Effectiveness of Integrated Fire Management in Australian Savannas.

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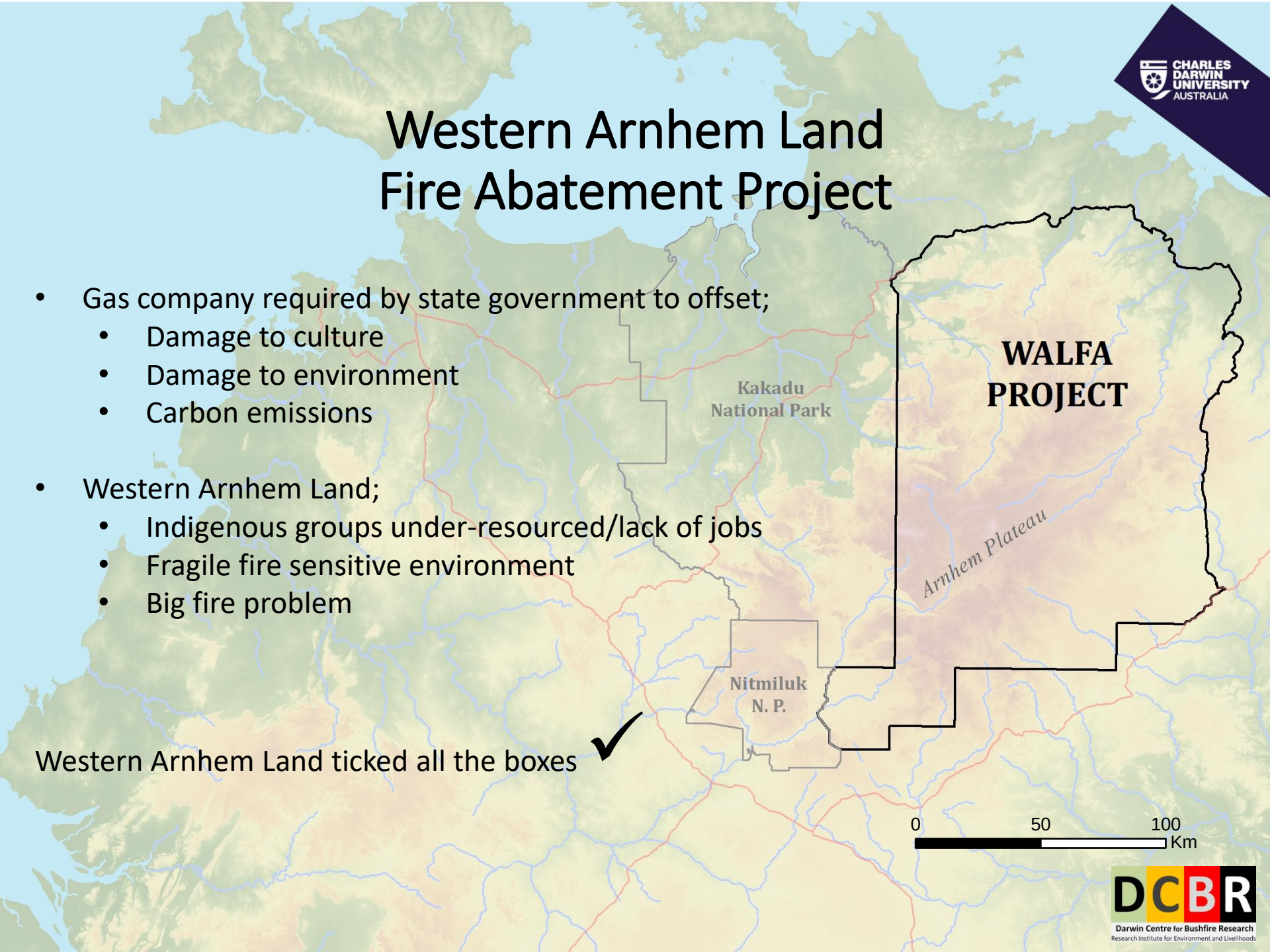
Western Arnhem Land Fire Abatement Project

- Gas company required by state government to offset;
  - Damage to culture
  - Damage to environment
  - Carbon emissions

- Western Arnhem Land;
  - Indigenous groups under-resourced/lack of jobs
  - Fragile fire sensitive environment
  - Big fire problem

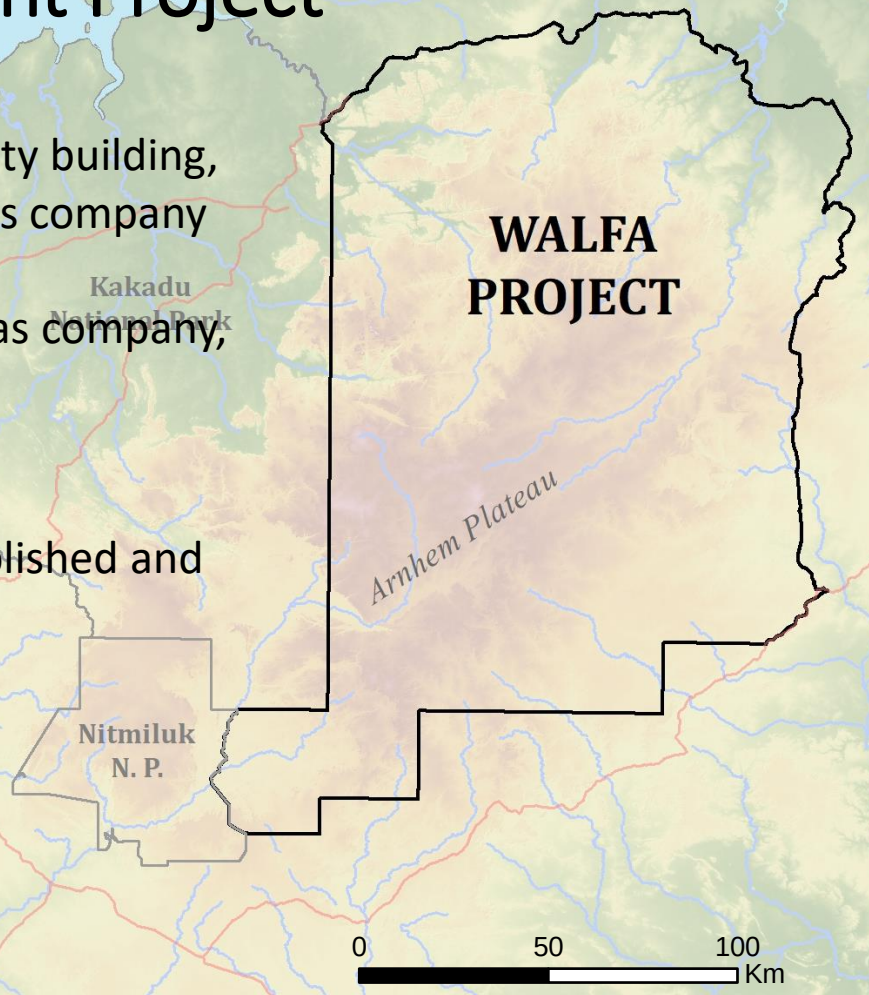
Western Arnhem Land ticked all the boxes ✓



Western Arnhem Land Fire Abatement Project

Timeline

- **Pre- 2005:** Unmanaged fire, Indigenous capacity building, Emissions accounting method developed, Gas company proposes development.
- **2006:** Contract between indigenous groups, gas company, and State government.
  - Begin IFM
  - Greatly increased capacity building
- **2009-2012:** Emissions accounting method published and passed as Federal Law.
- **2014:** WALFA registered as Federal project to produce carbon credits.
  - Abated over 2 million tCO_2-e
  - Environmental ???
  - Social ???

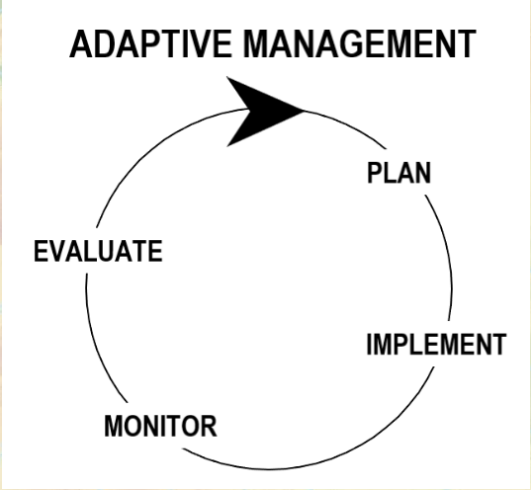


Environmental Monitoring and Evaluation.

1. Fire effects research
2. Fire mapping
3. Habitat mapping

Spatial analysis

- Fire effects x fire regime x habitat map

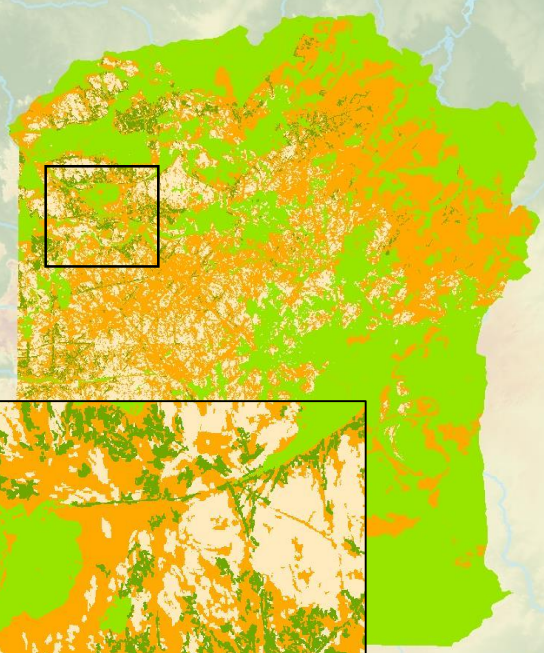


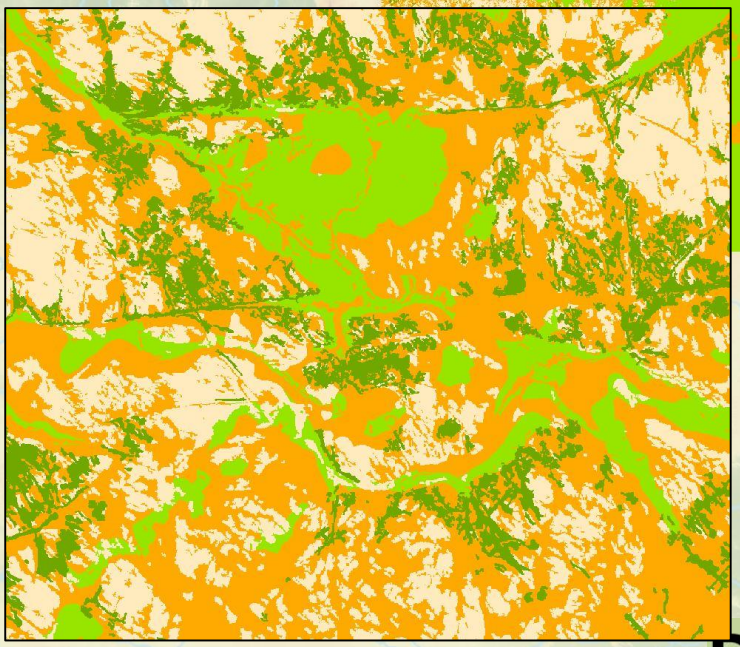
Fire effects research.

- Woodlands x Fire Severity
  - *(Edwards and Russell-Smith 2009; Russell-Smith 2006, 2012; Bowman and Panton 1993)*
- Woodlands x Pyrodiversity
  - *(Fraser et al. 2003; Andersen et al. 2005; Woinarski et al. 2005; Woinarski and Legge 2013; Radford et al. 2015; Woinarski and Winderlich 2014)*
- Flora and fauna with restricted dispersal capacity or small home ranges x Extensive Fire
  - *(Lowe 1995; Kerle 1998; Franklin 1999; Oakwood 2002; Fraser et al. 2003; Woinarski et al. 2005; Firth et al. 2006; Russell-Smith 2006; Yates et al. 2008; Barrow 2009; Radford 2012; Woinarski and Legge 2013; Hohnen et al. 2015; Lawes et al. 2015; Radford et al. 2015)*
- *Allosyncarpia* Monsoon Forests x Severe Fire
  - *(Russell-Smith et al. 2012; Freeman et al. 2017)*
- Sandstone Heath x Frequent Fire
  - *(Russell-Smith et al. 1998, 2002, 2012; Russell-Smith 2006)*

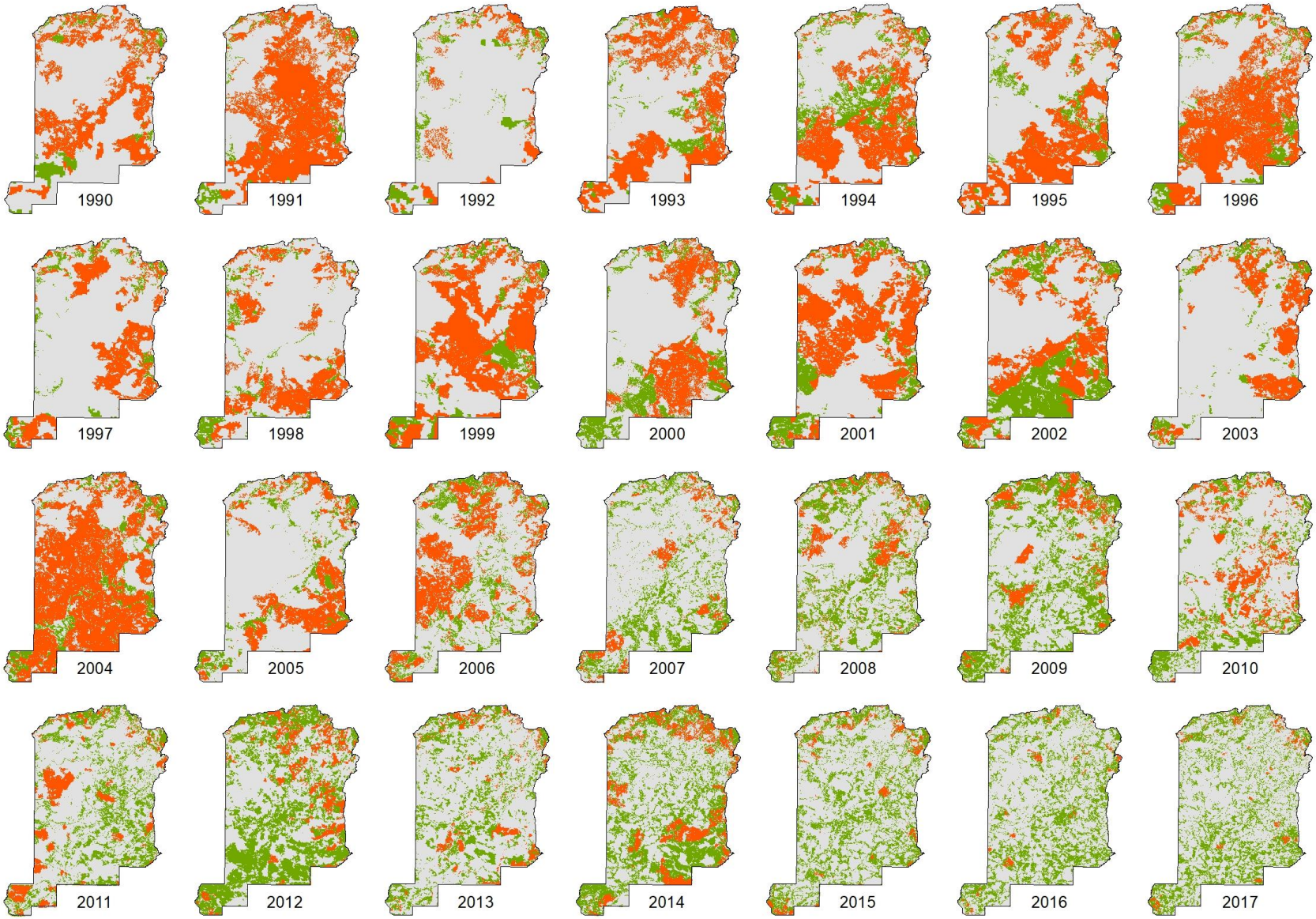
Habitat Mapping

- *Allosyncarpia* forests
  - sub-meter scale *(Freeman et al. 2017)*
- Sandstone heath, woodlands
  - Landsat (30m x 30m scale) classification
    (Blake, Edwards)





Fire Mapping *(Edwards and Russell-Smith 2009, Evans and Russell-Smith 2019)*



Green = Early dry season fires. Red = Late dry season wildfires

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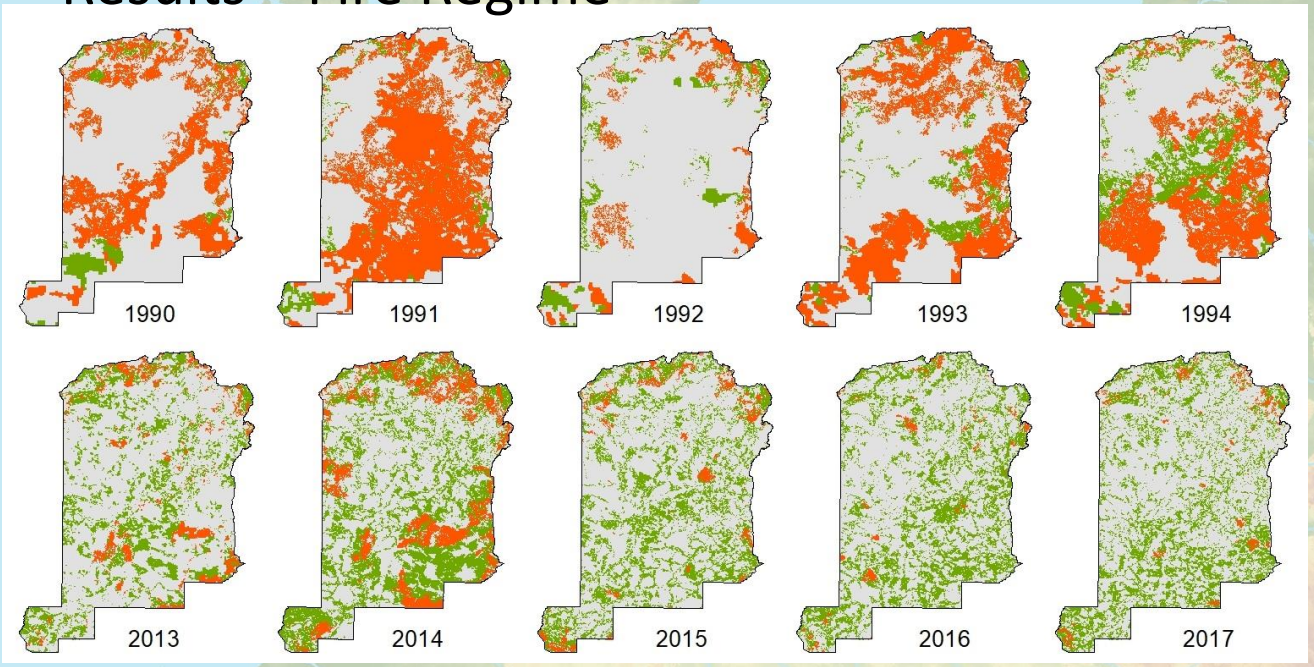
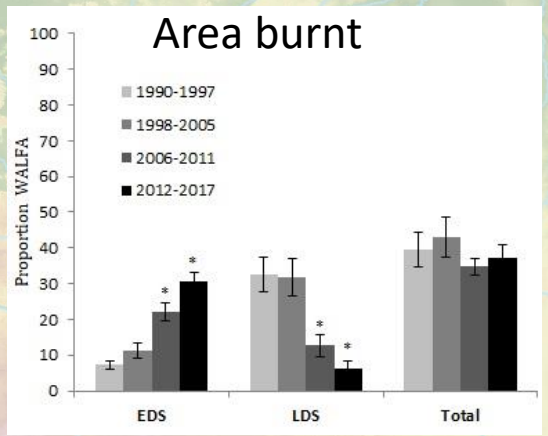
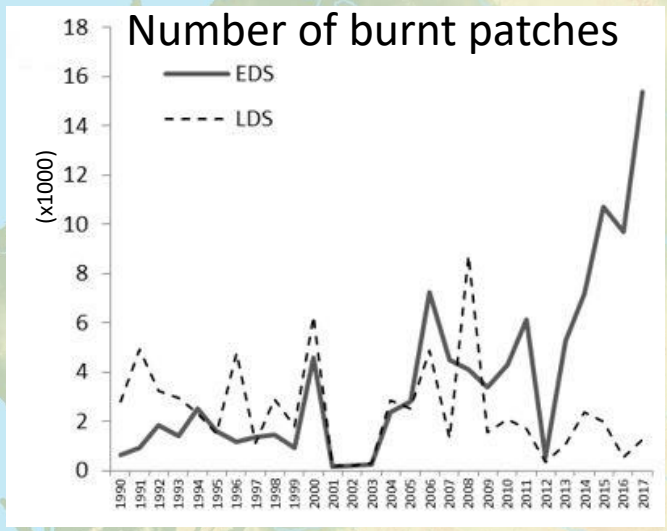
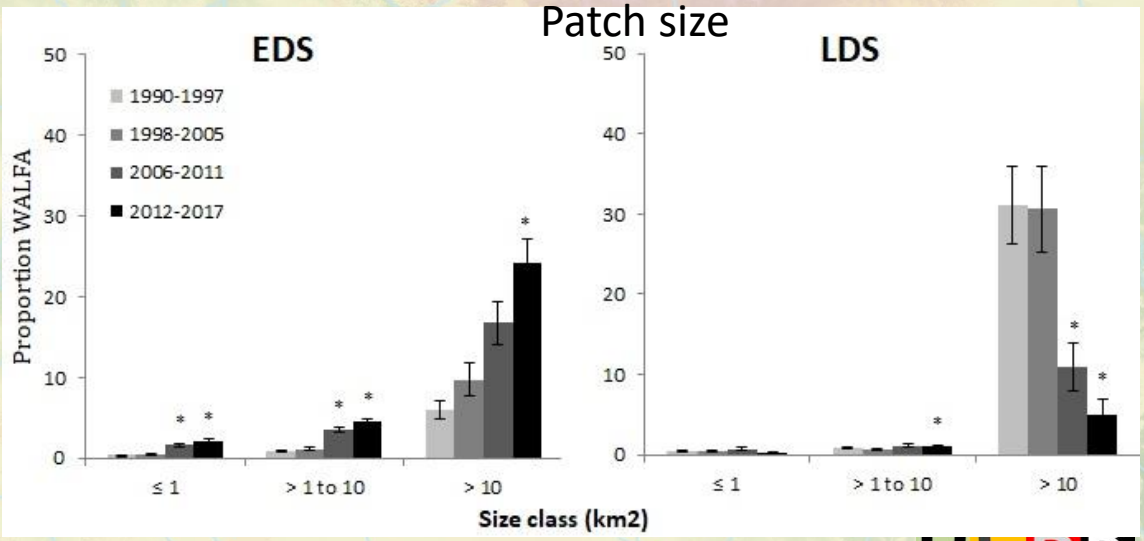
Environmental

Results – Fire Regime









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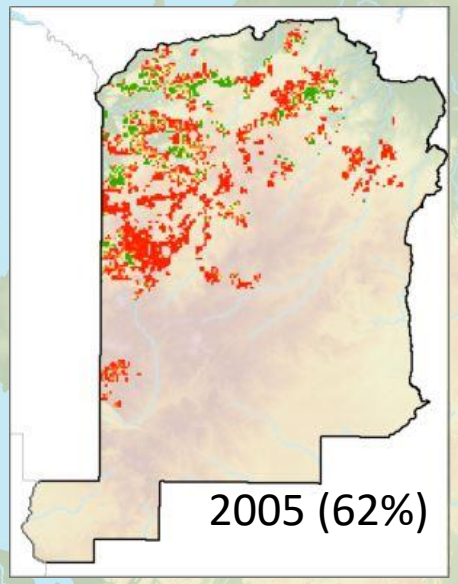
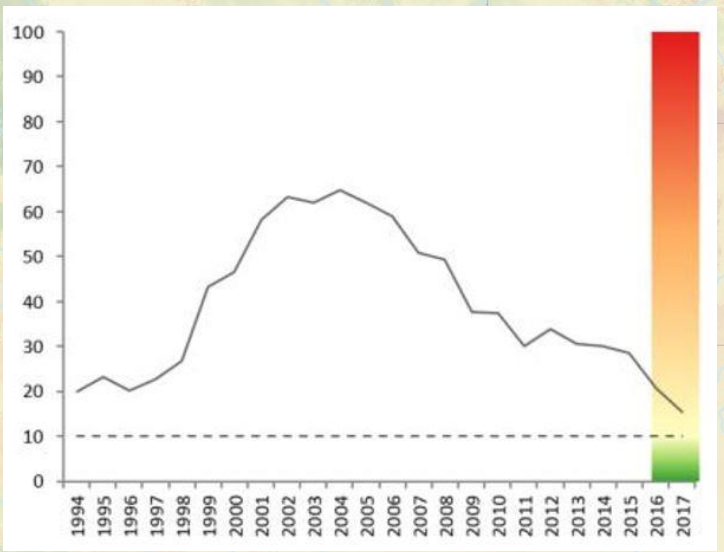
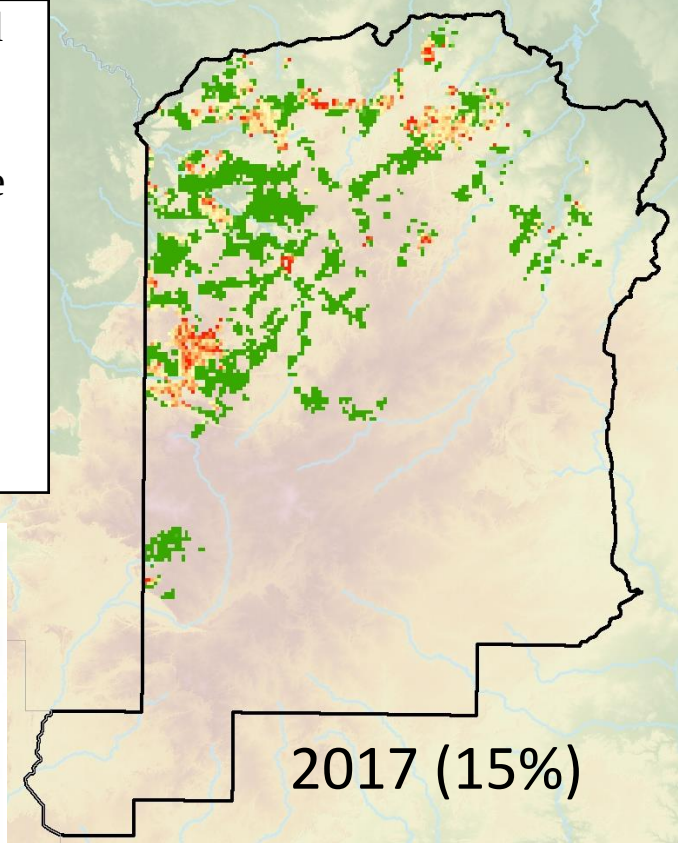
Closed forests impacted by severe fire.

Response group	Rationale	Threshold exceeded when:	Result after 2017:
Severe fires affecting upland closed forests.	Closed canopy monsoon forests dominated by the regional endemic *Allosyncarpia ternata* are susceptible to incursions particularly from severe fires primarily occurring during the late dry season (LDS).	Forest boundaries impacted by any severe (LDS) fires over 5 years.	**15%** of closed forests had experienced 1 or more severe (LDS) fires in the previous 5 years.



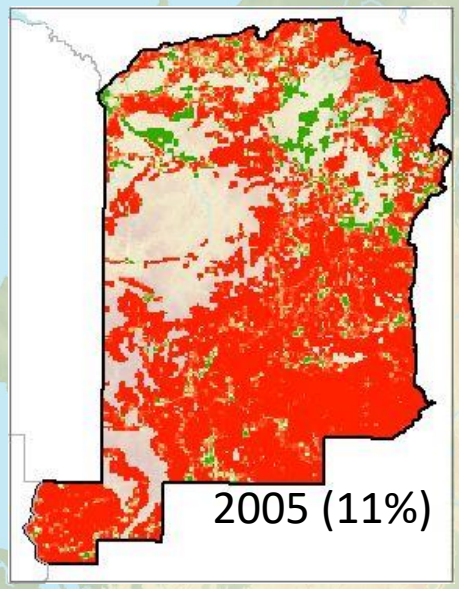


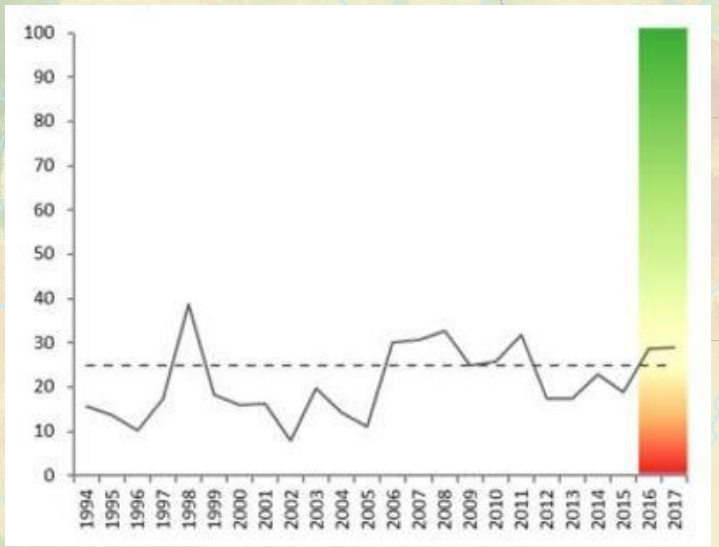


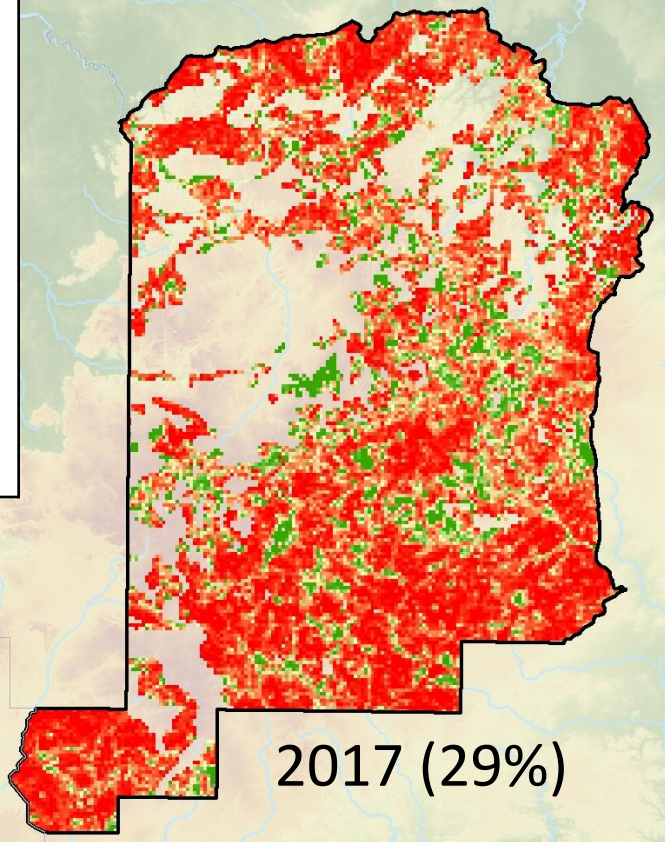
Environmental

Moderately long (≥3yr) unburnt woodlands.

Response group	Rationale	Threshold exceeded when:	Result after 2017:
Maintaining structural diversity in woodlands.	The development of diverse shrub and mid-canopy food resources in the absence of burning, is critical for many small mammal and bird taxa.	Woodland habitats are re-burnt within 3 years	**29%** of lowland woodlands were at least 3yr unburnt.



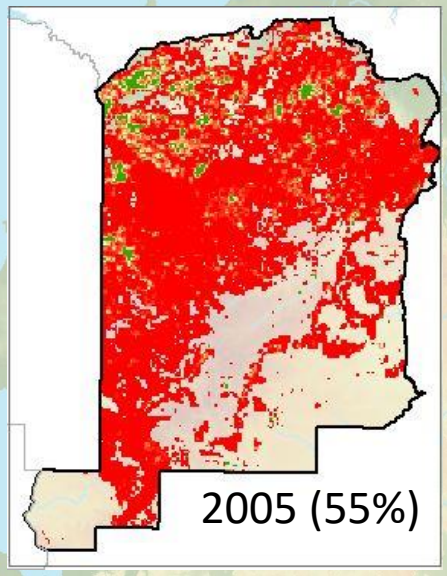


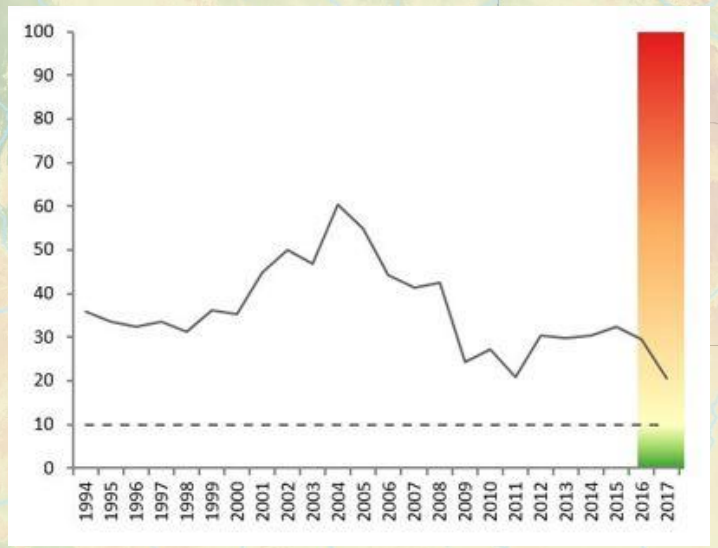


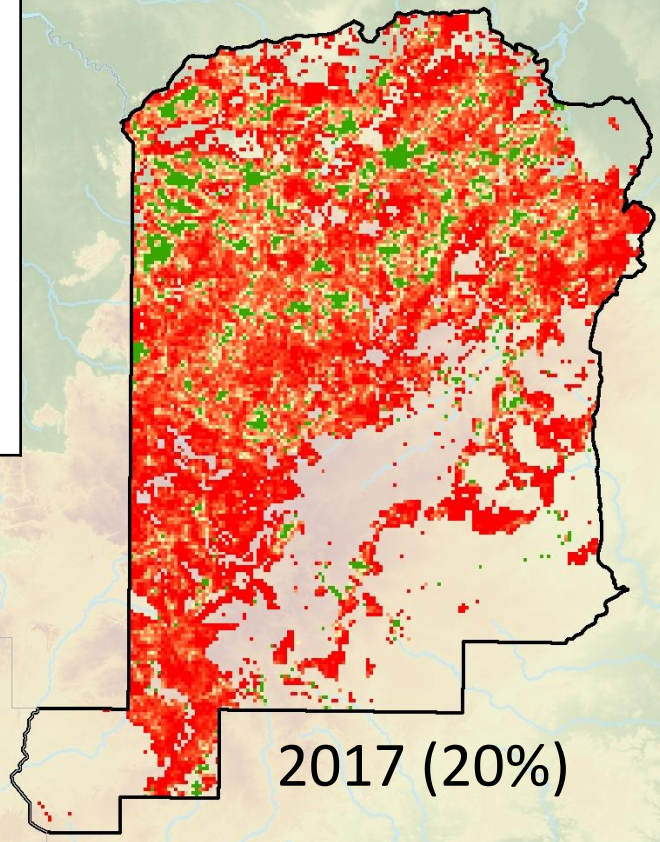
Environmental

Extensive (>1km^2) fires.

Response group	Rationale	Threshold exceeded when:	Result after 2017:
Frequent large fires impacting fauna with restricted home ranges and obligate seeder flora.	Fauna with restricted home ranges and obligate seeder plant taxa with limited dispersal capacity are impacted by extensive fires. (even far less than 1km2)...	Landscapes are impacted by any extensive (>1 km2) fire over 5 years.	**20%** of uplands experienced extensive fires in last 5 years.







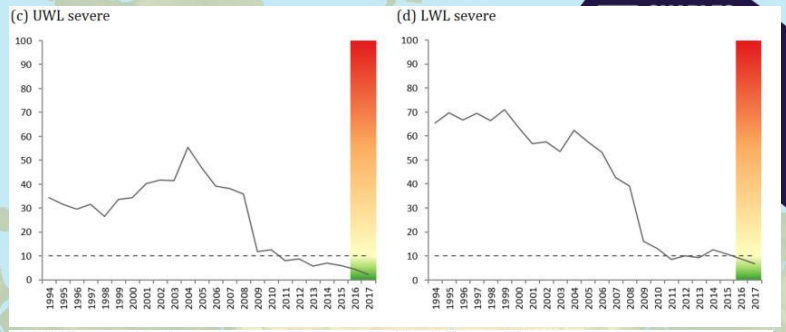
Environmental

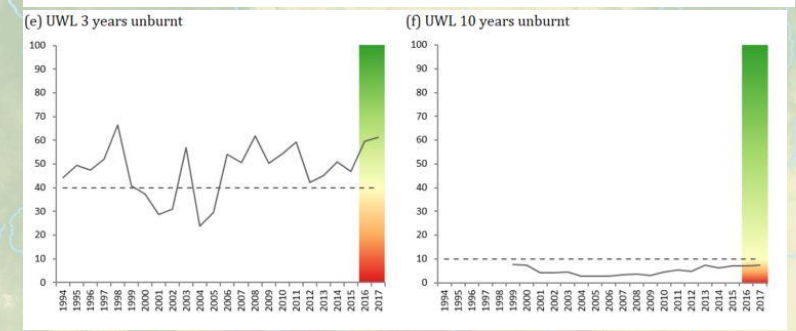
After 12 years,
The negative fire regime is being addressed,

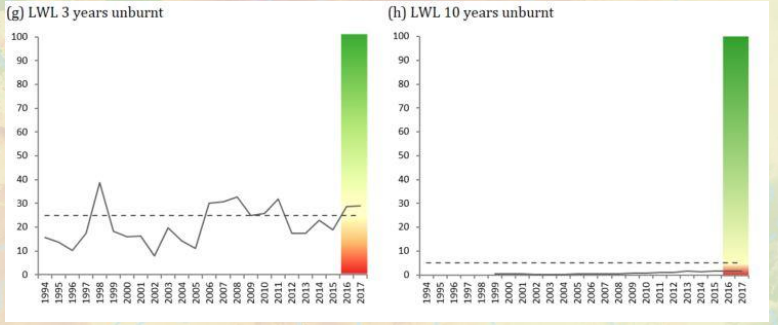
- seasonality reversed
- EDS fires patchier/ generally smaller
- LDS fires fewer and smaller,

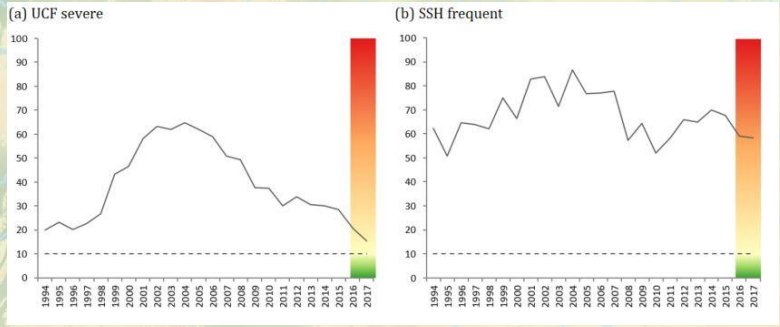
Overall area burnt not significantly reduced (but declining),

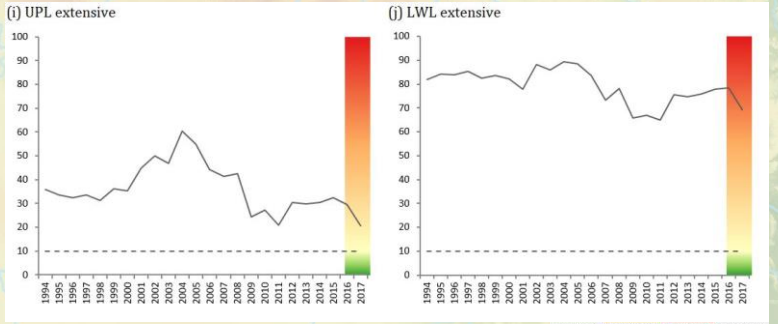
- Large (>1km^2) fires still dominant
- Burning still too frequent, especially in uplands
- Long unburnt areas lacking (but increasing).











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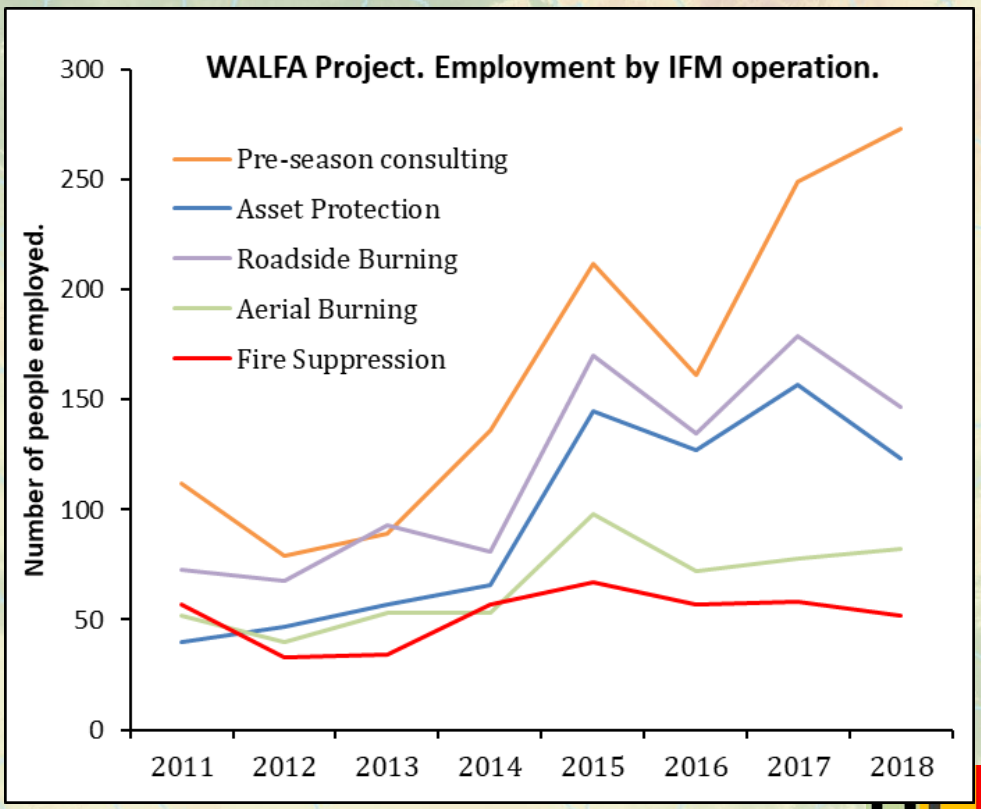
Social.

Healthy Country Planning *(Ansell et al 2019).*

Indigenous aspirations for land management goals.

- Continue to participate in IFM
- See fewer large wildfires
- Protect biodiversity
- Protect sacred sites
- Maintain culture
- Save carbon



Conclusion.

IFM is effective, however more time is required.

- Fire effects can happen fast (2-5 yrs), but recovery requires long term IFM (decades).
- Market-based resourcing can enable the necessary long term sustained IFM.
- Indigenous aspirations are being met.
- This is based on recommendations from fire effects research, and is not a replacement for long term biodiversity monitoring. It is only as good as the fire effects research.
- Fire effects research needs to produce clear recommendations of fire regime limits that can be mapped/monitored.
- Habitat mapping needs to be dynamic/ongoing, including other habitats (e.g. riparian zones).
- Fire mapping needs to account for Severity.