gordon Graham

Large block, biodiverse rich, NP surrounded by other land tenure.
- Fire prone area, relatively infrequently burnt
- Remote

Diagram

Protect infrastructure
Identify key values
Define what you think you know
Review technology
Establish a plan
Define objectives – define clear management objectives
Fire history
Mapping – vegetation, topography, mud map etc.
Stakeholders
Neighbours objectives
Vegetation type and landform
Identify data gaps
Ecological/biodiversity information
Indigenous views – field inspection – identify correct people
On ground consultations
Meetings – internal and external
Verification of data
Definition of scale of operation
Technical ability of staff
Mosaic size
Define what you wont/don't wont, ie; don't wont a wildfire
Need to identify risks:– fuel loads, boundary issues, neighbours, etc.
risk analysis
Budget and resources
Remote sensing info
Established monitoring strategy
Define biodiversity assets
Legislation
Benchmark

Mosaic
Rule of thumb – patchiness?

Type of ignition
Ground
Aerial
Timing - of applying fire
Effective implementation
Intensive V's extensive
Use seasonal variations
Protecting what you've done
Don't interfere with some areas

Country type
- Sandstone
  - Infrequent fire
  - Use of corridors (creek lines, walking lines)
  - Intensive use of fire
  - Initial peripheral burning
  - Small mosaic/patches, breaking up, and strategic
- Go early go back

- Valley floors
  - Data gap
  - Random ignition
  - Increase fire prone
  - Select access – minimise costs of returning to complete burn

- Identify areas requiring special attention
- Role of late dry season fires;
  - Knowledge
  - Management
  - Desirable for some species
- Identify fire prone areas

Role of wet season burns
- Specific locations
- Erosion risk may be higher (particularly on slopes 3 degrees or more.
- Environmental impact assessment

Post burning
- Feral animals

Obligate seeders
Vary what is done to various areas 9ie don't just repeat fire regimes over and over again).
Incorporate natural refugia in to plans and known small range species.

Max Haste **Queensland example**

Max www.aileadership

Normal process – 18 months to 2 years, several volumes, etc. Very long process, external and internal ownership.

Interim fire management strategies
- Guidelines - completion of statement of fire management intent.
  - Readily available information
  - Aligned fire management zones (exclusion, protection of assets, biodiversity, etc).
- Two weeks desktop exercise to pull together statement of fire management intent.
- Pro-forma and example.

FIRE MANAGEMENT

GUIDING PRINCIPLES

TROPICAL AND SUB-TROPICAL SAVANNA

(Kimberley Region – Western Australia)

Background

A CALM-Kimberley fire management workshop was held in Broome in March 2005, to enable robust discussions and information exchange relating to fire management on CALM-managed estate in the Kimberly. The workshop was the first step towards the development of a Kimberley Fire Management Strategy. The workshop concluded with a session aimed at identifying and defining a set of principles that would guide fire management in the Kimberley. This process of generating a set of fire management principles was successfully implemented at a Spinifex fire management workshop in 2004, and was determined to be a very good way of commencing the Kimberley strategic fire planning.
In the first instance the principles should be considered when addressing the lands managed by CALM in the Kimberley. However, it is a logical step to use them when discussing broad fire management matters as they apply at the landscape scale. The broader landscape is generally a non-fragmented one in terms of fire fuel availability and fire conditions, or at least is only fragmented in terms of the land uses and management objectives being applied.

In broad terms fire management objectives must always reflect the primary roles of the Department of Conservation and Land Management, notably with respect to conservation management (CALM). Actions must be specific, measurable, achievable, relevant, and timebound (SMART).

1. **Guiding Principles** Savanna landscapes of northern Australia have co-evolved with fire.
    - Lightning and human ignitions have ensured that fire is an environmental factor that has influenced landscape structure, function and biodiversity.

2. Species and communities vary dramatically in their adaptations to, tolerance of, and reliance on fire.
    - Knowledge of the ways in which species and communities respond to fire, and of the temporal and spatial scales of fires in relation to life histories of organisms or communities, should underpin fire management.

3. Rainfall is a primary driver of the rate of fuel accumulation and subsequent flammability of savannas.
    - For the Kimberley high rainfall areas (>600mm), vegetation communities will generally carry fire annually whereas areas with lower rainfall will carry fire every two years.

4. Savanna vegetation structure and biodiversity are influenced by the fire regime.
    - The characteristics of a fire regime are determined by the interaction between variable such as frequency, season, intensity, scale and patchiness of fire. Changes in those variables can bring about rapid changes in vegetation structure and biodiversity..

5. Fire management, including proactive burning and fire suppression, is required to re-establish and maintain heterogeneity and a rich biodiversity of savanna ecosystems. In some circumstances, it will be necessary to manage fire to protect cultural values, people, property and infrastructure which may impinge upon biodiversity objectives in localised areas.
    - The fire regime of the Kimberley has been substantially altered from the natural or historical range, resulting in stress and degradation to the environment.
    - The current fire regime is one dominated by extensive frequent and intense late dry season fires.
    - As a result of this the trend is towards a homogeneous annual grass dominated savanna which is undesirable.
    - For practical and ecological purposes broader scale prescribed burning should commence as early as possible at the cessation of the wet season to promote patchiness, but burning throughout the year should be considered for ecological and management purposes as required.
    - Areas of particular focus will be identified to implement wet season burning. For example burning at this time may help reduce the prevalence of annual grasses (*Sorghum* sp.). An important consideration is to ensure that wet season burning does not exacerbate any erosion problems

6.
    - .

7. Fire management should be both precautionary and adaptive.
    - The requirements of both fire sensitive and fire maintained communities and species should be documented and considered in all activities in order to optimize biodiversity conservation outcomes. There must be a system of constant review of fire management in order to respond to better information and technology.

8. Fire management resources are scarce, so active fire management including fire suppression and prescribed burning should focus on areas of high conservation value assets (prioritizing). Passive management, including allowing unplanned (by CALM) fires to burn, is a realistic and acceptable management option
    - Savanna landscapes are vast, remote and difficult to access.
    - .

9. Fire diversity can benefit biodiversity both at landscape and local scales.
    - At the landscape scale, a mosaic of patches of vegetation of varying time since fire will provide a diversity of habitats for organisms that are mobile and can move through the landscape. At the local scale, appropriate intervals between fire based on vital attributes (e.g., time to maturity and seed set), and home ranges of many fauna species are necessary to ensure the persistence of sessile or less mobile species.

10. The application of the same fire regime over large areas for long periods, should be avoided.
    - This includes avoiding vegetation successional and structural homogenization by not treating large areas with extreme regimes such as sustained frequent burning or infrequent burning. This also emphasizes the importance in documenting the fire regimes affecting an area by recording the frequency, interval, season and scale.

11. The scale of the vegetation mosaics established should aim for patchiness ranging from hectares to thousands of hectares.
    - Parameters to be considered include enabling the dispersal from breeding sites to new habitat, optimizing boundary habitat (the interface between two or more vegetation successional stages or fire boundaries), and optimizing connectivity allowing the ability of keystone species to migrate between various mosaics.

12. Strategic low fuel buffers, for example 300 to 1000 metres wide, may be required to help prevent the spread of wildfires.
    - The selection of the location of low fuel buffers must be done with great care. Considerations include ensuring that areas of special habitat (such as ridges that afford protection to fire sensitive species) are avoided and that the buffers established are able to perform their function.

13. All available knowledge including indigenous, scientific and local knowledge should be documented and utilized to develop ecologically appropriate fire management.
    - The GIS and data management capacities may need to be enhanced and accessibility to the information should be a primary requirement.

14. Consultation and partnerships with stakeholders is required to manage fire for mutual benefit.
    - As a matter of standard procedures in preparing and implementing fire management programs that stakeholders are consulted including neighbours, traditional owners, and other government agencies.

15. Fire management should be planned and implemented in an active adaptive management framework.
    - Use of tools including remote sensing and aircraft, will be essential for planning and implementing fire management. This includes fire suppression, mapping and monitoring fire mosaics and fire history.

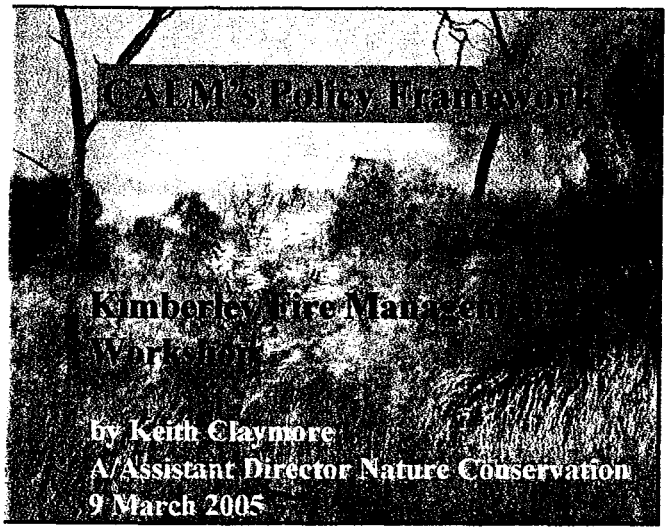
16. As part of an adaptive management framework, biodiversity monitoring must be undertaken and should focus on, in order of priority; threatened species and communities, fire sensitive species and communities and the remaining biota.

- It may be useful to focus on easily identifiable indicator species (e.g., Cypress pine) and assemblages (e.g. mound springs) to monitor fire effects.

17. In keeping with developing Government policy the planning and implementation of fire management will be undertaken in partnership with traditional owners.
    - Fire management plans will incorporate the protection of Aboriginal cultural values. For fire management undertaken by CALM, particularly on CALM managed lands, every effort will be made to have the active participation by Aboriginal people who speak for that country.

POWERPOINT PRESENTATIONS

1.	CALM Policy Framework	Keith Claymore
2.	Fire Management Policy, Responsibilities, Resourcing and Issues	Alan Walker
3.	Role of Fore Management Services	Femina Metcalf
4.	Kimberley Fire Management Program	Kevin White
5.	Environmental Effects of Recent Modern Fire Regimes	Gordon Graham
6.	The Top End	Jeremy Russell-Smith
7.	Kimberley Fire Management – Pastoral Sector	Jane Blackwood/ Andrew Craig
8.	Aboriginal Burning	Tom Vigilante
9.	Fire Behaviour in Tropical Savannas	Neil Burrows
10.	Dreaming: envisaging the future	Max Haste
11.	Fire Management System – Qld model	Max Haste



Outline of talk

- Policy context
- Corporate goals and objectives
- CALM's Outputs
- Nature Conservation Output
- Fire Management Budget
- Challenges

CALM's fire obligations

- Fire management subject to provisions under CALM Act on CALM managed lands
- Promote appropriate fire management across all tenure – special obligation for threatened biota
- Duty under common law – negligible activity

CALM's Corporate Plan (1 of 3)

Conserving biodiversity

Objective: To protect, conserve and, where necessary and possible, restore Western Australia's natural biodiversity

Strategies: include "...use fire to promote biodiversity, to reduce fire hazards and damage to biodiversity, and to regenerate and protect ecosystems"

CALM's Corporate Plan (2 of 3): The three primary Outputs

- Sustainable Forest Management
- Parks and Visitor Services
- Nature Conservation

Nature Conservation Output (3 of 3)

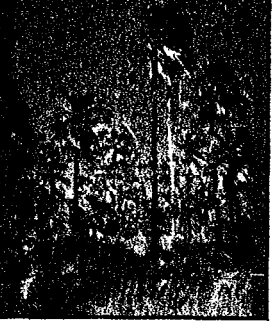
- Output Description
  - The development and implementation of programs for ...
- Outcome Description
  - Conservation of biodiversity (the variety of life forms: the different plants, animals and micro-organisms; the genes they contain and ecosystems they form)

Key Result Areas (1 of 3)

KRA 1 – Est. of conservation reserve system
KRA 2 – Maintenance of a protected area network
KRA 3 – Conservation of landscapes/seascapes scale ecological systems and processes (integrating reserve and off-reserve conservation)
KRA 4 – Recovery of signf. species and ecological communities
KRA 5 – Providing sustainable tourism and increased enjoyment of protected areas
KRA 6 - providing community involvement and encouraging understanding, and support of biodiversity conservation activities

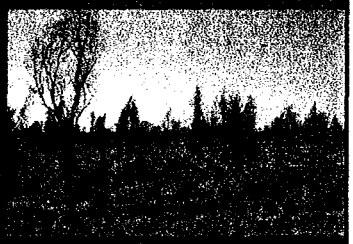
Fire management goals: Need for integration (2 of 3)

- Nature Conservation Output
  - Maintain and recovery biodiversity
- Parks and Visitor Services Output
  - Maintain life and property



Draft fire management policy, outlines principles

- Fire management has multiple goals
- Fire management will be planned and implemented in partnership with key stakeholders
- Sets out principles



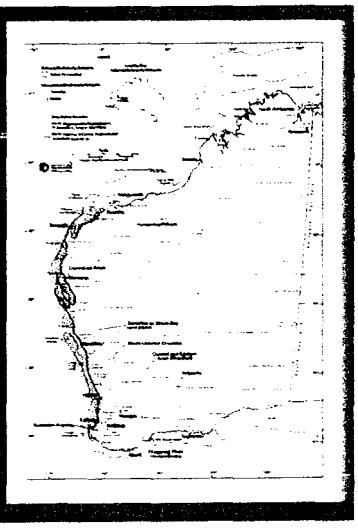
NC Output priorities relating to fire management 05/06 (3 of 3)

KRA 3

- "Management of fire to maintain and recover biodiversity, including development of a State and regional monitoring and evaluation programs to gauge effectiveness and progress, and progressively develop targeted landscape approaches"

Budgets

- Department adopts a purchaser/provider model where the Output Directors purchase services from other Divisions
- For 2004/05 – NC $58 665 000
- Functional Review 2002/03 Estimated about $14.2
- Target budget for 2004/05 $17,352 657



Budget split – target fire budget 04/05

	NC	PVS	SFM	$
Planning	0.896	0.353	1.0	2.258
Operations	6.89	2.46	4.97	14.3
Training	0.333	0.186	0.257	0.777
TOTALS	8.12	3.0	6.2	17.35
	47%	17%	36%	

30% prescribed burning

Additional funding for fire (1of 2)

- 2003/04 – S2.986 M (one off)
- 2004/05 - S3M – SW
- 2005/06 –$5
- 2006/07 -$6.930

Increased Fire Management Funds for outside SW (2 of 2)

- Additional funds to:
  - Fire operations officers
  - Operational planning
  - Implementation
  - M&E
  - Research scientist

Indicative:

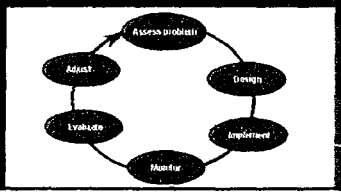
Kimberley - $340K
Pilbara - $420K
Goldfields – $400K
Mid-West - $410K
Science - $140K

Kimberley NC Review 2002

- Recommended regional fire plans
- Undertake series of large-scale adaptive management projects
- Inappropriate fire regime recognized as a high priority across the Kimberley sub-regions
- Candidate activities, inc
  - Strategic fire plan at bioregional scale
  - Specific fire projects – Mitchell; and high value assets
  - More patch burning;
  - Need for monitoring
  - Couple prescribed burning with introduced animal control

Challenges (1 of 2)

- Operationalise Nature Conservation Output generic goals and objectives relating to fire management
- Move from a linear fire management model towards an active adaptive management framework



Challenges (2 of 2)

- Development of a active adaptive management plan for fire management at a property (reserve) and regional scale THAT:
  - describes clear goals and objectives for management;
  - describes and sets management action targets to achieve desired condition targets;
  - describes and sets resource (biodiversity) condition targets; and
  - determines measures of success (indicators) for maintaining and/or recovering biodiversity.

THE END

Department of Conservation and Land Management

FIRE MANAGEMENT POLICY, RESPONSIBILITIES, RESOURCING AND ISSUES

Presentation to Kimberley Region Fire Management Workshop

Alan Walker
Director Regional Services

9-11 March 2005

GOVERNMENT OF WESTERN AUSTRALIA
DEPARTMENT OF Conservation AND LAND MANAGEMENT

Fire Management Policy, Responsibilities, Resourcing and Issues

Policy

- Government Policy
- Opposition Policy
- Bushfire Inquiries – National and State
- CALM's Draft Fire Management Policy

Responsibilities

- CALM-managed lands
- Unallocated Crown land and Unmanaged Reserves

Fire Management Policy, Responsibilities, Resourcing and Issues

Resourcing

- Budget increases 2003/04–2007/08 and ongoing
- New Cabinet Submission
- 40 additional firefighters in the south-west – also to be deployed in remote regions

Issues

- Smoke management
- CALM's workforce
- Incident management – command and control on other than CALM-managed lands
- South-west centricity!

GOVERNMENT POLICY

The Government strongly supports prescribed burning as the primary fire protection strategy for biodiversity values, private and public assets and rural communities in the south-west.

Dr Judy Edwards
Minister for the Environment

February 2003

The Department of Conservation and Land Management will work to step up its prescribed burning activities in the face of a potentially serious summer bushfire season.

Environment Minister Dr Judy Edwards said she had asked the Department to complete as much of its proposed burning program as possible in the northern and central forest areas during November.

Dr Edwards said the program would continue in the southern forests into December as conditions became more suitable for planned burns.

“Although the Department has an annual planned burning program of about 200,000 ha, in three out of the past four years it has achieved less than 50 per cent of this target,” she said …….

12 November 2002

“This accelerated program will be vital if we are to have the strategic buffers throughout the forest to minimise extended fire runs in the event of wildfires.

“Research by the Department and other agencies – such as CSIRO – has repeatedly demonstrated there is a high correlation between fire intensity and the available fuel loadings.

“There also is a similar correlation between the speed at which a forest fire travels and fuel loading.

Consequently, by controlling the fuel loadings, land managers and fire authorities will have a better chance of minimising the potential damage to property and community assets, as well as conservation values ……

12 November 2002

Dr Edwards said the Government recognised accelerating the burning program might result in some short-term smoke impacts in built-up areas.

“Smoke management is a limiting factor in the Department’s prescribed burning operations,” she said.

“While I expect the Department to continue to incorporate smoke management guidelines in its prescribed burning operations, there may be periods over the next few weeks when smoke or haze will impact on the metropolitan area.”

Dr Edwards said she had asked the Department to monitor the burning program closely and to provide advance warnings to the public in the event of haze or other smoke impacts.

12 November 2002

The Government supports the use of planned burning to achieve biodiversity and protection outcomes, and has provided additional funds to ensure that the Department has sufficient resources to achieve the planned burning program.

I ask the House to join me in commending the efforts of the Department's fire crews.

Dr Judy Edwards
Minister for the Environment

Statement to Parliament
8 May 2003

Members may remember that last December, the Government announced the allocation of an additional $3 million to CALM for fire management in the 2003-04 financial year. This allocation has been a significant factor in allowing CALM to achieve its targets through the employment of additional seasonal personnel. That additional funding was provided in response to concerns that the backlog of burning programs in the south-west was increasing and that there could be a significant risk to communities and environmental values. In further recognition of the need to protect property, community assets and biological values from the ravages of wildfires, the Government is allocating an additional $24.3 million to CALM over the next four years for fire management. Additional funding for 2004-05 is $3.6 million, with extra funding of $5.6 million in 2005-06 and $7.6 million a year in the following years.

2 June 2004

The additional funding that the Government is providing to CALM and the development of new technology will assist CALM in placing a greater emphasis on managing fire for ecological purposes, as well as helping to protect human life, private property and community assets.

Dr Judy Edwards
Minister for the Environment

Statement to Parliament
2 June 2004

OPPOSITION POLICY

Motion

Mr P.D. Omodei (Warren-Blackwood): On behalf of the members for Vasse, I move –

That this House calls upon the Government to accept that –

(a) fire is a natural part of Western Australia's environment;

(b) fire is an essential management tool in virtually all WA ecosystems;

(c) the exclusion of all fire from natural areas, as supported by some environmentalists, poses serious threats to life, property and environmental values if implemented; and

(d) adequate funding for the appropriate use of fire as an environmental management and hazard reduction tool must be provided as a high budget priority.

CALM does not have the resources to burn large areas. It can burn only a certain amount with the number of staff it has. Some of the reasons for the reduction in controlled burning over the past four years has been smoke management, unusual weather – including dry winters ……..

I am gravely concerned about the future of our forests, particularly in the wake of this Government's decision on forest management in Western Australia. The Government needs to make a conscious decision to place significantly more resources into fire control and prescribed burning in Western Australia.

Mr P.D. Omodei
Member for Warren-Blackwood
6 November 2002

If the prescribed burning is not done and the risk is not minimised, there is an element of negligence on the part of the Government of the day and the people responsible for making decisions. CALM burnt 75,000 hectares last year and 88,000 hectares the year before; that is, in 2000-01. That is way down on the 174,000 hectares burnt in 1999-2000. My understanding is that CALM usually burns about 2000 hectares a year ……

Colin Barnett
Member for Cottesloe
6 November 2002

I am not apportioning personal blame. The level of burning over recent years has been too low. I hope we get through this summer without a fire. The Minister needs to ensure that prescribed burning is undertaken at an accelerated level.

If it causes haze across Perth, the Minister will have our support. We will support the Government on the issue of air quality around Perth. We recognise it will cause discomfort to some people. The Minister will not find members on this side of the House criticising the Government for undertaking prescribed burning.

Colin Barnett
Member for Cottesloe
6 November 2002

A Nation Charred: Inquiry Into the Recent Australian Bushfires

October 2003
House of Representatives Select Committee on the Recent Australian Bushfires

59 Recommendations – few relate to arid, semi arid or tropical ecosystems

Recommendation 13

The Committee recommends that the Commonwealth seek to ensure that the Council of Australian Governments seek agreement from the States and Territories on the optimisation and implementation of prescribed burning targets and programs to a degree that is recognised as adequate for the protection of life, property and the environment. The prescribed burning programs should include strategic evaluation of fuel management at the regional level and the results of annual fuel management in each State should be publicly reported and audited.

A Nation Charred: Inquiry Into the Recent Australian Bushfires

October 2003
House of Representatives Select Committee on the Recent Australian Bushfires

Recommendation 17

The Committee recommends that the Bushfire Cooperative Research Centre conduct further research into the long term effects and effectiveness of grazing as a fire mitigation practice.

Recommendation 18

The Committee recommends that the Bushfire Cooperative Research Centre conduct further research on the impact of weeds on the flammability of land and the most economically and environmentally appropriate way to remove weeds after fire events.

National Inquiry on Bushfire Mitigation and Management

Council of Australian Governments
March 2004

29 Recommendations

6.4.4 Risk Modification

There is compelling evidence to show that a reduction in fuel loads in bushland environments will reduce fire intensity and modify fire behaviour. This is the only cost effective way to achieve fuel reduction in large areas of the landscape.

National Inquiry on Bushfire Mitigation and Management

Council of Australian Governments
March 2004

Inappropriate Fire Regimes and Biodiversity

Inappropriate fire regimes have been recognised as potentially threatening to the conservation of biodiversity.

The National Land and Water Resources Audit noted that changed fire regimes threaten ecosystems across Australia and are one of the principal threats in northern Australia. The national *State of the Environment Report 2001* highlighted the deleterious effects of inappropriate fire regimes on native species, especially in the arid and semi-arid rangelands. *The Action Plan for Birds 2000* estimated that altered fire regimes affect 45 per cent of mainland bird species.

The Australian Government and state and territory governments recently identified 15 national biodiversity “hot spots” – regions of Australia that are rich in biodiversity but also under immediate threat – as priorities for funding. For 10 of these 15 regions, altered fire regimes and/or threat from bushfires is listed as a key threatening process adversely affecting the biodiversity of the region.

National Inquiry on Bushfire Mitigation and Management

Council of Australian Governments
March 2004

Indigenous Australians' use of fire

Recommendation 6.4

The Inquiry recommends that fire agencies, land managers and researchers continue to work in partnership with Indigenous Australians to explore how traditional burning practices and regimes can be integrated with modern practices and technologies and so enhance bushfire mitigation and management in current Australian landscapes.

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

Environmental Protection Authority Bulletin 1151
October 2004

9 Recommendations

4.1.1 Fuel Reduction

There is a degree of dispute in the community on the value of prescribed burns for reducing fuels. This may stem from data which indicate there is no reduction in the number of wildfires as a consequence of prescribed burns. The value is not in reducing the number of wildfires, but rather in reducing the intensity and increasing the prospects of suppressing them, and of reducing the damage they cause to biodiversity values and to property.

It is the EPA's view that CALM's fuel reduction program is imperative to reduce the extent of the damage caused by wildfires to biodiversity and other assets, while recognising that prescribed burns may also affect biodiversity.

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

Environmental Protection Authority Bulletin 1151
October 2004

Other Advice

5.5. Fire management in other regions of ecological importance in the State

The review has encompassed only three CALM administrative regions, in the south west of the State. There have been calls for the EPA to broaden its brief to consider other areas, such as the eastern agricultural areas, the Pilbara and the Kimberley. The EPA recognises that there are serious fire management issues that should be addressed in other parts of the State, especially in the Pilbara and Kimberley areas, but to have done so would have greatly extended the terms of reference for this study, taken much more time and would have been outside of the terms of reference of the review. The EPA considers that CALM should, as a matter of urgency, review fire management procedures in these other areas and report its findings and recommendations to the Minister.

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

Draft Policy (February 2004)

- Released for public comment 27 February 2004 for 2 months
- Advertisements in State and local newspapers
  - Distributed to key stakeholders
  - Posted on CALM's NatureBase website
- 25 submissions received

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

Objective

The Department will manage prescribed fire and wildfires on the lands managed by the Department to protect and promote the conservation of biodiversity and natural values whilst also providing for a sufficient level of protection to human life, community assets and fire sensitive ecosystems. The Department will also promote fire management that protects biodiversity on lands not managed by the Department.

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

Objective

Fire management will be planned and implemented in partnership with other land owners and land managers, fire authorities and with the community. The Department will implement an informed and balanced approach to risk management. A variety of fire regimes incorporating different frequency, intensity, season and scale will be applied at the landscape scale on lands vested in the Conservation Commission of Western Australia

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

5.1 Use of fire

Prescribed burning plans will incorporate both nature conservation and protection objectives in order to optimise outcomes. The planning of prescribed burning will require the integration of multiple objectives and must take into account the role of planned fire in the maintenance of biodiversity (for example, by timing burning to achieve regeneration) and reducing the risk of wildfire (for example, by reducing fuel loads).

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

5.1 Use of fire

Planning for prescribed burns will incorporate the need to address strategic protection from large fires, as well as landscape scale and land management unit scale (several hundred to several thousand hectares) plans that provide for the protection and conservation requirements at each of these levels.

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

5.1 Use of fire

During the planning process for prescribed burning the Department will consult with traditional owners, the community and specific stakeholders regarding the Master Burn Plan, fire regimes for the conservation of biodiversity, the scope of the proposed burning program, individual burns and burning methods, road and track maintenance and other fuel management treatments. Fire management will also be considered during public consultation on the content of area management plans prepared for the Conservation Commission. Consultation processes will also be used as an opportunity to develop community understanding and support for fire management programs

Review of the Fire Policies and Management Practices of the Department of Conservation and Land Management

CALM's Fire Management Policy

5.1 Use of fire

Prescribed burns will be managed to reduce the risk of smoke causing detrimental impacts on population centres and other sensitive areas through the application of smoke management guidelines. Potential impacts of smoke and ash on water catchments, road traffic, neighbours and visitors, and firefighters will be considered when planning and implementing prescribed burns.

CALM's Fire Management Policy

Rationale

- Fires have occurred regularly on most lands managed by the Department. Fires from natural causes (eg. lightning) will inevitably occur. Fires from human activities, either deliberate or accidental, will also occur, but unplanned fires may be minimised by effective public education and awareness, and by enforcement of legislation and compliance management. (Refer Policy 5.1, 5.3.)
- Aboriginal people have inhabited Western Australia for more than 40,000 years and over this period they have used fire as a management tool for hunting, access and spiritual reasons. The landscapes that European settlers and their descendants have come to recognise as being distinctively Australian have been fashioned by fire over many generations. (Refer Policy 5.1, 6.)
- Fire has very different impacts on the biota contained in the twenty-six bioregions represented in Western Australia. Fire regimes must be appropriate to the needs of each bioregion. (Refer Policy 5.1.)

CALM's Fire Management Responsibilities

- **CALM-managed lands**
  - CALM Act silent on fire
  - Management plans, Nature Conservation, Bushfires Act and Duty of Care are the main drivers
- **UCL**
  - Pre-suppression only
- **Other lands**
  - Wildlife Conservation Act responsibilities

Fire Management Resourcing

Allocation of additional Fire Management Budgets 2003/04 to 2007/08

	$M				
Region/CC	**2003/04**	**2004/05**	**2005/06**	**2006/07**	**2007/08**
Swan	1.000	1.000	1.000	1.250	1.250
South West	0.840	0.810	0.810	1.100	1.100
Warren	0.750	0.780	0.780	1.100	1.100
South Coast	0.183	0.180	0.400	0.550	0.550
Midwest	0.183	0.180	0.400	0.550	0.550
Wheatbelt			0.300	0.300	0.300
Goldfields			0.300	0.480	0.480
Pilbara			0. 300	0.480	0.480
Kimberley			0.300	0.480	0.480
Fire Mgmt Services	0.030	0.050	0.170	0.500	0.500
Science			0.140	0.140	0.140
TOTAL	**2.986**	**3.000**	**5.000**	**6.930**	**6.930**

Fire Management Resourcing

Cabinet Submission – November 2004

Requested funds	04/05	05/06	06/07	07/08 (ongoing)
	$5.6 m	$10.4 m	$9.2 m	$9.9 m

Justification

- Appropriate funding level for native forests
- Adequate level of trained/experienced staff in CALM
- CALM's capacity to deal with fire preparedness statewide
- Responding to the EPA's review (research scientists and technical officers, fire planners and operations staff)
- Fire protection of plantations

Fire Management Resourcing

Ministerial approval – February 2005

40 additional firefighters in the south-west. (Also available to undertake projects in other regions.)

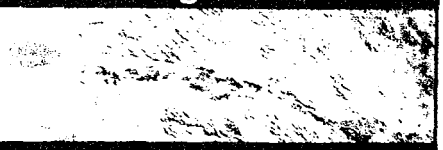
Issues

- Smoke management (impacts on tourism in Kimberley Region)
- Incident management – command and control on other than CALM-managed lands
- CALM's workforce

THANK YOU

QUESTIONS PLEASE

Role of Fire Management Services in Remote Regions



Fire Management Services (FMS)
Regional Services Division (RSD)

Conservation

Broad Key Result Areas (KRA)

(our guiding principles)

- Management of Conservation Reserve System
- Management of Fire to Maintain and Recover Biodiversity
- Identification and Mitigation of Fire Risk to Environmental and Cultural Assets
- Communicate and 'Involve' the Public
- Maintain adequate suppression preparedness and response capability

Broad Management Tools

For Rangelands Fire Management

- **Fire and Biodiversity project** (planning framework)
- **Wildfire Threat Analysis project** (risk analysis framework)
- **Fire Management Plans** (eg. Yampi, Goldfields)
- **Monitoring and Recording** (eg. Fire History - Remote Sensing)
- **Scientific Research** (eg. Bushfire CRC, BoM, CSIRO, CALMScience)
- **Community participation** (eg. Pastoralist and Indigenous involvement)

What is our Role?

- Provide standards, guidance & support to RSD & other sections of the dept to meet
  - Purchasers requirements (KRA's)
  - Legal obligations (Acts and Regulations)
  - Community expectations
- Provide leadership, coordination & integration by:
  - Determining purchasers requirements
  - Implementing the Dept's fire program inline with KRA's and approved Plans
  - Developing, implementing and maintaining Fire Management Tools (i.e. Fire & Biodiversity, WTA)

How do we do it?

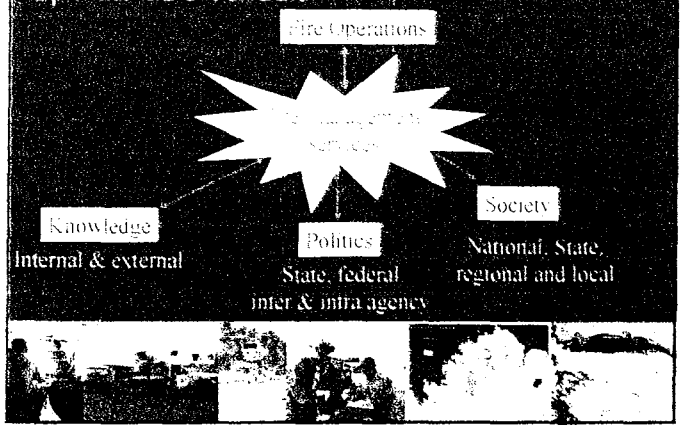
- **High-level liaison**
- **Integration and coordination**
- **Operational tools and technology**
- **Information systems & decision support tools**
- **Knowledge management**
- **Risk management**
- **Public awareness and participation**

How can FMS help remote regions?

- **Resource acquisition**
- **Education and training**
- **Operational & technical support**
- **Information systems & decision support tools**
- **Knowledge transfer**
- **Champion your cause (strategic priority)**

How can FMS help remote regions?

•Operate as a conduit



How can FMS help remote regions?

•Integrate fire management across the department and across tenures

Biodiversity Inputs

Flora, fauna, aeriodicity, season, intensity

Management inputs

Scientific research, silviculture etc

Protection inputs

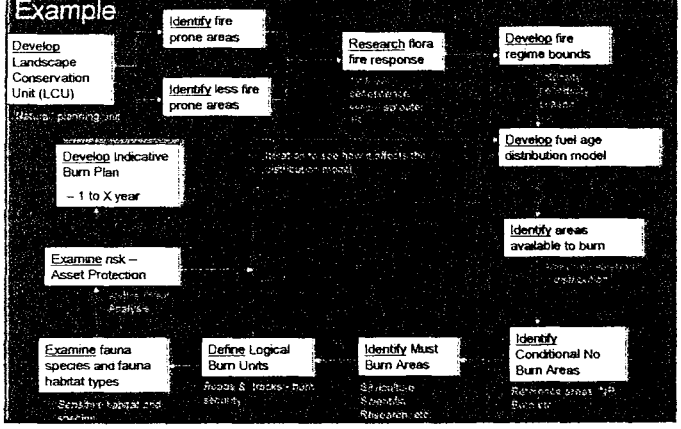
Wildfire Threat Analysis

Indicative 1 to X year Burn Plan

Seasonal Burn Plan

How can FMS help remote regions?

•Facilitate broad planning framework to deliver KRA's- Example



How can remote regions help FMS?

- **Involve FMS in the fire management business processes** – Planning, Operations, Education & Training and, Information and communication technology
- **Keep communication channels open**
  - Awareness of Issues and Concerns
  - Communicate Process and Outcomes
  - Timely maintenance and dissemination of processes
- **Use bi-focals – local AND strategic perspectives are needed**

Kimberley Fire Management Program

DEPARTMENT OF Conservation AND LAND MANAGEMENT

Kevin White, Ed Hatherley

Kimberley Fire Management Obligations

- To use fire as a tool to conserve biodiversity
- Protect assets & high use sites
- UCL fire planning
- Engage, liaise and cooperate with other stakeholders (LGA, pastoralists, traditional people, FESA, Mining Companies, Defence etc)

Introduction of Pastoral Activity and its associated impact on Biodiversity

Careening Bay now.....

Fire is an ecosystem driver – Careening Bay 1820

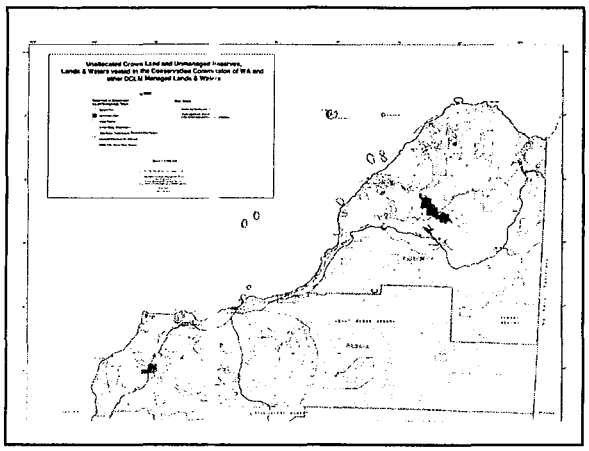
'The *Mermaid* under repair at Careening Bay on the Kimberley coast, September 1820' (sketch by King)

Kimberley fire management strategy.

- A landscape mosaic supported by fuel reduced buffers to manage high intensity late dry season fires.
- A mosaic within areas burnt - best achieved when senescent material is present.
- Diversity in vegetation structure and composition
- Maintain ecosystem processes (fire adapted/dependent)
- Asset protection (built, cultural & fire sensitive communities)

Where does CALM burn

- CALM managed land vested in Conservation Commission
  - National Park, Nature Reserve, Conservation Park, State Forest, Timber Reserves
- Unallocated Crown land
- Burning by Arrangement
  - Department of Defence land
  - Department of Indigenous Affairs land
  - Strategic buffers linked to pastoral land
  - *The amalgamated tenure within the Kimberley region equates to managing an area the size of Victoria – spread over 10.8 m ha.*

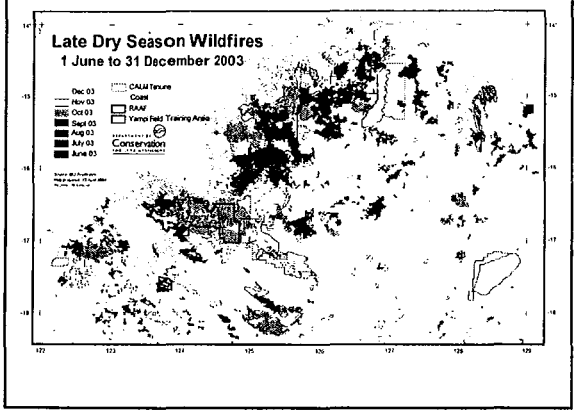


How much do CALM burn 2003/04

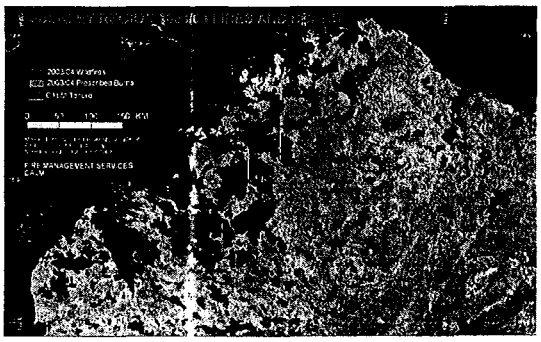
Tenure	Flying hours	Ignition line (km)
CALM &UCL	51	4,180km (21,311 capsules)
FESA/ pastoral	68	6,780km (42,545 capsules)
Defence	12	1,080km (6480 capsules)

How much gets burnt? Fire season 2002/03 – from the end of wet to December

- 32 % of Kimberley affected by fire during the entire fire season (April – Dec)
- 16% of Kimberley burnt up to end of June (early dry) - all fire
- Of area burnt to the end of June - only 7.6% was prescribed fire (92.4% wildfire)



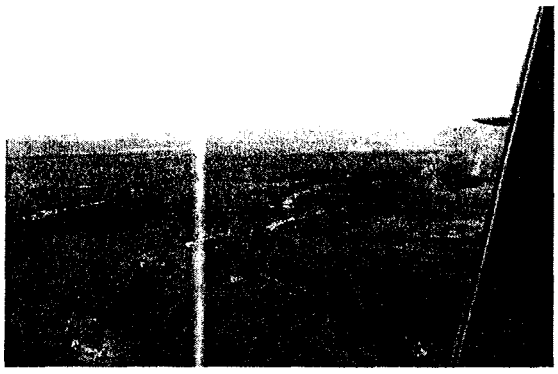
Modus image



What outcomes do we aim to achieve?

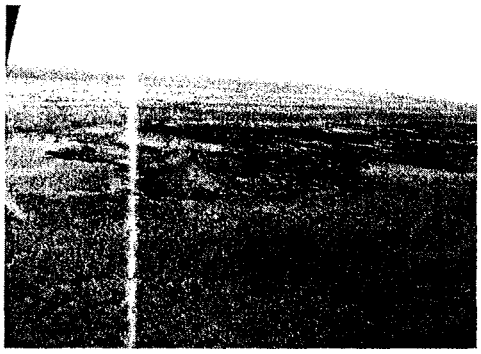
- To create and maintain a mosaic of vegetation structure and composition by creating and maintaining a mosaic of fire history (season, patchiness, time since fire)
- To protect this mosaic from impacts of uncontrolled wildfire by creating low fuel buffers

Linking Buffers across Tenure



Creating Buffers

Landscape mosaics using Natural Features, Water courses & areas of minimal vegetation



How do we burn?

- Ground operations – limited to asset protection burning
- Aerial operations – GPS guided delivery of incendiaries

Ground operations

Ground operations

Low intensity wet season burning

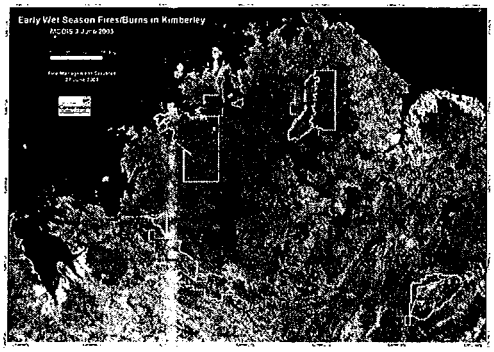
Low intensity early dry season burning

NO high intensity dry season burning

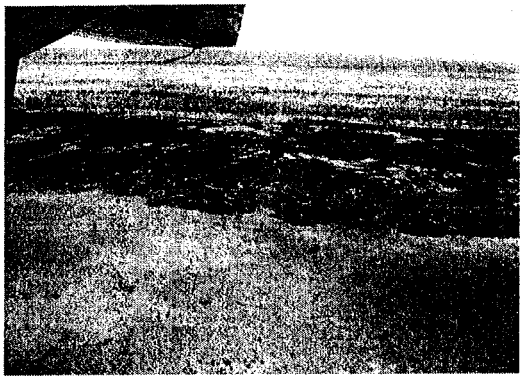
Within burn mosaic

Landscape mosaic

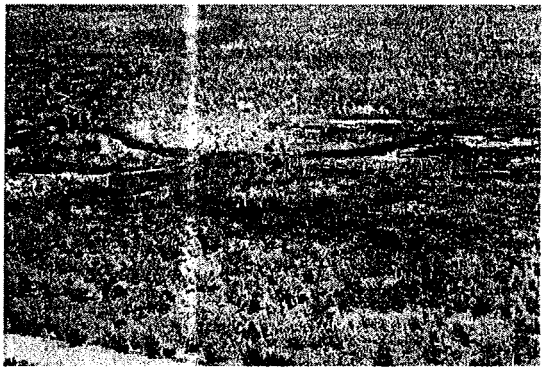
Regional mosaic



Effective buffers



Protection of infrastructure

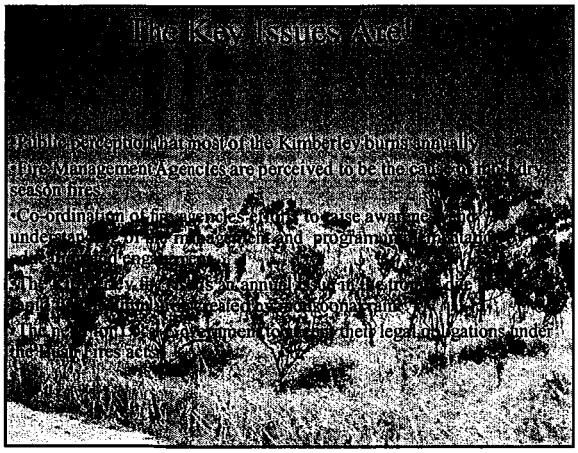


What is CALM working on

- Defining the 'fuel models' (land systems/ bioregion) for the Kimberley – what will burn, when and how?
- Fire weather – when to light and predicting when it will go out?, RAWS
- What happens after fire? – recovery
- Fire history records – remote sensing
- Kimberley biological survey – what is here?

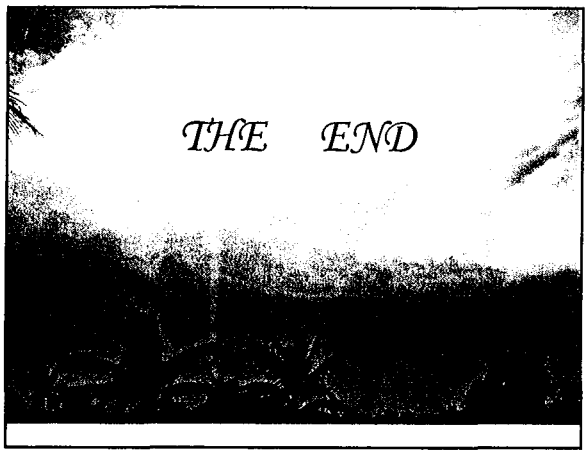
Where to from Here?

The Key Issues Are!



Calm Kimberley Key Issues

- Engage with Traditional owners as part of liaison and planning.
- Further develop Weights of Evidence models for CALM estate.
- Collaborative approach to Rangelands management with other land management agencies.
- Determine status of Biodiversity with the region.



Environmental Impacts of Modern Fire Regimes

Changed or inappropriate fire regimes remain the major threatening process affecting the biota of the Kimberley from the macro to micro scale.

Historical Perspective

'The seasonality of fire varied across the region. In northern parts of the Kimberley landscape fire was recorded from May to October with peak levels in June and September. In southern parts of the region there are records of burning as early as February and March, through to August but no records of fire were made in late dry season months' (Vigilante 2001)

Again from Vigilante (2001)

- In comparison with modern fire regimes; *'The results indicate an increase in early dry season fires and the overall frequency of fires across the region in modern times.'*
- Whilst wet season burning has been documented in the Northern Territory; *'There is no evidence that it was ever practiced in the Kimberley.*

Current perspective

- Traditional burning practices have all but ceased.
- There are a range of people with differing land management objectives.
- It is generally accepted that there has been a shift to large, late dry season fires that are environmentally damaging.
- The Kimberley environment is not 'pristine'.

Environmental perspective

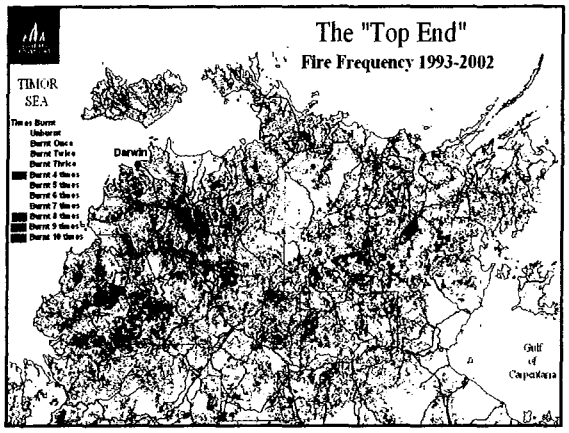
- We are seeing changes at the landscape scale.
  - Vegetation structure
  - Vegetation composition
- There are impacts on fauna
  - This may be due to habitat change, Eg protection, or;
  - Resource based

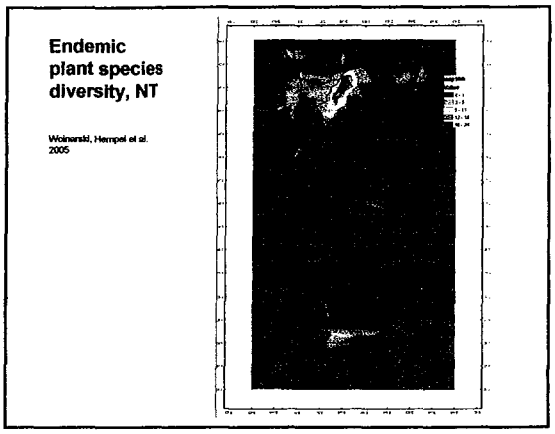
Examples

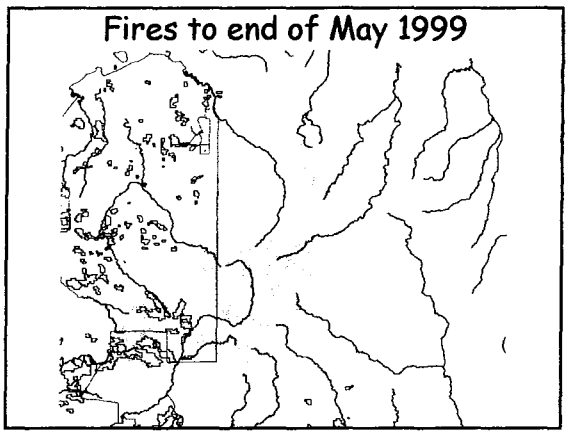
- Spinifex – sorghum shift
- Grasses shift
- Cypress pine.
- Mistletoes
- Certain rainforest types
- 'Resistant' species
- Granivorous bird species
- Bandicoot
- Termites?

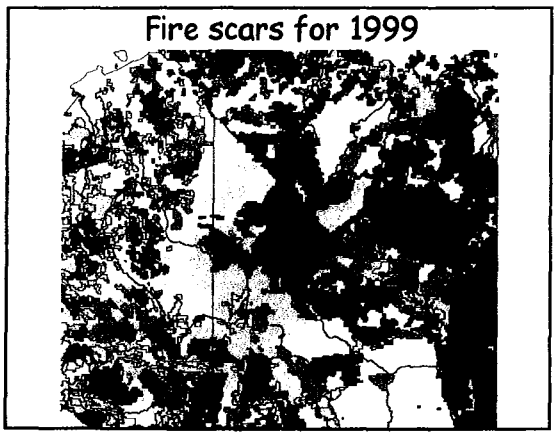
Future perspective

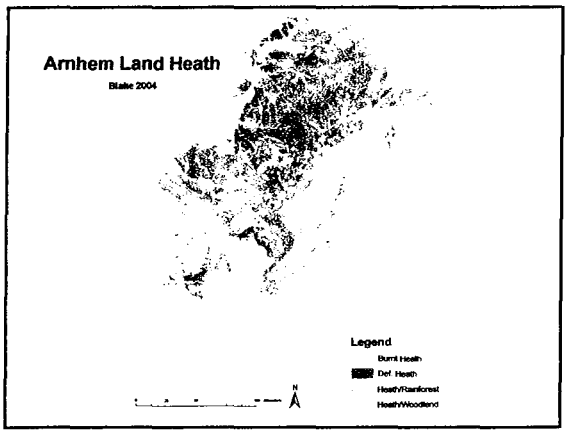
- Returning to a 'Traditional' burning regime.
  - The fuel characteristics have changed at a massive scale.
  - Knowledge has been lost.
  - The way the land is 'used' has changed.
  - The required resources are not available.
- Use simple indicators for the landscape to tell us its' fire regime.
- Question and know why fire is being used.

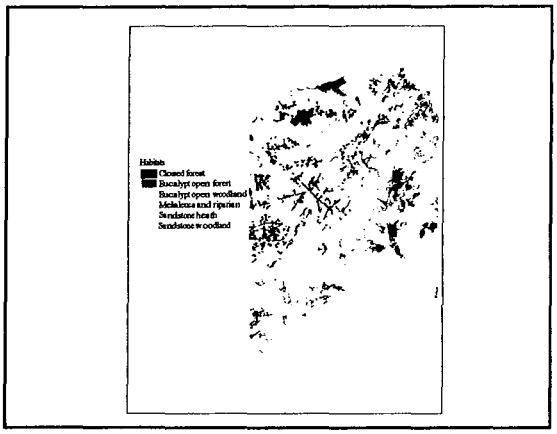

The "Top End"
Fire Frequency 1993-2002
TIMOR SEA
Darwin
Gulf of Carpentaria

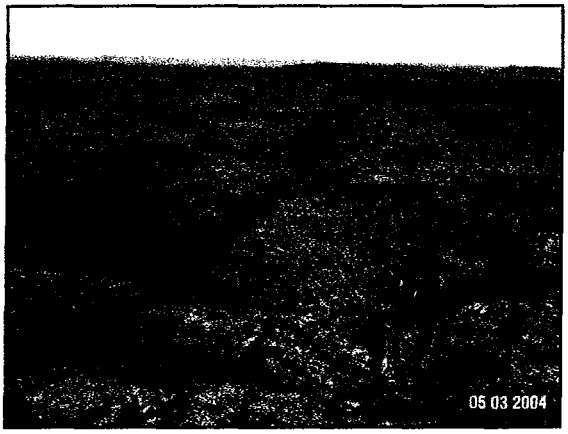

Endemic plant species diversity, NT
Weinanld, Hempel et al. 2005

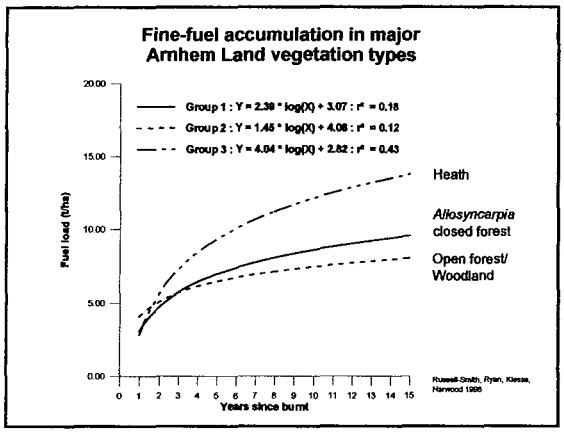

Fires to end of May 1999

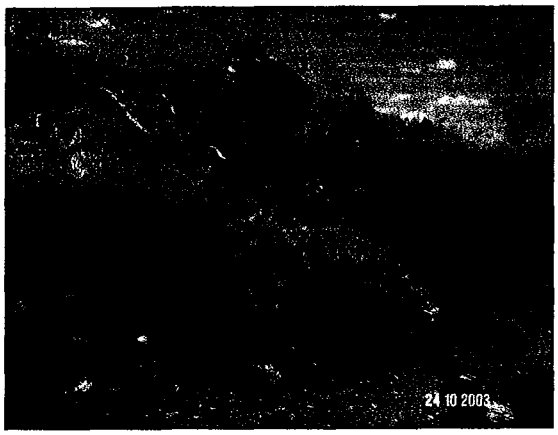

Fire scars for 1999


Arnhem Land Heath
Blake 2004
Legend
Burnt Heath
Def. Heath
Heath/Rainforest
Heath/Woodland
N

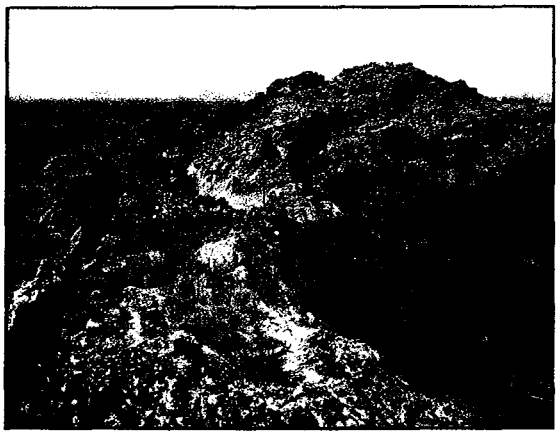

Habitats
Closed forest
Eucalypt open forest
Eucalypt open woodland
Melaleuca and riparian
Sandstone heath
Sandstone woodland

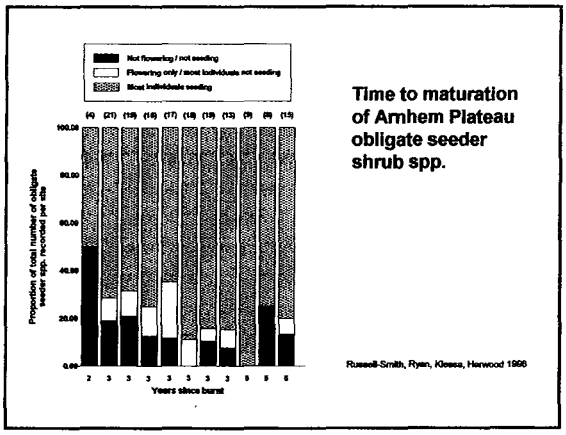

05 03 2004

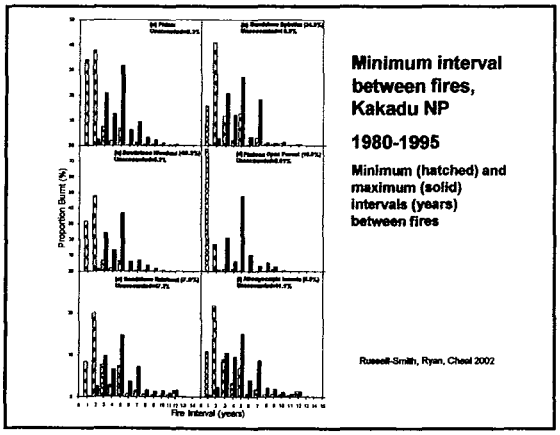

Fine-fuel accumulation in major Arnhem Land vegetation types
Group 1 : Y = 2.39 * log(X) + 3.07 : r² = 0.18
Group 2 : Y = 1.45 * log(X) + 4.08 : r² = 0.12
Group 3 : Y = 4.04 * log(X) + 2.82 : r² = 0.43
Heath
Allosyncarpia closed forest
Open forest/ Woodland
Fuel load (t/ha)
Years since burnt
Russell-Smith, Ryan, Klessa, Harwood 1998


24 10 2003

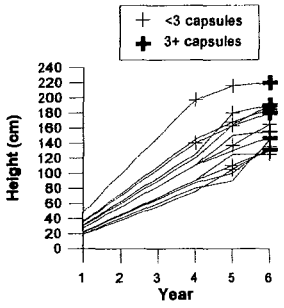

10 04 2003



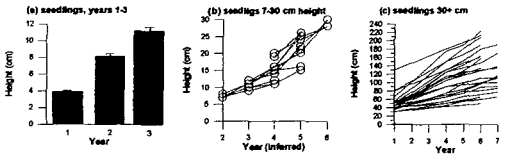

Not flowering / not seeding
Flowering only / most individuals not seeding
Most individuals seeding
Proportion of total number of obligate seeder spp. recorded per site
Years since burnt
Time to maturation of Arnhem Plateau obligate seeder shrub spp.
Russell-Smith, Ryan, Klessa, Harwood 1998

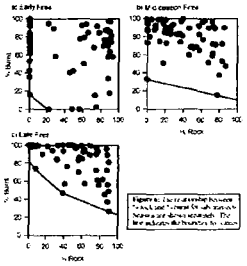

Proportion Burnt (%)
Fire Interval (years)
Minimum interval between fires, Kakadu NP
1980-1995
Minimum (hatched) and maximum (solid) intervals (years) between fires
Russell-Smith, Ryan, Cheal 2002

Time to maturation of *Petraeomyrtus* (*Regelia*) *punicea*, following burning



Growth of tagged Cypress pine seedlings, Arnhem Plateau

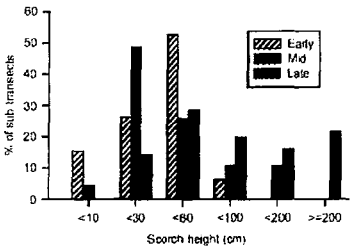




Relationship between %burnt and %rock, at different times of year, Arnhem Plateau

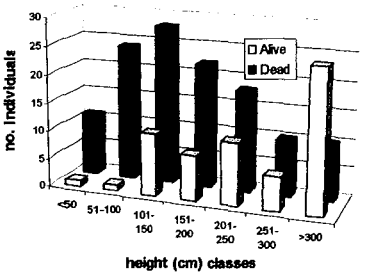
Price, Russell-Smith, Edwards 2002

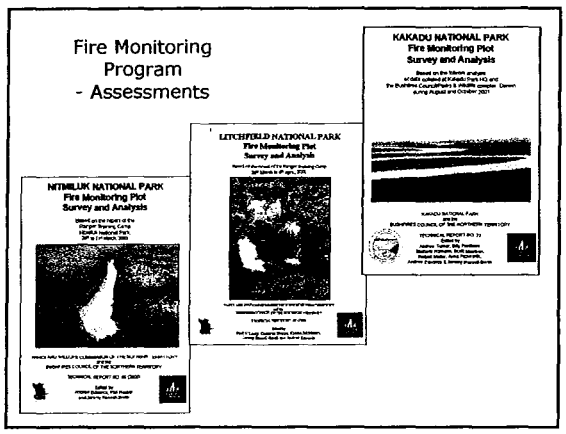
Relationship between scorch height and season, Arnhem Plateau

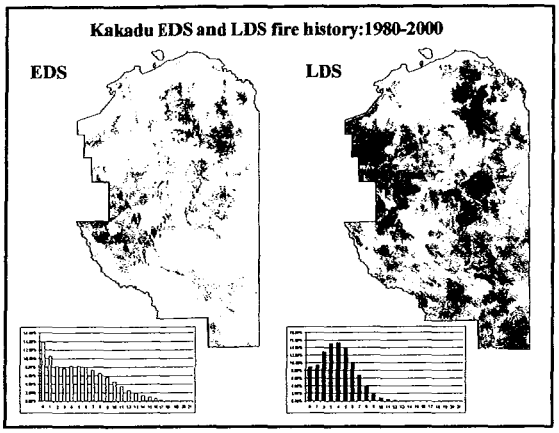


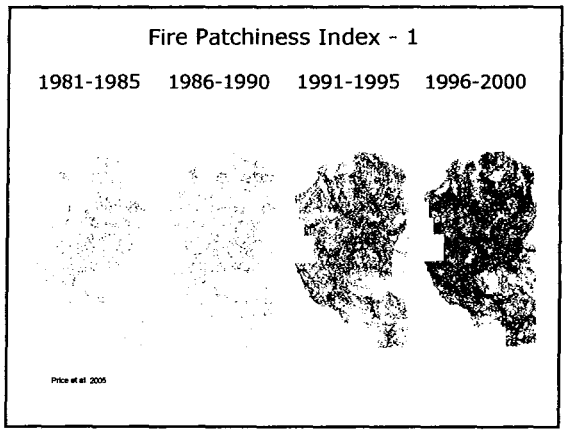
Price, Russell-Smith, Edwards 2002

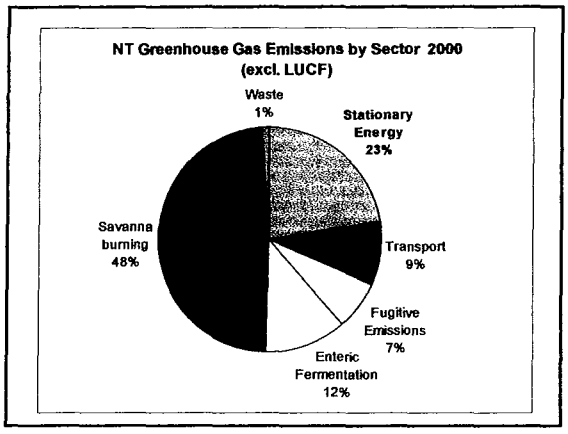
Relationship between height and survival of Cypress after fire (in April 2003), Arnhem Plateau

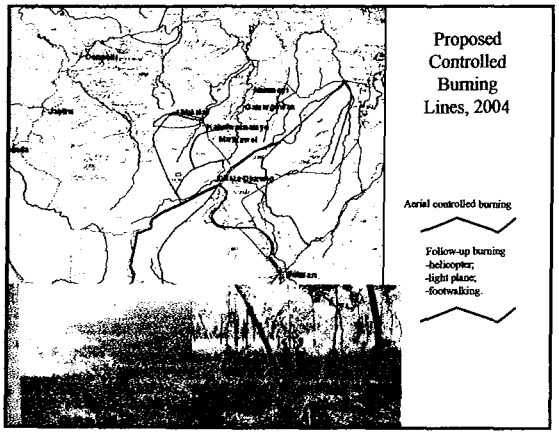



Fire Monitoring
Program
- Assessments
KAKADU NATIONAL PARK
Fire Monitoring Plot
Survey and Analysis
LITCHFIELD NATIONAL PARK
Fire Monitoring Plot
Survey and Analysis
NITMILUK NATIONAL PARK
Fire Monitoring Plot
Survey and Analysis


Kakadu EDS and LDS fire history:1980-2000
EDS
LDS

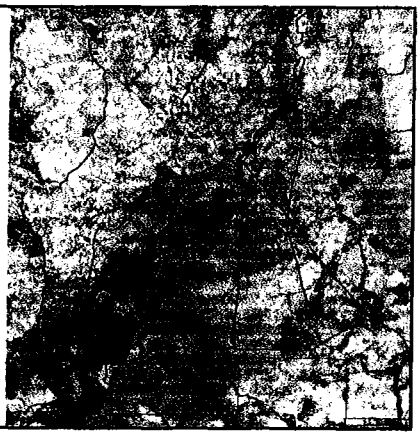

Fire Patchiness Index - 1
1981-1985
1986-1990
1991-1995
1996-2000
Price et al 2005

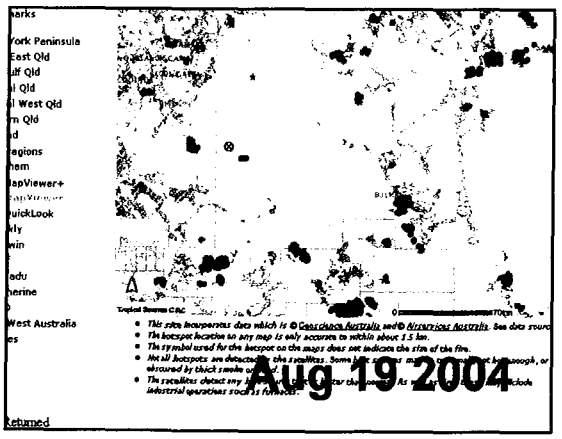


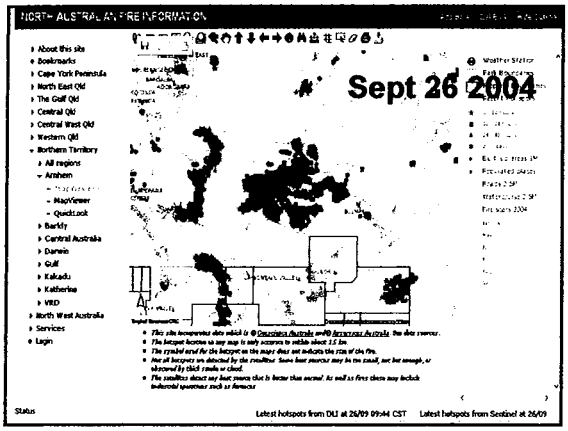


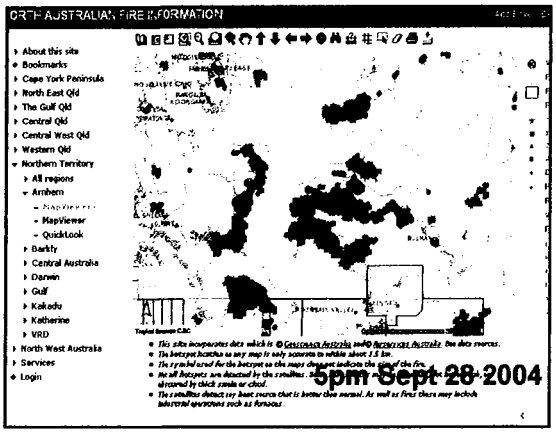
MODIS satellite image showing outcomes of the aerial control burning planned with elders at Kabulwarnamyo.

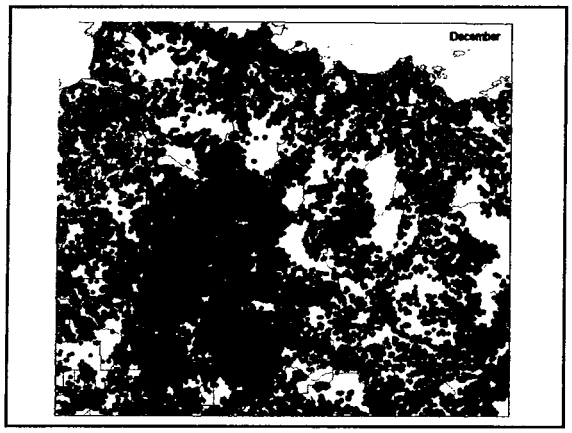
The satellite images show us where there are gaps in our firebreaks and they help us talk to the elders about the work we are doing.






NORTH AUSTRALIAN FIRE INFORMATION
About this site
Bookmarks
Cape York Peninsula
North East Qld
The Gulf Qld
Central Qld
Central West Qld
Western Qld
Northern Territory
All regions
Arnhem
MapViewer
QuickLook
Barkly
Central Australia
Darwin
Gulf
Kakadu
Katherine
VRD
North West Australia
Services
Login
Sept 26 2004
Status
Latest hotspots from DLI at 26/09 09:44 CST
Latest hotspots from Sentinel at 26/09


NORTH AUSTRALIAN FIRE INFORMATION
About this site
Bookmarks
Cape York Peninsula
North East Qld
The Gulf Qld
Central Qld
Central West Qld
Western Qld
Northern Territory
All regions
Arnhem
MapViewer
QuickLook
Barkly
Central Australia
Darwin
Gulf
Kakadu
Katherine
VRD
North West Australia
Services
Login
5pm Sept 28 2004


December

Kimberley fire management - pastoral sector

Andrew Craig (Dept of Agriculture)
Jane Blackwood (KRFMP)

March 2005

Kimberley pastoral industry

- pastoral area ~ 220,000 km^2
- 98 leases, covering half of region
- average lease size ~ 2,200 km^2
- (2001) estimated cattle herd ~ 531,000
- 80% production → live export market
- industry value (99/00) $59M
- mainly depends on native pastures

industry challenges

- protecting resource condition
- maintaining 'healthy savannas'
- balancing production and conservation
- supporting indigenous enterprises
- diversification opportunities
- cost/price squeeze; intensification?

fire management imperatives for pastoralists

- safety and training
- managing wildfire risk
  - protection of pasture, station assets, stock ...
- planned burning - objectives include
  - fuel reduction, improving pasture quality
  - shrub control, influence grazing spatially etc.
- managing post-fire grazing

planned burning ...not a simple task!

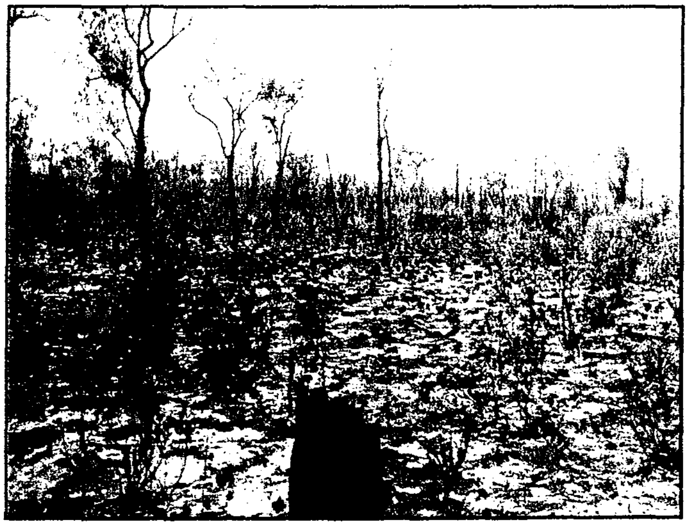
- identify purpose(s) of burning on property
- desired fire regime in time and space
- nutrition of stock - quantity and quality
- control grazing before/after fire?
- thorough preparation
- critical information - fuel and weather
- execution of burn
- monitor outcomes, adapt practices as reqd

fire regime - longer term consequences

- effect of fire-grazing regime on pastures
- managing vegetation structure
  - woody plants may reduce grass production
  - thickets increase mustering costs
- trading off grass as feed *vs* grass as fuel
  - economics and logistics
  - effect on long-term 'carrying capacity'

Examples

- Spinifex – sorghum shift
- Grasses shift
- Cypress pine
- Mistletoes
- Certain rainforest types
- Resistant species
- Granivorous bird species
- Bandicoot
- Termites?



Future perspective

- Returning to a 'Traditional' burning regime
  - The fuel characteristics have changed and [illegible] scale.
  - Knowledge has been lost
  - The way the land is used has changed
  - The required resources are not available
- Use simple indicators for the landscape to tell us its fire regime.
- Question and know why fire is being used.

planning needs include...

- information
  - guidelines, fire history, land type, infrastructure etc.
- training of station personnel
- equipment requirements & readiness
- track and fence-line grading
- consultation with neighbours
- permits
- documentation and monitoring

constraints on planned burning

- suitable fuel & weather characteristics
- limited resources on a per-hectare basis
- conflicting priorities (mustering, repairs...)
- topography and access often difficult
- legal responsibilities
- benefits may be uncertain / long-term

some research issues

- designing practical mosaics
  - proportion of paddock/country type to be burnt
  - animal production consequences
  - avoiding damage from congregating stock
  - controlling shrub establishment
  - minimising soil and carbon loss
- improved decision support software

Issues in common
conservation and pastoral

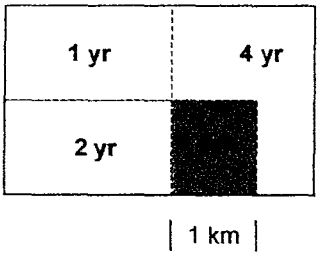
- priority given to managing wildfire risks
- avoiding loss of desirable perennial grasses
  - annual sorghum advantaged by frequent hot fire
- limited resources for fire management
  - people, equipment, $, time during year
  - terrain often rugged, limiting access

Issues in common - continued

- need workforce with practical fire management skills
- need for timely and reliable information
- limited control over complex natural systems
  - our understanding of responses remains limited
- interest in aerial control burning
- in some cases, boundaries!

Differences
pastoral *vs.* conservation

- Pastoral: greater emphasis on
  - end of year burning, especially in drier areas
  - more productive parts of landscape (lowlands)
  - larger-scale mosaics preferred? (time since fire)
  - maintaining open structure of vegetation
  - managing post-fire grazing
  - wider range of purposes for burning



PADDOCK MOSAIC

Differences
pastoral *vs.* conservation

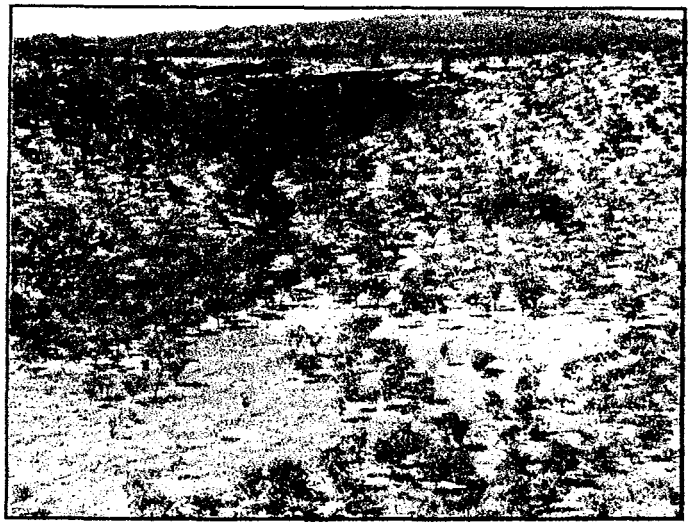
- Conservation: greater emphasis on
  - visitor safety
  - fire-sensitive spp / communities (sandstone ...)
  - 'special' habitats (rainforest patches, springs ...)
  - habitat diversity (e.g. mid-storey development)
  - fine-scale mosaics preferred ? (time-since-fire)
  - maintaining some long-unburnt patches
  - aesthetic considerations

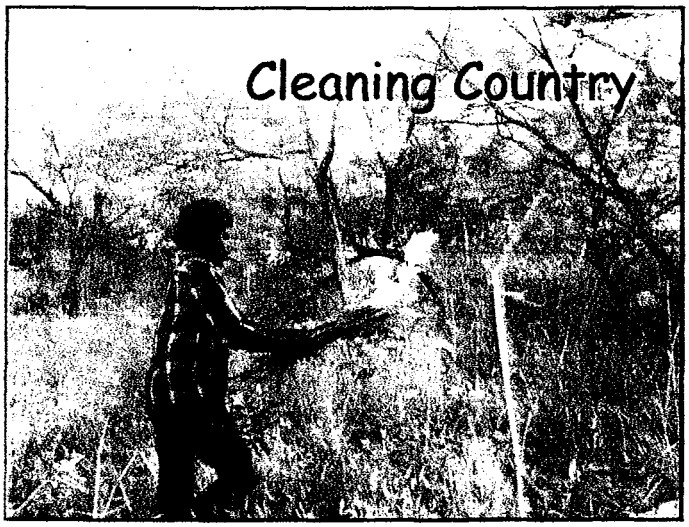
conclusion

The two sectors have much in common and much to gain from cooperation...


ABORIGINAL
BURNING
Tom Vigilante


Reasons for burning:
Hunting



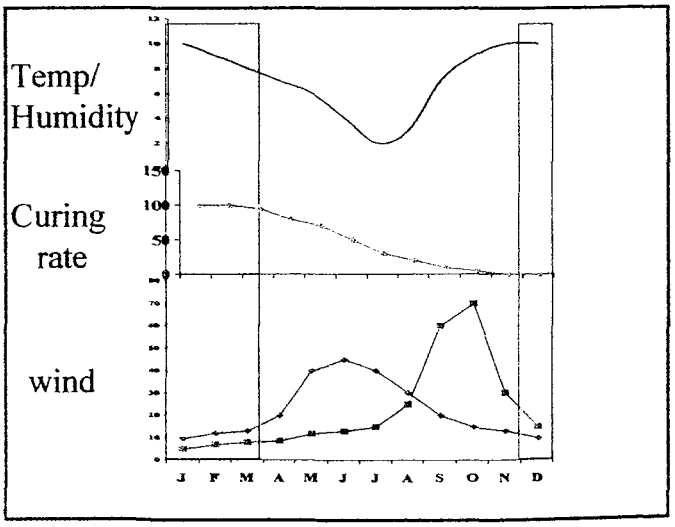

Cleaning Country

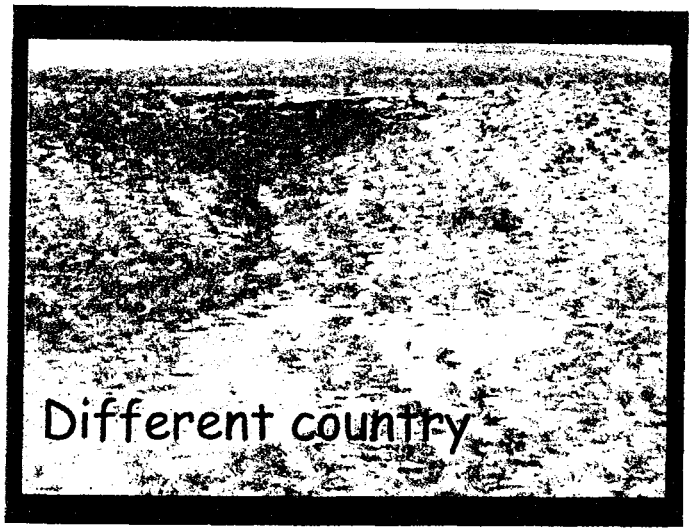

Wildlife Management

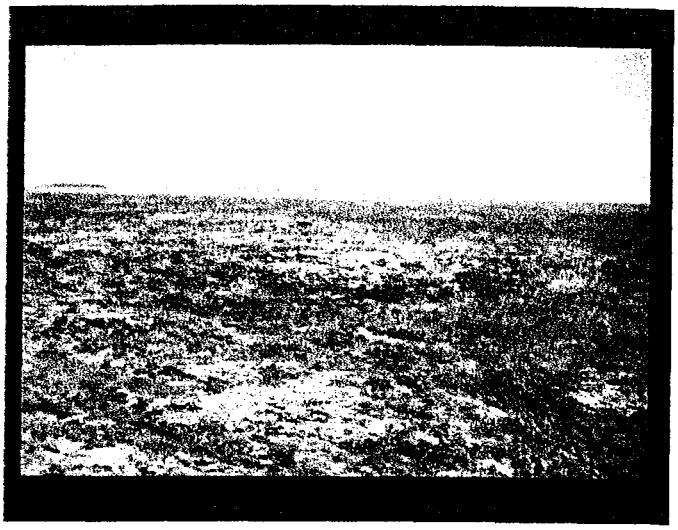

Plant Resources

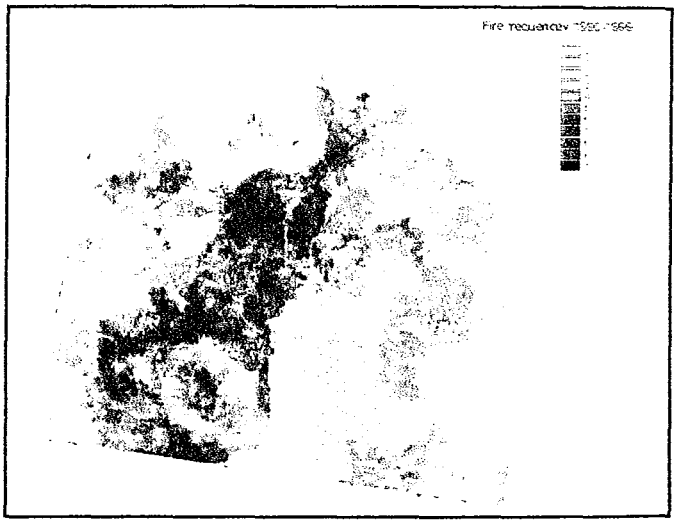

Burning for Rain

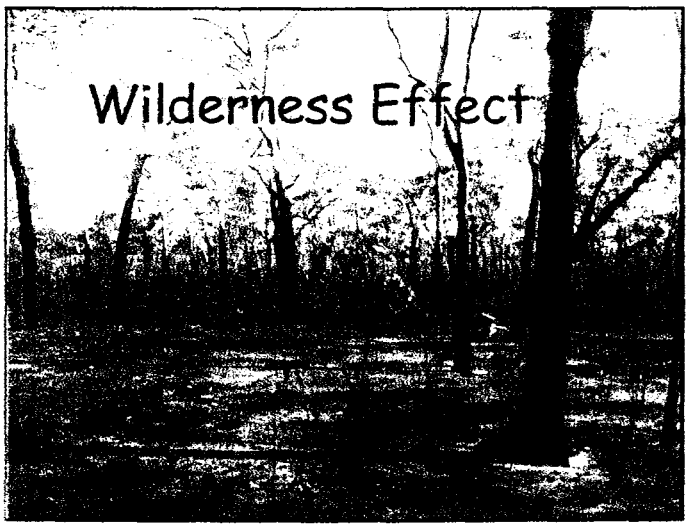

Right time for fire

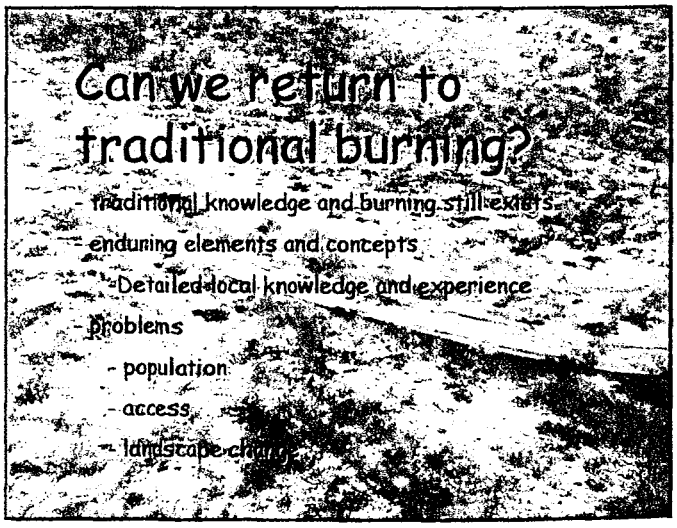

Temp/
Humidity
Curing
rate
wind
150
100
50
0
J F M A M J J A S O N D


Different country




Fire frequency


Wilderness Effect


Can we return to traditional burning?
- traditional knowledge and burning still exists
- enduring elements and concepts
- Detailed local knowledge and experience
- Problems
- population
- access
- landscape change

Need for indigenous involvement

Demographics

Tenure - native title, UCL, ALT, conservation estate

More than a stakeholder

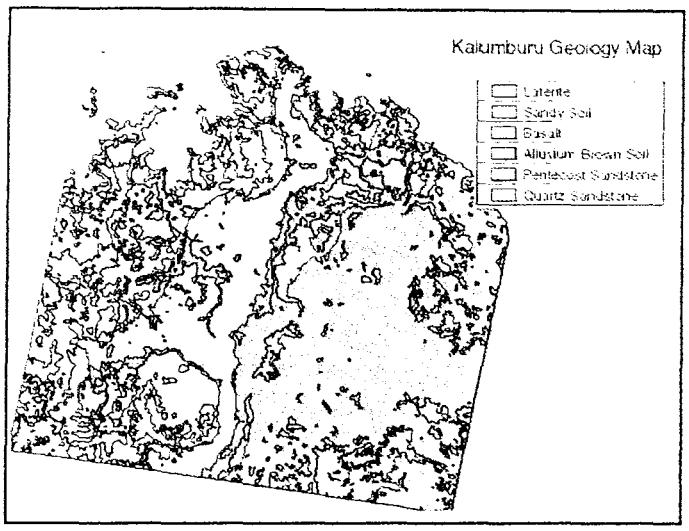
- custodial rights to land
- knowledge holders

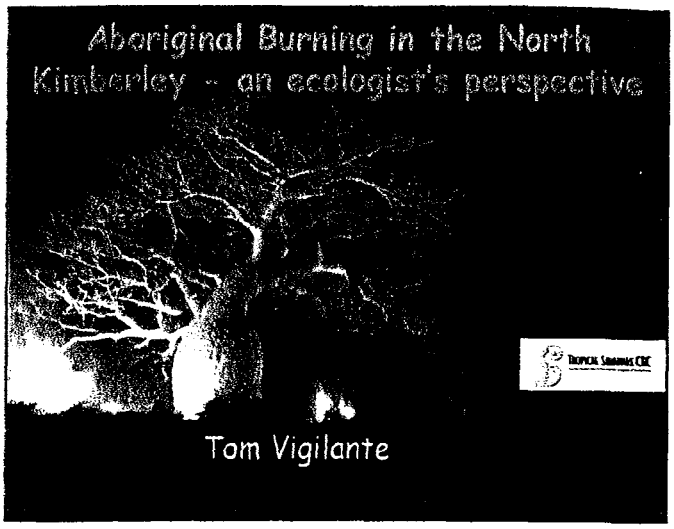
Potential conflict of values and ideology

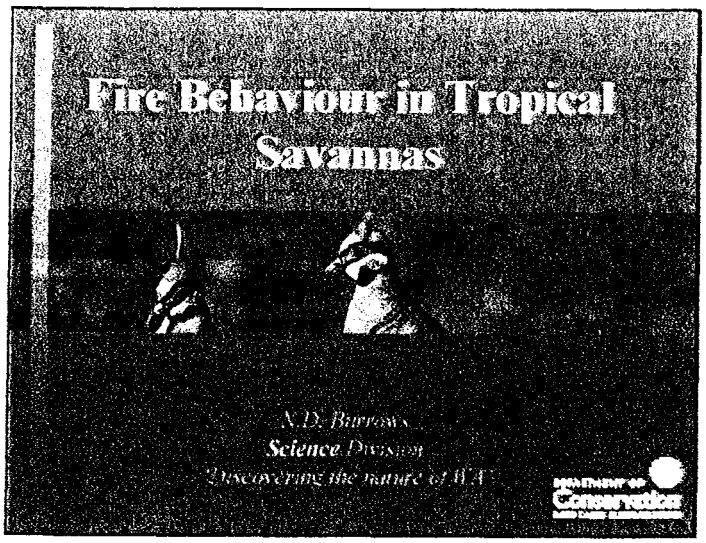
Are long unburnt landscapes healthy ?

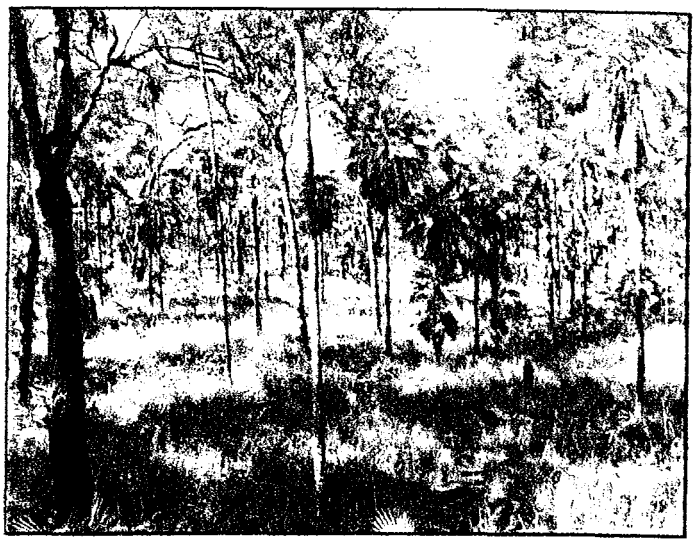
e.g. offshore islands and peninsulas

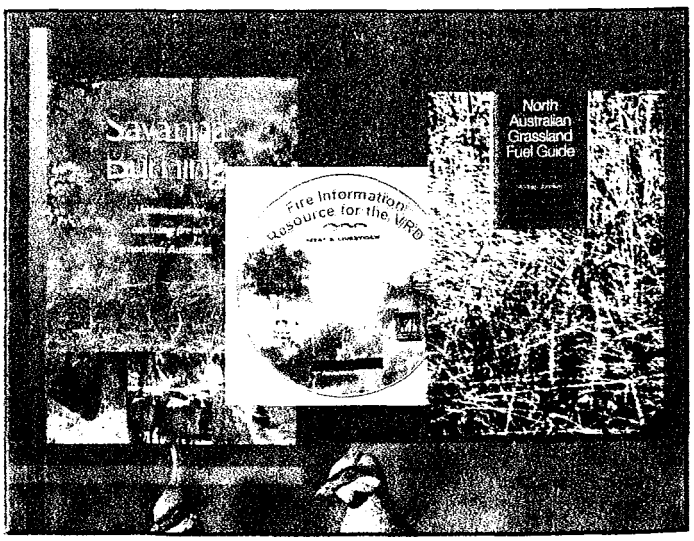
Build on existing and ongoing collaborations


Kalumburu Geology Map
Laterite
Sandy Soil
Basalt
Alligator Brown Soil
Pentecost Sandstone
Quartz Sandstone


Aboriginal Burning in the North Kimberley - an ecologist's perspective
Tom Vigilante

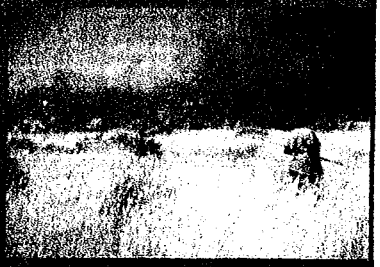

Fire Behaviour in Tropical Savannas
N.D. Burrows
Science Division
Discovering the nature of WA

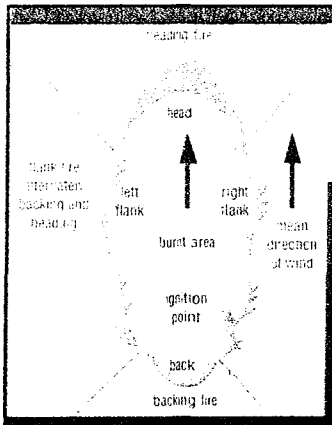



North Australian Grassland Fuel Guide
Fire Information Resource for the NRIS

Describing & Predicting Fire Behaviour

- Prescribed burning
- Wildfire response
- Public warnings – fire danger
- Interpreting fire effects





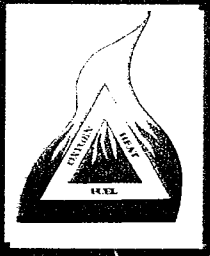
Fire Behaviour

- Fire rates of spread
- Flame dimensions
- Fire intensity (I = Hwr)

Source: Cheney and Sullivan 1997

Understanding the Fire Triangles

Combustion



Bushfire Behaviour

Fuel Characteristics

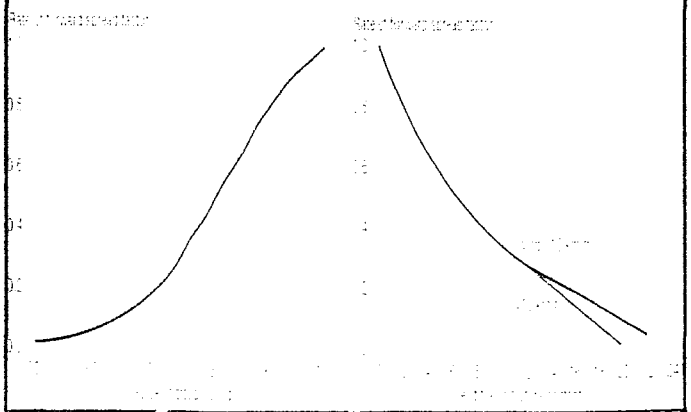
Available fuel is live and dead vegetation that burns in the flaming zone

- Fuel moisture (seasonal & diurnal)
- Particle size, shape and arrangement
- Fuel loading
- Horizontal and vertical continuity

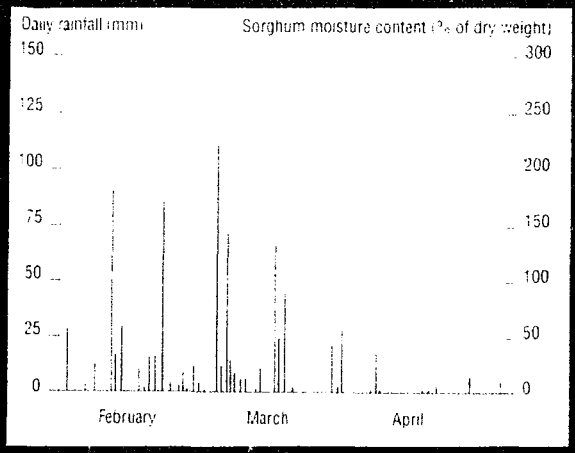
Fuel Moisture Content

Is the amount of water in a fuel expressed as a percentage of the oven-dry weight of the fuel.

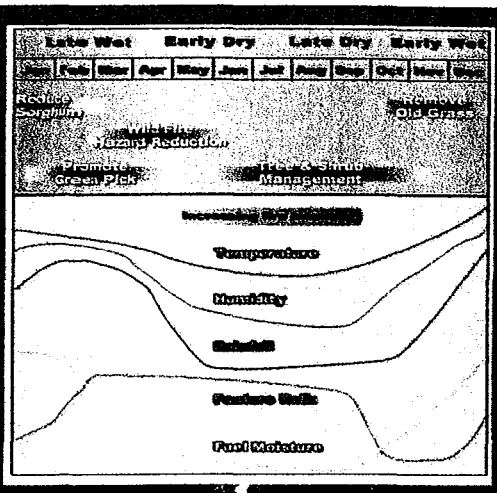
Rate of spread vs fuel moisture content (degree of curing)



Source: Cheney and Sullivan 1997



Source: Cheney and Sullivan 1997



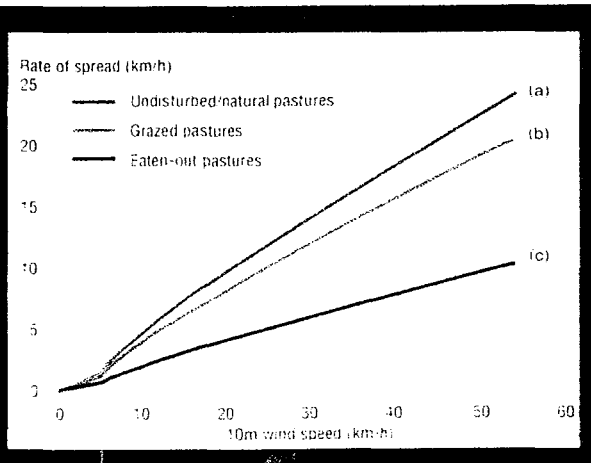
Source: Fire Information CD

Measuring Fuel Moisture/Curing

- Direct
  - moisture meters
  - oven drying
- Indirect
  - Remote sensing
  - Visual - photos
  - Guides, drought indices

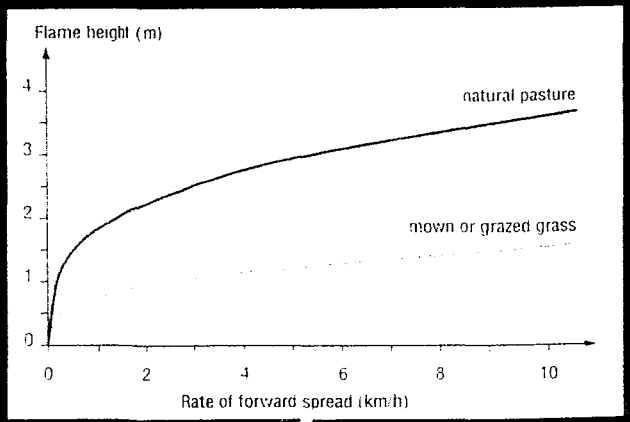
Fuel Loading

The quantity of fuels in an area - usually expressed in t/ha odw



Source: Cheney and Sullivan 1997

Flame height vs rate of spread for different pasture heights and biomass



Source: Cheney and Sullivan 1997

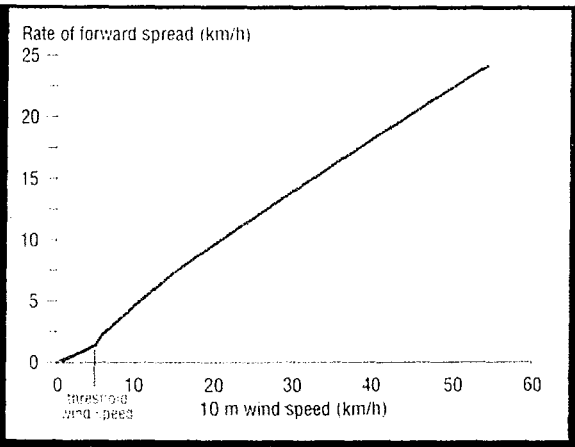
Measuring Fuel Load, Height, Cover

- Direct
  - destructive sampling
  - measuring height and cover
- Indirect
  - Remote sensing
  - Visual - photos
  - Predictive models

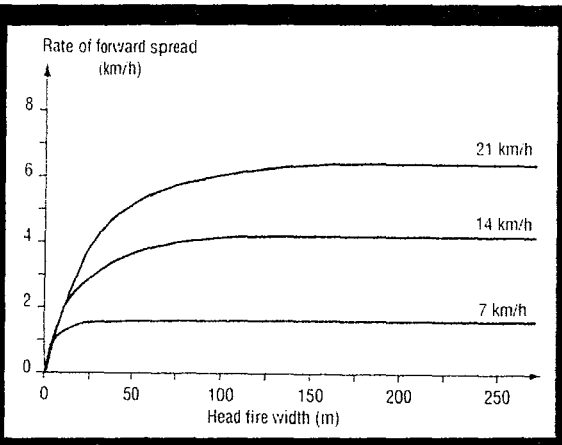
Weather

Wind

- Increases supply of oxygen
- Tilts flames over fuel - enhanced pre-heating by radiation
- Drives convective heat into adjacent fuels.
- Influences direction of fire spread, fire shape and spotting.
- Changes fuel moisture
- Influences convection development
- Influences smoke dispersion



Source: Cheney and Sullivan 1997



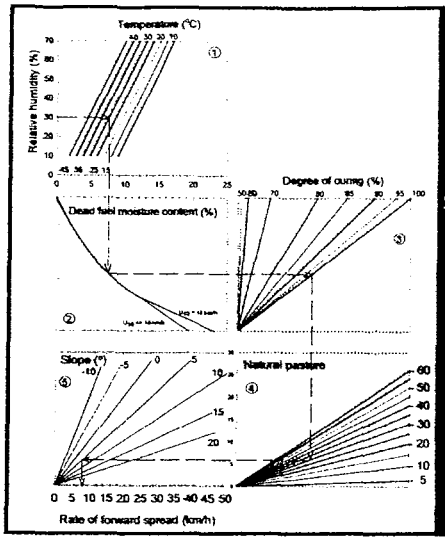
Source: Cheney and Sullivan 1997

Weather ctd

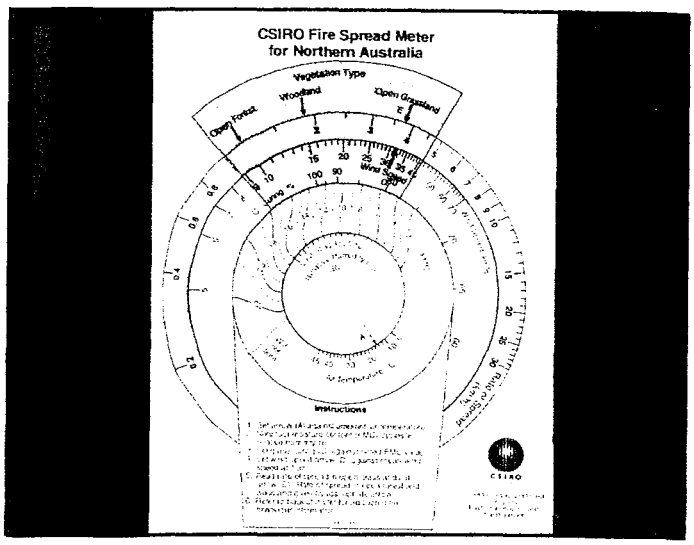
- Relative Humidity
  - As RH increases, fuel moisture increases.
- Air Temperature
  - Fuel pre-heating
  - Convection, radiation, atmospheric stability
- Precipitation

Topography

- Aspect
- Slope
  - Steepness
- Position of Fire
  - Top, middle, or bottom of slope



Nomogram for Predicting Fire Spread (Cheney and Sullivan 1997)



Management Tools

- Remote sensing
  - Fuel biomass/cover
  - Fuel curing
  - Fire history/footprints
- Prediction systems (models & guides)
  - Fuel biomass & height
  - Fuel curing
  - Fire behaviour
  - Acute impacts – Heat dissipation (above the flames, in the flames, below the flames (in the soil)

Fire Behaviour Uncertainties

- Weather forecasting
- Fuels and fire spread models

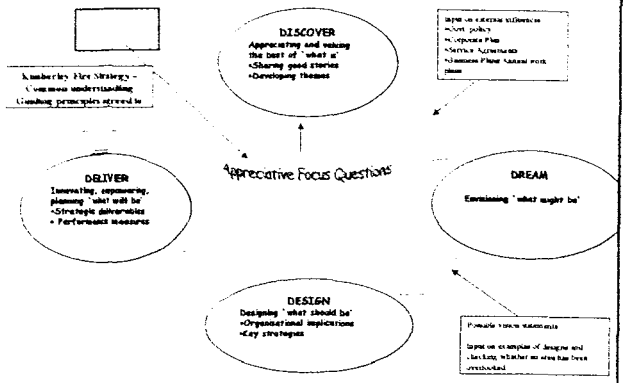
Adaptive Management

- Learning by doing
  - Clear objectives
  - Develop prescriptions
  - Implement
  - Monitor
  - Evaluate, validate
  - Document
  - Adjust

DREAM

`envisioning what might be'

PHASES of APPRECIATIVE INQUIRY



Source: Adapted from Mellish and Annis (2002)

State Government Policy

Protecting WA's unique environment will continue to be a hallmark of the Labour Govt.

Labour pre-election speech Jan 2005

CALM Vision

A natural environment in WA that retains its biodiversity and enriches people's lives.

Source: Corporate Plan 2002-2005

CALM Strategic Directions

1. Conserving biodiversity
2. Creating sustainable community benefits
3. Maintaining community involvement and support
4. Improving the way we do business

Source: Corporate Plan 2002-2005

1. Conserving biodiversity

Objective – To protect, conserve and, where necessary and possible, restore WA's natural biodiversity

Strategies –

- Identify and protect threatened species and ecological communities
- Use fire to promote biodiversity, to reduce fire hazards and damage to biodiversity, and to regenerate and protect ecosystems

2. Creating sustainable community benefits

Objective – To generate social, cultural and economic benefits through the provision of a range of services that are valued by the community and are consistent with ESD principles

Strategies –

- Assist in reducing the threat of wildfire to human life and property
- Maintain a trained firefighting capability in key areas
- Work with the local community to implement appropriate fire management programs.

3. Maintaining community involvement and support

Objective – To develop community awareness and appreciation of ... natural ecosystems ... and promote community involvement in and support for their protection, conservation and restoration.

Strategies –

- Develop and implement appropriate public participation and involvement programs that are part of core business activity for the Department
- Increase traditional owner involvement in managing conservation lands and waters
- Partner with other agencies and groups with similar interests
- Promote a customer focus

4. Improving the way we do business

Objective –To foster a positive work culture of trust, continuous improvement and anticipation of biodiversity conservation issues and customer needs, and deliver core business in the most effective and efficient manner.

Strategies –

- Sound internal communication
- Develop and improve knowledge and information sharing
- Focus scientific research
- Ensure management is based on good science (*tempered with politics - MH*)
- Focus on strategically important areas

Developing shared values

Step 1: Spilt into three groups and consider one of the 3 case studies;

- Do we want to be the `*best at*' fire management at this location? Why, why not?
- What might we realistically achieve (fire management) as a Region at the location in 5 years time?
- What are your personal work-based aspirations for fire management ?

Take notes (butchers paper) to report back

Step 2: Share future scenarios with the entire group.

Step 3: Develop a list (2-4) of common shared values as a group

Card exercise to ID priority (1, 2, 3 votes)

Leg Stretch and coffeeeee!

Identifying priority Fire Principles

Break into 3 groups – representing case studies

Record scores on 1 –10 scale against each criterion. How well does the Principle rate

(butchers paper).

	Principle 1	Principle 2	Principle 3
Conserving biodiversity			
Creating sustainable community benefits			
Maintaining community involvement and support			
Improving the way we do business – Can we continue to learn and grow?			
TOTAL SCORES			

Step 4: Spilt into `x' groups (1 group per Principle) and develop Provocative Proposals around the high priority Principle allocated to your group.

- Provocative – a stretch or challenge to innovate
- Grounded in examples
- Stated in bold, affirmative terms – present tense
- Something that you would passionately defend

STAY in GROUPS

Example:

Eg. Principle – *CALM and the relevant Traditional Owners jointly manage fire at Parry's Lagoon*.

Start by saying; *What if...* in front of the Principle

Then;

Provocative Proposals can become...

1. We involve traditional owners in protected area issues affecting their community.
2. We devote time to understanding the needs of traditional owners.
3. We determine priorities jointly with traditional owners
4. We incorporate traditional owner views into our business planning

pin up around room

Implications

of our
Provocative Proposals

Stakeholder identification and analysis;

-Who are our clients?

-What are there expectations?

-To what extent are we satisfying them via implementation of the Provocative Proposals?

Client	Expectation	Score 1-10
Eg. T/Os	Joint management	`x'

(Butchers paper)

S.W.O.T. Analysis

of each Provocative Proposal

Name of PP:

STRENGTHS:	WEAKNESSES:
OPPORTUNITIES:	THREATS:

Identifies significant omissions in Provocative Proposals

FIRE MANAGEMENT SYSTEM

VOLUME
Planning & Reporting

Queensland Government
Queensland Parks and Wildlife Service

ontents

Guidelines - Completion of Statements of Fire Management Intent

SFMI's should be based on information readily at hand at the time of preparation.

The aim of the SFMI is to succinctly outline:

- The significant fire risks on or adjacent to the QPWS estate (including risks to life, property, infrastructure, environmental values and cultural values) and the management actions mitigating those risks;
- Guidance on fire requirements for maintenance of biodiversity; and
- Guidance on fire requirements for sustainable production.

The format of the SFMI is aligned to the fire management zones of the Fire Strategy. This will enable adaptation and incorporation into comprehensive fire strategies in the future.

A SFMI is required for all areas of the estate that have any fire management implications, and where there is no approved fire strategy. It provides either:

- Interim fire management guidance for areas not having an approved Fire Strategy, pending development of a more comprehensive Fire Strategy in accordance with the requirements of the Fire Management System; or
- On-going fire management guidance for those areas where a more comprehensive Fire Strategy is not required.

In completing the SFMI, generic statements may have applicability in some circumstances, where they overcome repetition or avoid some mapping needs.

STATEMENT OF FIRE MANAGEMENT INTENT

Region: Mgt Unit:

District: ParkInfo Instances:

QPWS Component Covered:

Officer: Date Completed: Review Date:

Fire Management Objectives for ParkInfo Instances

- Protection of life and property on the reserve and neighbouring lands (also consistent with Queensland Fire & Rescue Authority Act 1990 and QPWS Good Neighbour and other policies as required)
-
-

Fire Management Guidelines

Description/Location of Fire Management Zone (and Fire Association where applicable)	Significant values (eg life, property, infrastructure, environmental, cultural) on or adjacent to the reserve that are impacted by fire management in this zone, association etc	Management Regime

STATEMENT OF FIRE MANAGEMENT INTENT

Region: Central Mgt Unit: All

District: All ParkInfo Instances: All

QPWS Component Covered: All parks, forests, reserves in Central Region not covered by a Fire Strategy or specific Statement of Fire Management Intent

Officer: R. Melzer Date Completed: May 2003 Review Date: n/a

Fire Management Objectives for ParkInfo Instances

Protection of life and property on the reserves and neighbouring lands (also consistent with Queensland Fire & Rescue Authority Act 1990 and QPWS Good Neighbour and other policies as required)

Promotion or maintenance of diversity by maintaining a range of ages since fire for each fire-adapted vegetation type including recently burnt areas, long unburnt areas and various ages in between (within the ecological limits of the plant community)

Restoration or regeneration of disturbed plant communities and fauna habitats

Enhancement and/or maintenance of conditions suitable for particular flora/fauna species (e.g. rare and threatened species) and communities

Protection/maintenance of significant cultural, natural assets (e.g. fire sensitive communities) and sustainable production assets

- Weed management including reducing the risk of invasion

Fire Management Guidelines

Description/Location of Fire Management Zone	Significant Values (eg life / property / infrastructure / environmental / cultural) on or adjacent to the reserve that are impacted by fire management in this zone, association etc	Management Regime
Protection Zone	Campgrounds, park base complexes and other significant infrastructure cultural sites deemed to require a protection zone Commercial leases ex boundaries adjacent to residential infrastructure property where there is a risk of wildfire entering / leaving the reserve	Fuel loads will be managed to enable wildfires to be contained under fire weather conditions that are typical for a particular area and season. Access tracks will be maintained as required. Advantage will be taken of features such as fuel and vegetation moisture gradients to contain fire. All hazardous wood or liquid fuels that are likely to jeopardize wildfire suppression will be removed from the area unless they are an essential part of the work environment. Such fuels will be maintained according to the current work place health and safety standards Fuel loads will be reduced by appropriate means (e.g. burning, slashing, brushcutting, chemical). Fuel reduction burns will be undertaken in conditions that will ensure a low intensity burn and they will be constructed as often as is necessary to reduce the hazard.

SUPPORTING PAPERS

1. Fire Management and Healthy Country in the Kimberley region, WA
   Tony Start
2. Statement of Fire Management Intent – Qld Model
   (supplied by Max Haste)
3. Fire Management Guidelines for Kimberley Pastoral Rangelands –Best Management Practice *Andrew Craig*

Fire management and healthy country in the Kimberley region, Western Australia[1]

Synopsis

The fundamental steps for determining the resources, objectives and strategies for fire management in the Kimberley can be addressed by the questions "what have we got?", "what do we want?" and "How do we get there?". Arguments for returning to either pre-Aboriginal or pre-European landscapes are shown to be spurious. In reality the bio-physical processes and the biological resource pools that are present today constitute the foundations for managing biodiversity and environmental health in this region. Changes to fire regimes since European settlement and the use of indicators of environmental health and are considered and the importance of perceptions and value judgements are discussed. In conclusion, work is needed on two fronts; better use of fire and better community knowledge of the role of fire in our environment.

Management Implications.

The paper contributes to the process of communication between stake-holders (Including CALM, pastoralists, Aboriginal interests and others) about common ground in terms of fire management as well as "on & off-reserve" conservation.

As part of a "3-paper set" presented by me (CALM), Paul Novelly (Department of Agriculture, rangelands) and Susan Worley (Water and Rivers Commission) it also strengthens understanding and cooperation between the agencies with responsibility for managing natural resources.

Dr A.N. Start
Principal Research Scientist
Department of Conservation and Land management
& Tropical Savannas Management CRC
PO Box 51
Wanneroo, WA 6111
Ph 08 9405 5146
Fx 08 9306 1641

Fire management and healthy country in the Kimberley region, Western Australia[1]

A.N. Start.[2]

INTRODUCTION

There is a rapidly growing awareness that healthy landscapes are fundamental to sustainable use of Australia's tropical savannas (Whitehead *et al.* 2000). This is certainly true for the diverse users of the Kimberley region's tropical savannas, including pastoralists, rural communities, tour operators, miners, defence forces, visitors and others. While some lands are managed specifically for conservation all land users interested in sustainability of their activities are, necessarily, conservationists. The term "land users", rather than "land managers", is deliberate here. Many users have no tenure-based responsibility for management. Nevertheless they have a moral and practical responsibility to care for the lands they visit as well as the interests of the tenured managers. Despite that distinction, this paper is concerned with the practice of fire management by tenured land managers. Any manager of natural lands in the Kimberley, as elsewhere, has to address three primary questions:

- What have I got?
- What do I want?
- How do I get there?

What have I got?

To answer this question, three distinct components must be defined.

---

[1] Text of paper presented at the El Questro Fire Management Forum in 2001

[2] Department of Conservation and Land Management, PO Box 453, Kununurra, WA 6743. tonys@calm.wa.com.au

- The management unit which will be **an area of land**. It may have natural boundaries (e.g. a catchment or a land system) or cadastral boundaries (e.g. a pastoral lease or national park). Moreover, it may be necessary to distinguish sub-units (e.g. vegetation types, paddocks) because they have particular values or to program rotational application of treatments (e.g. grazing spells or control burning).
- **Its components** are the assets that must be managed. They will include biological elements, the most obvious being vegetation communities, which may be subdivided into categories (e.g. pasture or community types) and may contain special elements (e.g. rare fauna, fragile habitats or watering points). They will also include physical elements, soils and topographical features such as rivers and hills. The biological components usually correspond closely to the physical attributes.
- **The processes** to which the land and its components are subjected. They include independent (e.g. climate) and manageable (e.g. grazing) factors. Mis-management of the latter often causes asset degradation (e.g. erosion). Fire falls somewhere between these categories because wild fire ignited by lightning or the actions of other people can damage asset values while wise use of fire by a manager can enhance them and reduce the risk of degradation by wildfire.

What do I want?

Inevitably, this will be a value judgement influenced by land use and management objectives. A park ranger will value biodiversity, a pastoralist will value productive potential and a tour operator will value aesthetic attributes. Nevertheless, they have a common interest because the attributes each one of the values are based on healthy

country and because many of them are inextricably linked to land managed by other people, often for other purposes.

How do I get there?

We get there by manipulating the manageable processes. Understanding the processes that influence the resource is fundamental to achieving desired outcomes, but they are often inter-woven and complex. Thus, pasture condition may be a result of the interaction of grazing, fire regimes and climate. Grazing is manageable, wildfire may be inevitable, but controlled burning can be used to reduce its impact as well as to promote desired pasture types. However, rainfall lies in the lap of the gods. Good managers will have to find balance between the manageable processes and build the inevitability of drought, wildfire, market price fluctuation and the other phenomena that they can't control into their longer-term decisions.

This paper uses fire, as an example of a manageable process that affects all land managers and other land users of the Kimberley's savannas. My perspective is 'management for biodiversity'. Nevertheless, if I had addressed economic or social perspectives, I would have dealt with similar if not identical issues because environmental health is a fundamental common denominator to them all. Paul Novelly (this publication) will explore the complex task of having to juggle many factors into planning and decision-making in the real world and Susan Worley (this publication) will offer a process for finding solutions. Thus, our papers are facets of the same issues.

FIRE AND HEALTHY COUNTRY

Red Herrings

In listening to debates about fire management objectives, I have frequently heard arguments for returning to either pre-Aboriginal or pre-European landscapes. Both notions are spurious.

The former because the climate has swung between glacial and interglacial phases since Aboriginal colonisation of the continent at least forty to sixty thousand years ago (e.g. Kohen, this publication). Vegetation that the first Europeans witnessed about 100 years ago was a product of the effects of changing climate in conjunction with anthropogenic fire regimes throughout that time (Singh *et al.* 1981) and other factors, such as the extinction of a megafauna. We have little detailed knowledge of the conditions then and we certainly can not recreate them from today's environment.

Similarly, we can not recreate the immediate pre-European environment because there have been substantial post-European changes which can not be reversed. They include altered patterns of human distribution (migration to towns has depopulated huge areas), mode of travel (Toyotas on roads), nutritional source (purchased, not gathered), novel tenure systems, the introduction of exotic animals and plants and socio-economic pressures including the need to generate money from the land.

Reality

In reality, 'what we have got' are the natural resources that are there now[3] and maintaining biodiversity means maintaining all the biological elements. That is not

[3] Re-introduction of species that have become locally extinct are possible, but often costly and predicated on control of the original threatening process to levels that can be tolerated by the subject

to say that the balance between the components of the current biota and processes such as nutrient and water cycling are necessarily appropriate. If they are, management will aim to maintain the *status quo*. However, if they are not, managers have to manipulate the manageable processes that can drive change towards a more desirable status. For example, we may want to increase ground cover to reduce erosion and improve water retention in the soil or we may wish to halt, even reverse, reduction of rainforest patches by fire. In either case fire will, at some stage, be a significant management issue.

The rainforest case exemplifies an easily defined objective that could be achieved by deliberately not burning the rainforest and using managed fire to reduce fuel in the surrounding savanna so as to minimise the risk of wildfire. However, biodiversity in the vast, fire-prone savanna landscapes is also important and whilst vegetation of some sort always regenerates after fire, the floristic composition and structural diversity (an important element of habitat that supports a diverse fauna) can be fundamentally altered by fire regimes.

In this situation, it is much more difficult to assess landscape health and we often resort to indicators. For example, pastoral condition can be assessed by the relative abundance of "increaser" and "decreaser" species (Petheram and Kok 1983 p.17). The same ratio is also useful for assessing environmental health from a biodiversity perspective. However, many other observable features have been mooted as useful indicators of environmental health in the tropical savannas of northern Australia (see Whitehead *et al.* 2000 for a discussion). They include the presence of plants that are killed by fire and depend on seed for regeneration. After fire, new generations of these obligate seeders have to mature before their seed banks can be replenished. For many species, five years between fires is a reasonable rule-of-thumb

(Jeremy Russell-Smith pers. comm.). But some, like cypress pine, need much longer intervals (Bowman and Panton 1993).

Many birds that feed on grass seed, like finches, have declined over much of Australia's tropical savannas (Franklin 1999). The plight of Gouldian Finches is well known, but species like Crimson and Star Finches that are common on the irrigated country around Kununurra have disappeared from much of Queensland where remaining populations are endangered (Garnett and Crowley 2000). Change in the composition of grasses, particularly from perennial to annual species, appears to be a key threatening process and fire is known to be a factor that can influence the species composition of grasslands.

Just as fire can cause sensitive species to decline or vanish from landscapes, it can stimulate the increase of others. In the Kimberley, there is much anecdotal evidence that annual sorghum has either invaded or increased to dominate many landscapes. This annual grass generates a substantial fuel load, allowing fires to burn the same areas each year. Moreover, its height and open structure generate hot fires and crown scorch is probably more severe than it used to be with lower fuels. This can become a vicious circle.

CHANGING FIRE REGIMES

There is no doubt that most people see as undesirable the huge fires which show up dramatically on satellite images and characterise the modern Kimberley (Palmer, this publication). We know that this regime is unlike that which Aboriginal people imposed before European settlement disrupted traditional burning practices (e.g. Russell-Smith 1998). Sadly, much of the intimate knowledge about Aboriginal use of fire in the landscape is passing. However, there is a sense of urgency about learning

what we can (Palmer, this publication) and there are a few places where Aboriginal people continue to use fire in something approximating traditional ways. Kalumburu is one (Russell-Smith 1998) where, despite frequent fire, cypress pine stands are still common and contain all life stages from seedlings to senescence (Craig 1998). This contrasts with much of the rest of the country where cypress seedlings are rare and burnt stags are often almost all that is left of once-healthy stands (Gordon Graham pers. comm., Bowman and Panton 1993)

To be sure, we can no longer apply fire in the traditional Aboriginal way because people no longer live throughout the land. But understanding the difference between the old system and today's scenario, will help us to understand what sort of fire regime we should aim for and that is the first step in implementing a more desirable fire management program for the region. Table 1 summarises the differences between the old and the present fire regimes.

Table 1. Changing Fire Regimes

	The Old	The New
Burning Seasons	All Year	Extensive in the late dry
Fire Intensity	Diverse	Often hot
Area burnt by individual fires	Mostly small	Often vast
Landscape Burning Patterns	Mosaics	Relatively uniform

PERCEPTIONS.

All managers of natural areas in the Kimberley have to address the issues of fire management for to avoid them inevitably results in unplanned and often costly wildfire. Their decisions are based on value judgements influenced by land use

objectives. Other members of the community may perceive priorities differently and question the legitimacy of the manager's values and actions.

Thus different people will perceive the role and effects of fire differently and each person's perceptions will be a product of values and experience. Even where perceptions are erroneous, they are real to those who hold them. We should all take stock of our own perceptions, question their legitimacy and try to understand other peoples' point of view for that is the only way we will get it right and work to a common goal with the rest of the community. A healthy perspective on fire in the environment requires a balance between three value sets, The Good, The Bad and The Ugly.

The Good

We live in an environment that has been prone to and moulded by fire, including human burning practices, through ice ages and over millennia. Fire can be used to sustain biodiversity by creating complexity in the structure and composition of vegetation, thus creating a diverse array of habitats. Environmental complexity is generated and maintained by variety in the temporal and spatial distribution of fires. Moreover good fire can protect the environment from bad fire.

The Bad

Late, hot fires that burn massive areas typify today's fire pattern. This is the antithesis of good fire because it leaves vast uniform tracts, devoid of the complexity that fosters biodiversity.

The Ugly

Many urban Australians view fire as alien in the natural world. In their first-hand experience, fire is seen as a threat to life and property. Their perceptions of rural fire has changed little since literary giants, like Henry Lawson and Banjo Patterson,

portrayed fire as the enemy of the battlers in the bush. This perception receives frequent reinforcement from media headlines like "*Fire destroys national park*" implying nothing will regenerate. It is ironic that these people, caravanning round Australia, see burnt country as ugly while many older Aboriginal people see unburnt country as uncared for and ugly. Wise use of fire will continue to draw criticism until all the residents and visitors to the Kimberley can distinguish good fire from bad fire and shrug off the bias that makes all burnt country ugly. Thus, we have to work on two fronts; better use of fire and better community knowledge of the role of fire in our environment.

REFERENCES

Bowman, D.M.J.S. and Panton, W. J., 1993. Decline of *Callitris intratropica* R.T. Baker and H.G. Smith in the Northern Territory: Implications for pre- and post-European colonisation fire regimes. *Journal of Biogeography.* **20:** 373-381.

Craig, A.B. 1998. Fire and vegetation. Pp. 12-16 in: Saint, P. and Russell-Smith, J. (eds.) 1998. *Malgarra: Burning the bush.* Proceedings of the Fourth North Australian Fire Management Workshop, June 1997, Kalumburu, Western Australia. Bushfires Board of Western Australia. Kununurra.

Franklin, D.C., 1999. Evidence of disarray amongst granivorous bird assemblages in the savannas of northern Australia, a region of sparse human settlement. *Biological Conservation.* **90:** 58-68.

Garnett, S.T. and Crowley, G.M. 2000. The action plan for Australian birds 2000. Environment Australia. Canberra.

Petheram, R.J. and Kok, B. 1983. Plants of the Kimberley region of Western Australia. University of Western Australia Press. Perth.

Russell-Smith, J. 1998. Traditional resource management using fire in the Kalumburu region. Pp. 9-11 in: Saint, P. and Russell-Smith, J. (eds.) 1998. *Malgarra: Burning the bush.* Proceedings of the Fourth North Australian Fire Management Workshop, June 1997, Kalumburu, Western Australia. Bushfires Board of Western Australia. Kununurra.

Russell-Smith, J. 2000. Pre-contact Aboriginal and contemporary fire regimes of the savanna landscapes of northern Australia: patterns, changes and ecological responses. (in press)

Saint, P. and Russell-Smith, J. (eds.) 1998. *Malgarra: Burning the bush.* Proceedings of the Fourth North Australian Fire Management Workshop, June 1997, Kalumburu, Western Australia. Bushfires Board of Western Australia. Kununurra.

Whitehead, P.J., Woinarski, J., Jacklyn, P., Fell, D. and Williams, D. 2000. *Defining and measuring the health of savanna landscapes: A north Australian perspective.* Cooperative Research Centre for the sustainable development of tropical savannas. Darwin.

ACKNOWLEDGEMENTS

I am grateful to the many people from varied walks of life who have spent time teaching me about fire effects and fire management in the region. They have all been valuable but two people deserve special mention. Jeremy Russell-Smith, who has brought insight and balance to my knowledge and perceptions of fire in tropical savannas and Tricia Handasyde, who has been my colleague on many field trips. We have not always been working on fire, but we have observed and discussed fire issues as we go about our other business.

Project brief

This review of fire management in the Australia's rangelands was commissioned by the Australian Department of Environment and Heritage under the Natural Heritage Trust.

The aims of the project were to provide information and resources to:

- assist Australian Government officers assess the adequacy and effectiveness of proposed rangeland fire management programs and projects for NHT2.
- improve the regions' ability to plan for and implement fire management plans/strategies, drawing on a comprehensive overview of past projects and best-practice.
- assist in the implementation of ecologically sustainable fire management in the rangelands.

The main components of the project were to:

- Summarise and consolidate the reasons that fire management in the rangelands is an Australian Government priority.
- Collate and synthesise current information related to the fire-ecology of rangeland ecosystems/vegetation types.
- Recommend fire-frequency thresholds for the major vegetation types in the rangelands (where sufficient literature is available).
- Research and make recommendations into the transferability of fire management research across the rangelands and from south-eastern Australia to the rangelands.
- Develop a checklist for good fire management planning.
- Assess gaps in current fire management knowledge and information based on previous experience and/or the review of past research and projects.
- Identify priority regions in the rangelands where fire management plans are needed or should be improved (i.e. fire management hotspots).
- Develop a list of past projects with proponent details, funding amounts, date, location and a brief summary and categorise (e.g. by vegetation type, season, management objective).

Brief summary

Why fire management is important for natural resource management in the rangelands

The rangelands of Australia have a high biodiversity value: high species diversity, significant numbers of endemic species, areas of ecological and geo-morphological integrity, unique ecosystems and habitat for rare and endangered species. The rangelands are relatively intact with little clearing compared with the areas of intensive agriculture in eastern, southern and south-western Australia. Australia's rangelands are an important refuge for Australia's biodiversity.

Despite the relatively low level of disturbance in the rangelands, the abundance and richness of rangeland biodiversity is declining and there is evidence that inappropriate fire regimes are partly responsible. Fire is an integral part of the ecosystems of Australia's rangelands. Fire management is one of few management tools available to land managers in this zone. Sustainable pasture production is dependent on the maintenance of the resource base (soils and pastures) through sound fire management practices in the short and long term. These fire management practices will have significant impacts on biodiversity conservation. Therefore "understanding how fire affects biodiversity has national significance". (Dyer et al. 2001).

Impacts of various fire management practices on the environment—at regional and local/property scales

Fire management practices are a major factor affecting the ecological function and biodiversity of all ecosystems in the rangelands. For any region or sub-region, desirable fire management practices will vary with the desired management outcomes, and the climate, terrain and flora and fauna assemblages present, as well as the scale of the ecosystem mosaic. Some elements of rangeland ecosystems are resilient to variations in fire regime, others are sensitive to fire intensity and/or sensitive to fire interval. Therefore, no single fire regime applied at landscape scales can meet the needs of any one

major land management objective (e.g. biodiversity conservation), let alone multiple land management objectives.

Key sources of information for natural resource management planners

This report contains a checklist for fire management plans in the rangelands (Section 2), with links to a range of information:

- definitions of terms and concepts
- descriptions of the major vegetation types within the rangelands followed by a list of key references
- communication principles and planning priorities
- a list of sources of information, i.e. fire species attributes, and fire and land use mapping resources
- Links to other resources.

STATEMENT OF FIRE MANAGEMENT INTENT

Region:	Central		**Mgt Unit:**	All	
District:	All		**ParkInfo Instance/s:**	All	
QPWS Component Covered:	All parks, forests, reserves in Central Region not covered by a Fire Strategy or specific Statement of Fire Management Intent.				
Officer:	R. Melzer	**Date Compiled:**	May 2003	**Review Date:**	n/a

Fire Management Objectives for ParkInfo Instance/s

- Protection of life and property on the Reserves and neighboring lands (also consistent with Queensland Fire & Rescue Authority Act 1990 and QPWS Good Neighbour and other policies as required).
- Promotion or maintenance of diversity by maintaining a range of ages since fire for each fire-adapted vegetation type including recently burnt areas, long unburnt areas and various ages in between (within the ecological limits of the plant community).
- Restoration or regeneration of disturbed plant communities and fauna habitats.
- Enhancement and/or maintenance of conditions suitable for particular flora/fauna species (*e.g.* rare and threatened species) and communities.
- Protection/ maintenance of significant cultural, natural assets (*e.g.* fire sensitive communities) and sustainable production assets.
- Weed management including reducing the risk of invasion.

Fire Management Guidelines

Description/Location of Fire Management Zone	Significant values (eg life / property / infrastructure / environmental / cultural) on or adjacent to the reserve that are impacted by fire management in this zone, association etc	Management Regime
Protection Zone	Campgrounds; 'park' base complexes and other significant infrastructure; cultural sites deemed to require a protection zone; commercial beehives; boundaries adjacent to substantial infrastructure/property where there is a risk of wildfire entering or leaving the reserve.	Fuel loads will be managed to enable wildfires to be contained under fire weather conditions that are typical for a particular area and season. Access tracks will be maintained as required. Advantage will be taken of features such as fuel and vegetation moisture gradients to contain fire. All hazardous solid or liquid fuels that are likely to jeopardize wildfire suppression will be removed from the area unless they are an essential part of the work environment – then they will be maintained according to the current work place health and safety standards. Fuel loads will be reduced by appropriate means (*e.g.* burning, slashing, brushcutting, chemical). Fuel reduction burns will be undertaken in conditions that will ensure a low intensity burn and they will be conducted as often as is necessary to reduce the hazard.

Description/Location of Fire Management Zone	Significant values (eg life / property / infrastructure / environmental / cultural) on or adjacent to the reserve that are impacted by fire management in this zone, association etc	Management Regime
Wildfire Mitigation Zone The aim is to increase the likelihood of controlling a wildfire in strategically important areas within a reserve. It may be located adjacent to a Protection Zone to provide maximum protection to life/property or on a boundary to minimise the risk of fires escaping from the reserve or in an area that will reduce the potential for extensive areas being burned in a wildfire. They may be established along a boundary where the level of risk is too low to warrant a Protection Zone.	Rare and threatened species/ communities may be present. Cultural resources may be present.	Fine fuel loads will be maintained in a mosaic pattern ranging from low to moderate. As far as possible the Zone will be wider than the average spotting distance expected in a 'normal' fire season. Wherever practical and acceptable this Zone will be located to take advantage of natural control lines. The Zone will be burned in such a way as to generate a mosaic burn pattern such that the vegetation is not simplified to a single age class but maintains the ecological values of a range of age classes (within the constraints of the primary purpose of the Zone). Access tracks will be maintained as required to meet the purposes of this Zone, however in some areas it will be necessary to use aerial burning to create and maintain this Zone. As far as possible the fire regimes used in this Zone will be consistent with the ecological requirements of the vegetation communities but the frequency of burning will generally be towards the shorter end of the ecological range.
Conservation Zone The purpose of the Zone is to maintain the natural role of fire as an ecological process in fire-adapted vegetation communities and fauna habitats. It will usually be located in areas remote from assets and property, although this will depend on the vegetation types and associated risks.	Rare and threatened species/communities are likely to be present. Cultural resources are likely to be present.	The purpose of planned burns will be to produce and maintain a mosaic pattern of vegetation with areas of varying age since fire. As far as possible areas of similar age will be linked across the landscape to allow movement of fauna that may be dependent upon the particular habitat type created by a vegetation type of that age class. Strategically located tracks, natural fire control lines and previously burnt vegetation will be used to contain planned burns in this Zone. The fire regimes applied in the Zone will vary according to the ecological requirements of the flora and fauna communities present in it, and take into account the requirements of cultural resources.

Description/Location of Fire Management Zone	Significant values (eg life / property / infrastructure / environmental / cultural) on or adjacent to the reserve that are impacted by fire management in this zone, association etc	Management Regime
Sustainable Production Zone The Zone will be used where the main purpose of fire management is to maintain the production or use of a forest product. It should be located within or near Protection and/or Wildfire Mitigation Zones, unless the desired outcomes can be achieved in the absence of the protection afforded by the two latter Zones.	Forest products such as a commercial native timber resource or plantation. Significant cultural resources may be present. Rare and threatened species/communities may be present.	Strategically located tracks, natural fire control lines and previously burnt vegetation can be used to help contain planned burns in this Zone. Management of the Zone must give due regard to environmental and cultural outcomes. The fire regimes applied within the Zone will vary according to the product or sustainable use that is being protected or promoted in it. If possible the regimes will be compatible with, or complement, those of a Conservation Zone.
Rehabilitation Zone The Zone will encompass areas that are intended to be included in another zone (*e.g.* Conservation Zone) in the future but whose current management is aimed at combating a threatening process that can not be addressed by the 'usual' fire management practices used in the other zones to promote and maintain biodiversity or production values. It will only be used where disturbance has resulted in a highly modified environment that is to be rehabilitated to its original state (or some other more natural state) and where fire exclusion or manipulation is required to achieve this aim.	Often includes regrowth or disturbed communities of 'endangered' or 'of concern' Regional Ecosystems. Cultural resources may be present.	The Zone will be bounded by fire control lines (preferably temporary or natural) or a surrounding buffer will be burnt in such a way as to minimise the risk of the Rehabilitation Zone being burned in an inappropriate way. The fire regime used in the Rehabilitation Zone will be determined by the particular needs of the community or communities within it.

Description/Location of Fire Management Zone	Significant values (eg life / property / infrastructure / environmental / cultural) on or adjacent to the reserve that are impacted by fire management in this zone, association etc	Management Regime
Reference Zone The aim of the Zone is to allow monitoring of the long-term effects of particular fire regimes, a wildfire or fire exclusion on conservation values. A documented and approved research and/or monitoring project is required if this Zone is established. Most reserves will not require this Zone as monitoring can often be undertaken without it. The Zone must only be established in an area where it is possible and practical to ensure that it can be adequately protected from unplanned fires.		Every reasonable precaution will be taken to ensure that the Zone is adequately protected from unplanned fires. Fire management in the Zone will be in accordance with an approved research/monitoring project. Environmental conditions, including weather, will be monitored in the Zone.
Exclusion Zone The Zone will encompass fire-sensitive vegetation communities/habitats and cultural sites for which fire exclusion is required.	Fire sensitive species and communities (*e.g.* vineforest, brigalow, gidgee). Fire sensitive cultural resources (*e.g.* rock art sites).	Fire exclusion. Many fire-sensitive communities are largely self-protecting because of their structure, microclimate and/or position in the landscape and will require little specific fire management to protect them. Nevertheless, where necessary steps will be taken to reduce the risk of these communities being damaged in a planned burn (*e.g.* burn away from, rather than up to, the edge of the community; burn when soil moisture content is high) or wildfire (*e.g.* 'break-up' surrounding fire-adapted vegetation by planned burning).

FIRE MANAGEMENT GUIDELINES FOR KIMBERLEY PASTORAL RANGELANDS

BEST MANAGEMENT PRACTICE - MARCH 2005

BACKGROUND

- Kimberley pastoralists operate in a highly fire-prone environment. Uncontrolled fires pose significant economic, safety, and environmental risks to pastoral enterprises. In contrast, the controlled use of fire can benefit land management, animal production and biodiversity conservation.
- For any given country type, the interactions of fire, grazing and weather have complex effects on both land condition and animal production. Although general guidelines on the use of fire are valuable, based as they are on a combination of experience and available research findings, they should best be regarded as providing a starting point. At the property level, an adaptive approach that incorporates monitoring of the effects of documented management actions is recommended.
- While this document deals with property-scale management of pastoral leases, there are many important issues arising from the characteristics of the broader, regional fire regime. These include community health and safety, biodiversity, and economic effects on the tourism and aviation industries. Regional fire regimes are particularly important for highly mobile fauna such as granivorous birds that depend on the availability of food resources across large areas. At the national level, the fire regime across the northern savannas affects greenhouse gas emissions and carbon storage in the landscape, potentially influencing the global climate.

KEY ISSUES FOR MANAGERS

- It is vital to manage the risks associated with wildfires by strategic fuel reduction over the property early in the dry season, while maintaining adequate reserves of feed for at least the remainder of the dry season.
- It is also essential to maintain an effective network of firebreaks and tracks. Although these are often insufficient in themselves to stop a wind-driven fire they provide the means for quick access and for safely back-burning either during planned burning or for control of an approaching wildfire.
- The large size of Kimberley paddocks means that fires (planned or unplanned) often burn only part of a paddock. It is important to prevent cattle from congregating on small areas regenerating after fire, particularly near water points. While damage is most likely in the early part of the wet season, when root reserves of perennial grasses need to be replenished, such animal congregation should be avoided at any time.
- Uncontrolled or poorly managed fire regimes lead to unfavourable changes in pasture and overstorey. In the long term, the productive capacity of the land can be reduced. In addition, it is important to minimise the risk of accelerated soil erosion associated with the removal of litter and cover by fire.

- Where necessary, burning can play a vital role in controlling shrub densities. If unchecked, shrub densities may increase to the point where mustering is difficult and grass production is reduced through competition. As a rule, the taller the shrub, the higher the fire intensity required to control it. The deliberate use of moderate to high intensity fires for this purpose requires very careful preparation and skill to ensure that the fire does not 'get away'.
- Protecting station assets from fire is obviously essential. Vegetation should be kept away from homesteads, yards, bores and fences (electric fencing being particularly susceptible), and poly-pipe carrying water across country should be run in a trench and covered with soil.
- Keeping damaging fires out of environmentally sensitive areas is also important. Apart from their conservation values, such areas may be of particular significance to Aboriginal people and are increasingly the focus of tourism activities contributing to enterprise income.

PLANNED BURNING

Some key questions the manager should always consider are:

- What are the reason(s) for burning a particular area?
- What type of fire do I need?
- Can I successfully contain the fire?
- How do I manage grazing impacts after the fire?

Note that fires vary in their characteristics, affect country types in different ways and, importantly, have cumulative effects over time. It is important to recognize that there is no single 'recipe' that can be applied.

Advice on the various aspects of fire management can be obtained from relevant government agencies including the Fire and Emergency Services Authority, Department of Agriculture Western Australia, Department of Conservation and Land Management and the local government shire. It is important that feedback from pastoralists contributes to the further development of guidelines such as these. Further refinement can also be expected in the light of research and demonstration projects currently being undertaken across northern Australia, notably through the Natural Heritage Trust and the Cooperative Research Centre for Tropical Savannas Management.

MANAGING WILDFIRE RISK

Important aspects of managing wildfire risk are:

- aerial and ground burning early in the dry season to produce areas of low fuel;
- grading of fencelines and access tracks; these provide opportunities for back-burning against oncoming wildfire should that be required.
- clearing fuel from around assets such as buildings, yards (permanent and temporary) and bores;
- equipment readiness;
- training.

GUIDELINES FOR BURNING DIFFERENT TYPES OF COUNTRY

HIGH RAINFALL ZONE (ABOVE ABOUT 700 MM AVERAGE ANNUAL RAINFALL)

In the more productive country (eg, gently undulating with red volcanic soils), an emphasis on rotational burning (every 2-3 years) early in the dry season is recommended, under the relatively low stocking rates that apply. This regime appears to be effective in controlling the effects of patchy grazing. Some burning after first storms can also be incorporated, provided that fires can be contained by low-fuel areas from earlier burning or other natural obstacles. A patchy mosaic of burnt and unburnt areas is desirable so that cattle have access to both bulk feed and the more nutritious regrowth.

A lower frequency (3 years or more) is recommended where recovery after fire is slower, for example on gravelly rises or rugged sandstone country, where plants are more dependent on regeneration from seed. Special areas around springs and rainforest patches deserve protection wherever possible, particularly from hot fires.

A regime of annual fires, especially if they are of high intensity, is believed to favour annual native sorghum over the more desirable perennial grasses (especially in sandy country) and is likely to have a range of damaging effects on the ecosystem. Such a fire regime should be avoided.

Burning during spells in the wet season is an approach for controlling annual sorghum that has been adopted recently in some NT national parks. Testing this technique in the Kimberley pastoral context has proved to be quite difficult because it is often hard to get such fires to 'carry' over significant areas and ground access across the property can be quite limited. Research has been carried out in the NT on the effects of wet-season burning on erosion rates and botanical composition. Kimberley managers have been encouraged to try out this technique on a limited scale, for example close to homesteads. The feasibility of aerial burning during the wet season is yet to be tested.

INTERMEDIATE RAINFALL ZONE (400-700 MM)

Red Soil Pastures

A cautious approach should be adopted in burning pastures on red soil country. Pastures tend to be less resilient to heavy grazing than those found on both lighter and heavier soils, and soils are often more prone to erosion.

Burning small patches along tracks early in the dry season can lead to a concentration of grazing and subsequent loss of perennial grasses, especially if this practice is carried out year after year.

It is important to monitor the density and height of shrubs. If shrub control is needed, consider spelling or reduced stocking after the wet season to ensure that an adequate fuel load remains for burning towards the end of the dry season (at least 2 tonnes/ha). After burning a paddock it is preferable to defer grazing for at least some months after the rains begin, to ensure that the perennial grasses can re-establish an adequate leaf area and rebuild root reserves.

Black Soil Pastures

Black soil pastures have relatively high carrying capacities and have traditionally been protected from fire. However, burning can be considered for the following purposes:

- to encourage more even grazing within large paddocks;
- to rejuvenate rank pasture;
- to allow a temporary increase in the legume and annual component of pasture, which may improve nutritional quality;

- to break up large expanses of country with areas of lower fuel, and thus assist in reducing risks associated with wildfires; and
- for controlling woody shrubs.

It is important to bear in mind that pasture production on black soil country is more dependent on the amount and distribution of rainfall than is the case on the lighter soils.

How frequently and at what time of year should black soil pasture be burnt?

- A minimum of 4 years between fires is suggested as a general recommendation.
- For pasture management purposes, burning late in the year would be recommended, when the fire danger index has moderated, for example immediately after the first storms.

Limestone Grass Pasture

This pasture is dominated by annual or short-lived perennial *Enneapogon* grasses. No obvious benefits from burning have been identified, and burning of poor condition pasture should certainly be avoided. Occasional burning could be used if necessary to control shrubs such as prickly mimosa (*Acacia farnesiana*).

Pindan Pastures

Pindan is the term used to describe the vegetation occurring over deep red and yellow sands in the West Kimberley. It is characterised by dense stands of wattle (*Acacia* spp.). The main pasture species are curly spinifex and ribbon grass. Burning in October-December no more often than every 4 years, and resting over the subsequent wet season, have been recommended to keep the pasture in a condition attractive to stock.

LOW RAINFALL ZONE (LESS THAN ABOUT 400 MM)

This zone is dominated by various forms of spinifex pasture. The general advice given in this section would also apply to the management of spinifex country in the intermediate rainfall zone.

Spinifex Pastures

These pastures are of most value to pastoralists when in the early stages of regeneration after fire (say 1-2 years). Spinifex communities should be allowed to mature further before burning again to ensure that seedbanks are well replenished.

Managers should adjust their burning to take account of the actual maturity of the spinifex as this can vary considerably according to topography and the rainfall received over the seasons since the last fire. As a guide, burning a proportion of the country each year at intervals of 4-6 years is suggested. The burning plan will obviously need to be flexible, taking into account any unplanned fires.

The response to fire depends on the spinifex species concerned and conditions at the time of burning. For example, under cool conditions soft spinifex (*Triodia pungens*) has been observed to re-sprout from rootstocks, while a hot fire will kill most adult plants and regeneration will depend on seed stored in the soil. Spinifex seedlings are vulnerable to being pulled out in the early stages and it is recommended that wherever possible grazing should be deferred until they are well established (in practice this may mean one wet-season).

Spinifex found on the more rugged hilly country appears to regenerate most commonly from rootstocks and often shows small amounts of regeneration even after fires occurring quite late in the dry season.

It is suggested that best practice should encompass burning both early in the dry season and late in the year under suitable conditions when fires can be controlled. The main purpose of early burning is to provide broad areas to act as firebreaks. These are required for wildfire control and to allow larger burns to be conducted safely towards the end of the year.

PLANNING CONSIDERATIONS AND INFORMATION NEEDED FOR OPERATIONAL BURNING DECISIONS

PLANNING

- Fire management should be considered as a key aspect of the overall property management plan, and both prescribed burning and wildfire control activities should be incorporated. A laminated station map, marked-up to highlight areas where fire protection is a high priority, and showing station infrastructure, graded tracks, water-filling points etc., has proved to be a good starting point. The map can be updated as the season progresses, showing low-fuel areas resulting from aerial burning and other recent fires.
- In most cases a permit will be required from the local Bush Fire Control Officer prior to burning.
- Consultation and cooperation with neighbours and nearby communities are essential.

TRAINING

- Ensure manager and employees undertake relevant training in fire safety and control that can be provided by the Fire and Emergency Services Authority (FESA).

EQUIPMENT

- Advice on key items such as drip torches, slip-on fire units, protective clothing and communications equipment is available through the local FESA office.
- Relevant equipment including graders, water tanks and portable pumping equipment needs to identified in the plan and maintained in a good state of readiness.

SATELLITE INFORMATION

Imagery derived from the NOAA satellite can provide information on the following:

- degree of fuel 'curing';
- location of active fires (hotspots); and
- fire scars.

These map products are available from the Department of Land Information (Satellite Remote Sensing Services, Wembley). Satellite-derived information is used by FESA to plan aerial control burning and to assist pastoralists responding to wildfire emergencies.

The current system has some important limitations:

- a clear satellite image requires cloud-free conditions;
- mapping of fire scars resulting from patchy, early dry season burning is difficult;
- the minimum viewing size ('pixel') is about 1 km^2, so that burnt areas of less than about 400 ha are poorly mapped; and
- the accuracy of firescar mapping depends on ground characteristics.

Improved systems based on the MODIS satellites are being developed to help overcome these limitations.

For an annual subscription, pastoralists can now receive information by fax or email on the location of active fires, in the event that these are detected on or near their lease, through the 'Fire Watch' system (website: firewatch.dli.wa.gov.au). The Kimberley Regional Fire Management Project (KRFMP) can assist pastoralists with information on this system. Training in accessing fire scar information from the internet is also available.

FIRE BEHAVIOUR PREDICTION

CURING OF FUEL

Curing is a measure of pasture 'greenness' and is defined as the percentage of material in the sward that is dead. The degree of curing has an important effect on fire behaviour. The KRFMP has produced the *Kimberley Grasslands Field Curing Guide* to assist land managers estimate and communicate the degree of curing.

CSIRO FIRE METERS

A useful tool (and the one used to determine the 'fire danger' shown on the Main Roads signs along Kimberley roads) is the CSIRO Grassland Fire Danger Meter. This gives a measure of how difficult a fire will be to control based on curing, temperature, humidity and wind speed measured in the field.

A 'Fire Spread' meter is also available – this gives an indication of how fast the fire front can be expected to travel.

These meters are potentially useful to supplement the manager's own experience in making decisions about burning country. They should not be considered reliable for spinifex fuels.

WEATHER FORECASTS

The Bureau of Meteorology can provide spot weather forecasts (fee for service) to assist the manager in deciding when it is safe to light up an area intended for burning.