






**Invasive grasses & fire:
The changing landscape in
Australia's wet/dry tropics**


Samantha Setterfield
M. Douglas, N. Rossiter, L. Hutley, A. Petty (CDU)
K. Ferdinands, P. Barrow, S. Lamb (NT Government)

Outline


- The region – wet-dry tropics
- How invasive grasses affect fire behaviour
- Environmental consequences - stand structure
- Economic consequences - fire management
- Summary – major management issues

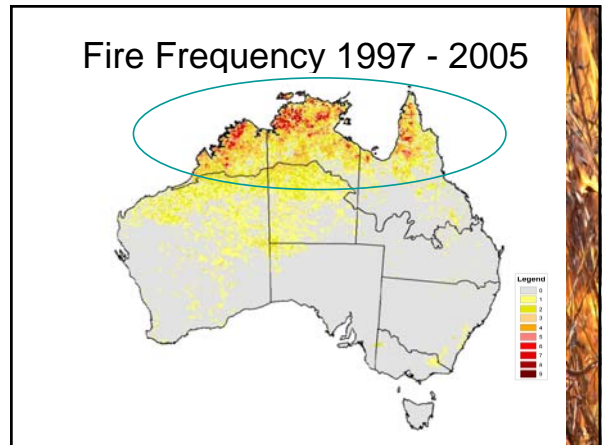
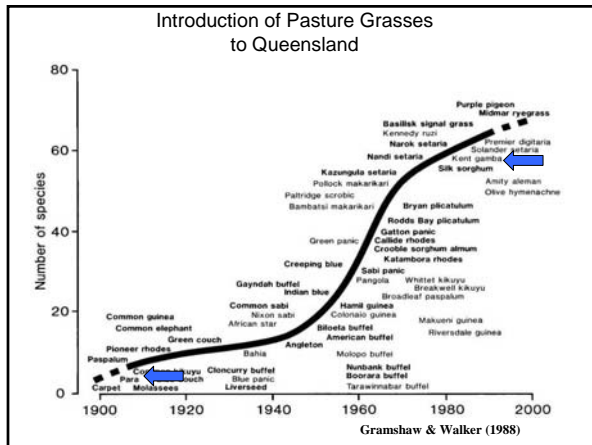
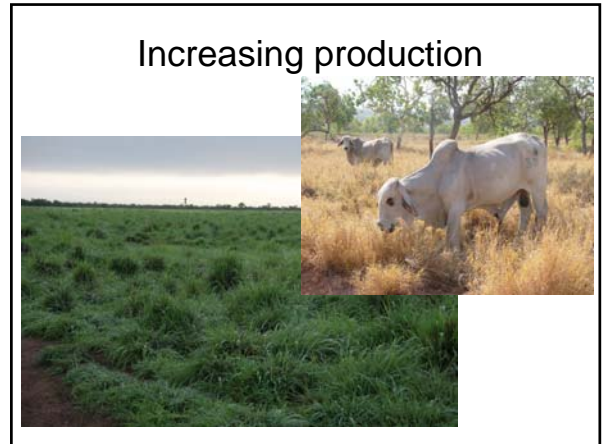
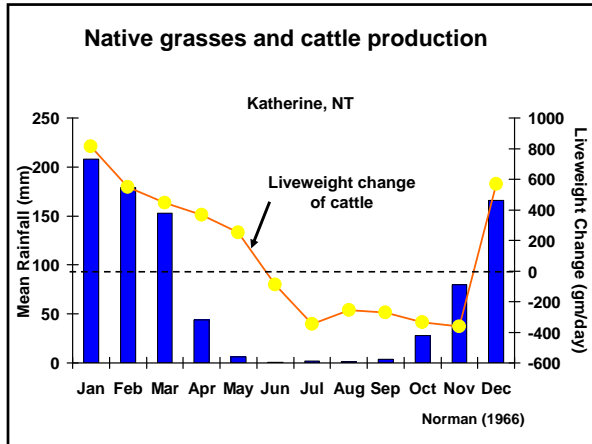
Australia's Wet/Dry Tropics



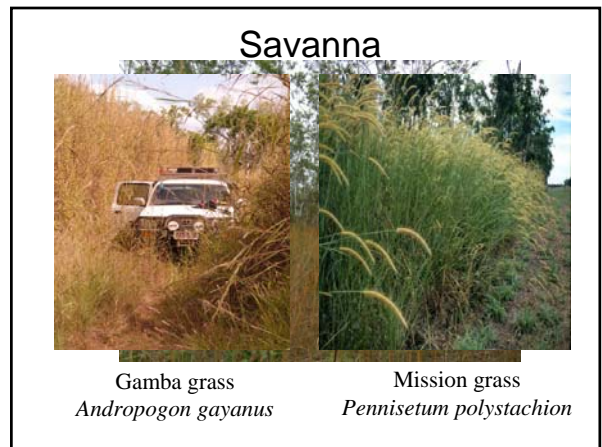
- Savanna biome
- Largest and most intact savannas in world (Woinarski *et al.* 2007)
- Ecology driven by wet-dry cycle



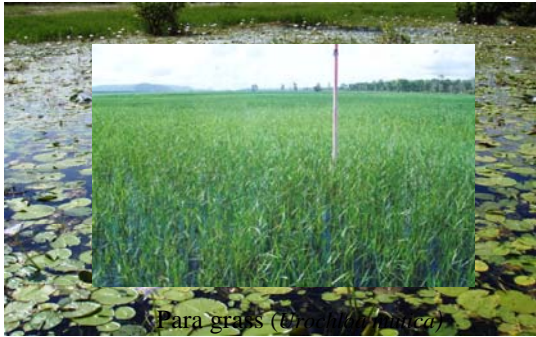




- ### Outline
- The region - monsoonal tropics ✓
 - How invasive grasses affect fire regimes
 - Environmental consequences - stand structure
 - Economic consequences - fire management
 - Current situation
 - Scale of problem



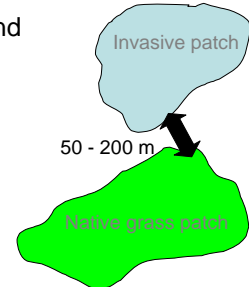
Floodplain



Para grass (*Stenotaphrum secundatum*)

Fuel characteristics & fire behaviour

- Compared native and invaded areas
- Quantified
 - Fuel load
 - Fire spread
 - Fire intensity



Fuel loads: Methods



- Harvested all fine fuel (< 6mm) from quadrats



Fuel load (t ha⁻¹)

	Native	Exotic	x increase
Gamba	1 – 7	4 – 25	5 - 10
Mission	2 – 3	9 – 14	5
Para	8	14 - 16	2

Fire characteristics: Methods

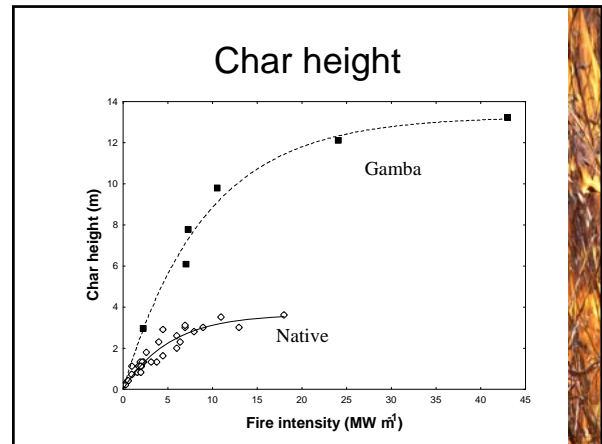
- Experimental fires
 - Wildman Reserve, Adelaide River, Kakadu
- Measured:
 - Fuel load
 - Rate of spread
 - Fire intensity
 - Scorch height
 - Char height



S7
S11

Fire characteristics: Results

	Native	Mission	Gamba
Fuel load (t ha ⁻¹)	1 – 7	9 – 14	4 – 26
Intensity (MWm ⁻¹)	0.5 – 4	5	2 – 42
Scorch ht (m)	4 – 10	13	Above canopy
Char ht (m)	1.5	2 – 3	3 – 13



Char height



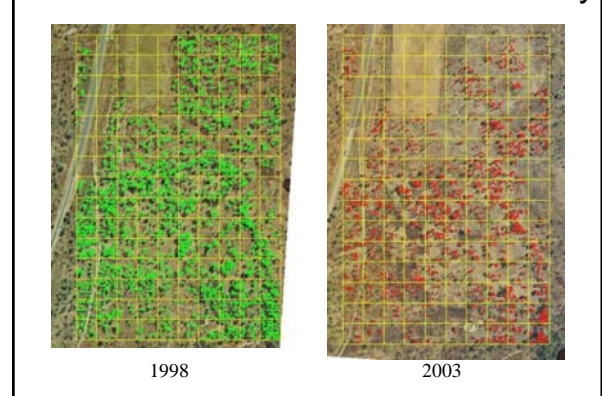
Outline

- The region - monsoonal tropics ✓
- How invasive grasses affect fire regimes ✓
- Environmental consequences - stand structure
- Economic consequences - fire management
- Current situation
 - Scale of problem

Tree Cover and Structure: Methods



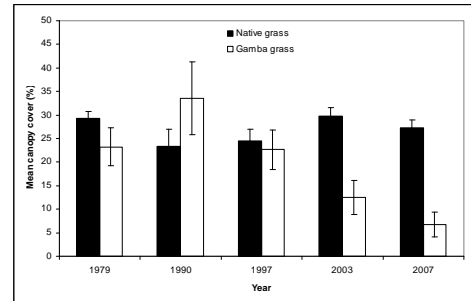
Tree cover with Gamba understory



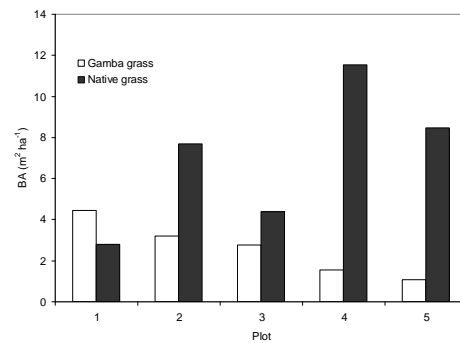
Tree Cover and Structure: Methods

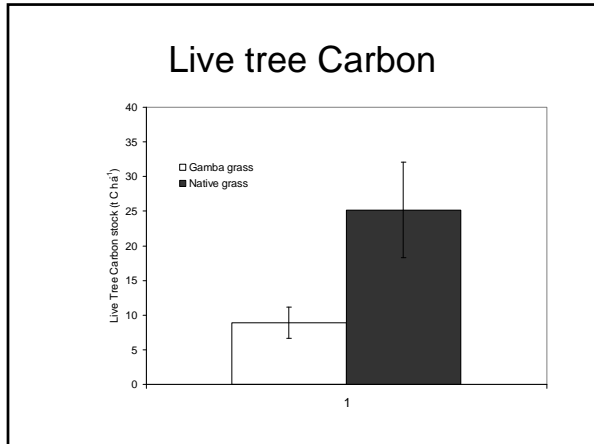
- Ground survey to determine difference in tree structure and total basal area
- Compared Invaded and Native grass (uninvaded)
- Structural changes from ground survey

Tree Cover: Results



Basal area





Outline

- The region - NT's monsoonal tropics ✓
- Invasive grasses and fire regimes
 - How do they interact? ✓
 - Environmental consequences ✓
 - Economic consequences for fire management?



Documenting Fire Management - Method

- Case study
 - Coomalie Shire
 - 100km S Darwin
 - Multiple use rural land
- Interview
- Fire histories

Fire Management – Interview Results

- More
 - fire fighters
 - experience/training
 - time
 - fire units
 - heavy machinery
 - helicopters
 - Injuries
- Different tactics
- More money



Fire Management Response

- | | Total Cost |
|---|------------|
| • Cost of single fire (Rum Jungle) | |
| • Native grass <ul style="list-style-type: none"> – 4 brigade members | \$1,296 |
| • Gamba grass <ul style="list-style-type: none"> – 3 BF staff & vehicles – 4 brigade units & 6 volunteers – tanker – Aircraft (water bomber) – Helicopters x 2 – Loader – Ground support staff x 2 | \$16,702 |



Fire Management: Standby costs

- Increased cost of standby equipment to fight gamba fires
 - Standby equipment required on every fire ban day
 - Plane \$3500 per day
 - Helicopter \$1000 per day
 - Water truck \$ 200 per day
 - Loader \$ 200 per day
 - Grader \$ 250 per day
- Total cost** **\$5150 per day**

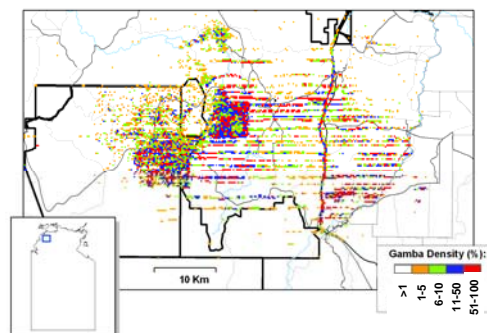
Fire Danger Index: Methods

- McArthur Mark 4 Grassland Fire Danger Index
- Determined by
 - Q is fuel quantity ($t\ ha^{-1}$)
 - C is curing factor (0-100%)
 - T is temperature ($^{\circ}C$)
 - V is wind speed ($km\ hr^{-1}$)
 - RH is relative humidity (%)

Fire Danger Index: Methods

- McArthur Mark 4 Grassland Fire Danger Index
- Determined by
 - **Q is fuel quantity ($t\ ha^{-1}$)**
 - C is curing factor (0-100%)
 - T is temperature ($^{\circ}C$)
 - V is wind speed ($km\ hr^{-1}$)
 - RH is relative humidity (%)

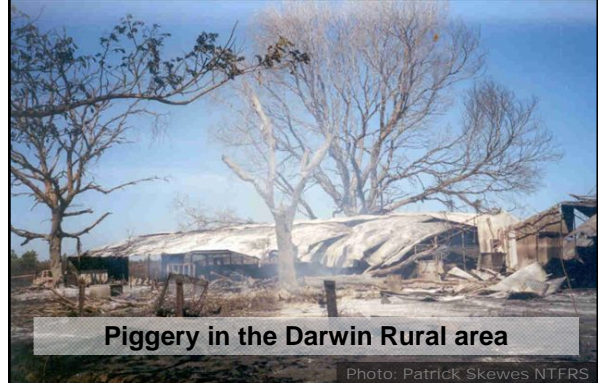
Landscape Threat



Fire Danger Index (>40)

	Grass Fuel Loads (t/ha)		
	6	10	15
No. of days	12	47	115
Cost (\$, 000)	\$65	\$253	\$621

Costs of property losses?



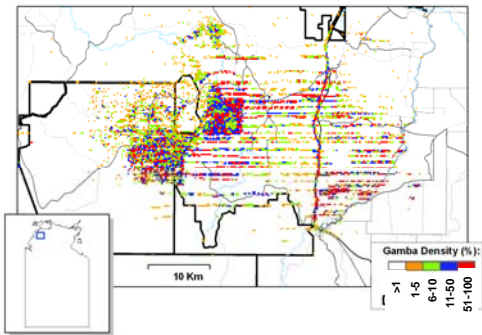
Outline

- The region - monsoonal tropics ✓
- How invasive grasses affect fire regimes ✓
- Environmental consequences-stand structure ✓
- Economic consequences - fire management ✓
- Current situation
 - Scale of problem

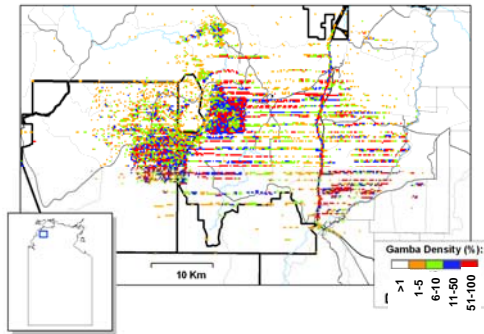
Counting the costs

- Major environmental, social and economic costs
- Aim of these research case studies to develop decision support tools
- Assess cost of invasion in different land use types
- Major decisions to make

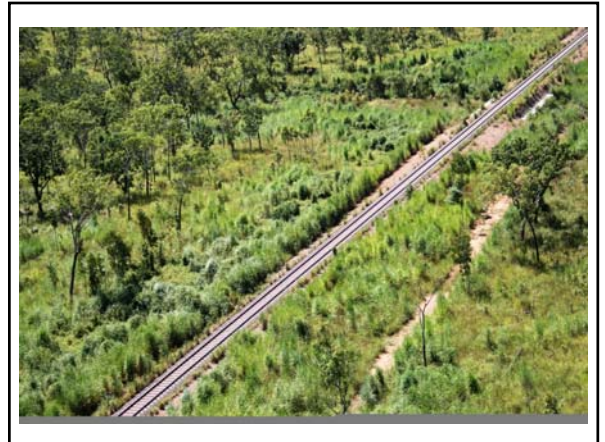
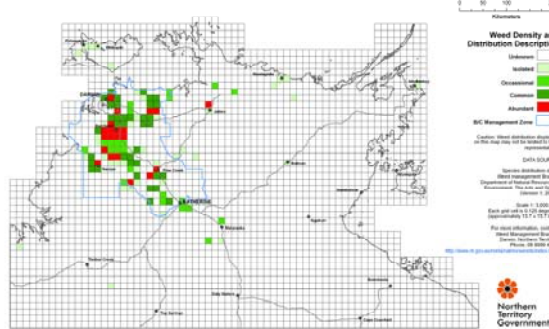
Litchfield NP and Coomalie Shire



Litchfield NP and Coomalie Shire



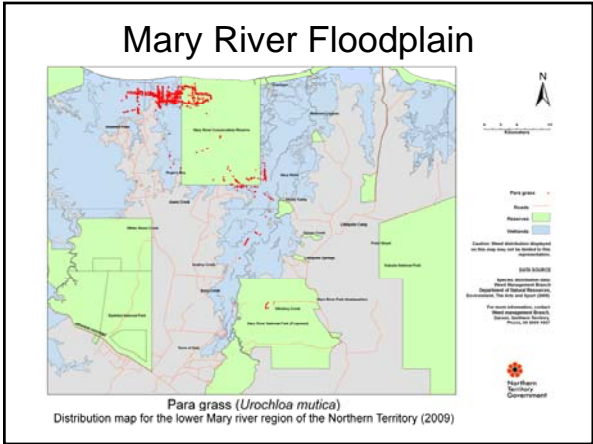
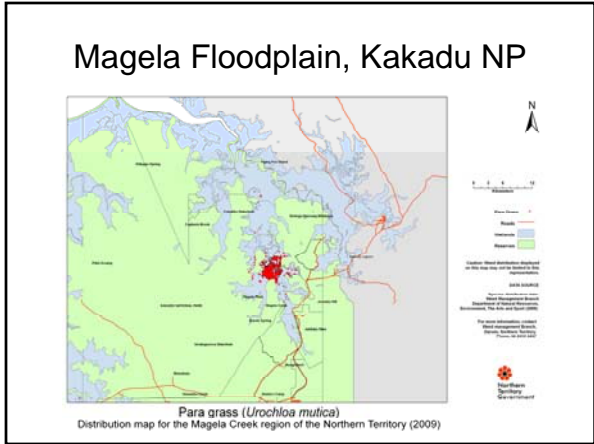
Gamba grass (*Andropogon gayanus*) Distribution map for the Top End of the Northern Territory (2009)





Summary

- Critical decisions about what to save and what to lose
- DWM project was major contribution to developing decision support tools
- Continuing to develop these tool
 - CERF funded project





Weed Risk Assessment in the NT

- Developed by CDU/TS-CRC, NT Government between 2001-2007
- Adopted 2007
- Major outcomes –
 - Tall invasive grasses were the majority of very high risk species that were not under management
 - Gamba grass, Para grass, Olive Hymenachne, Mission grass are major environmental concerns

S12