



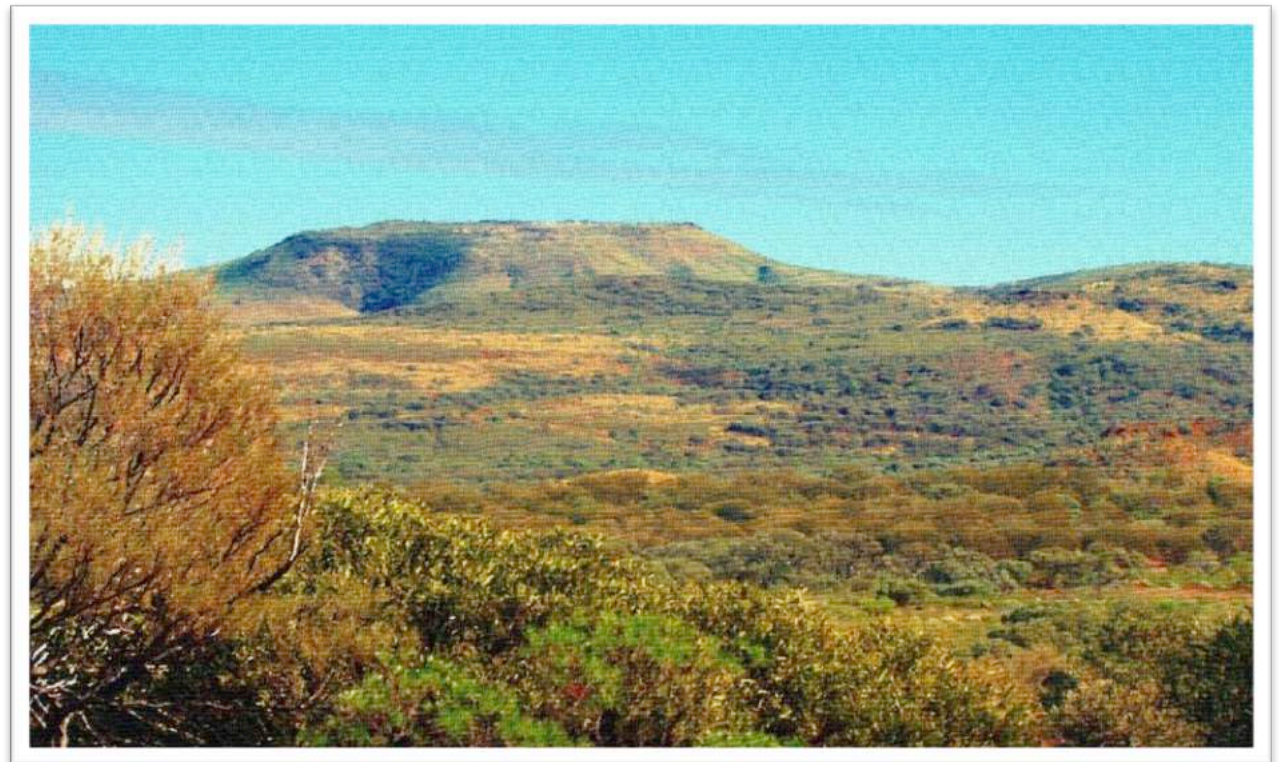
**CONTOUR**  
ENVIRONMENTAL & AGRICULTURAL CONSULTING

# How to Manage Your Landscape for Carbon

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17 August 2016

Presented to the Outback Carbon Farming Conference





- Three questions I hope to deal with in this presentation:
  1. What is your landscape?
  2. What does a landscape that is well managed for carbon look like?
  3. What are the management techniques and strategies that can help achieve that landscape?





# What is 'Your Landscape'?

- The visible features of an area of land (Oxford Dictionary 2016).
- The boundary of a landscape can be hard to define.
  - As far as you can see?
  - A paddock?
  - A station?
  - A drainage catchment?
- A more relevant and meaningful definition is arrived at by taking a landscape ecology perspective.
- “Landscape ecology emphasizes the interactions between spatial patterns and ecological processes, that is, the causes and consequences of spatial heterogeneity in a range of scales” (Turner et al. 2001).





# What is 'Your Landscape'

- A modified landscape definition...

*A set of features within an area of land that are **CONNECTED** through ecological processes.*

- The more important question then becomes...

**How does the area being managed for carbon fit within a landscape?**

- What other areas/features is it connected to?
- What areas/features influence it?
- What areas/features does it influence?



# A landscape...

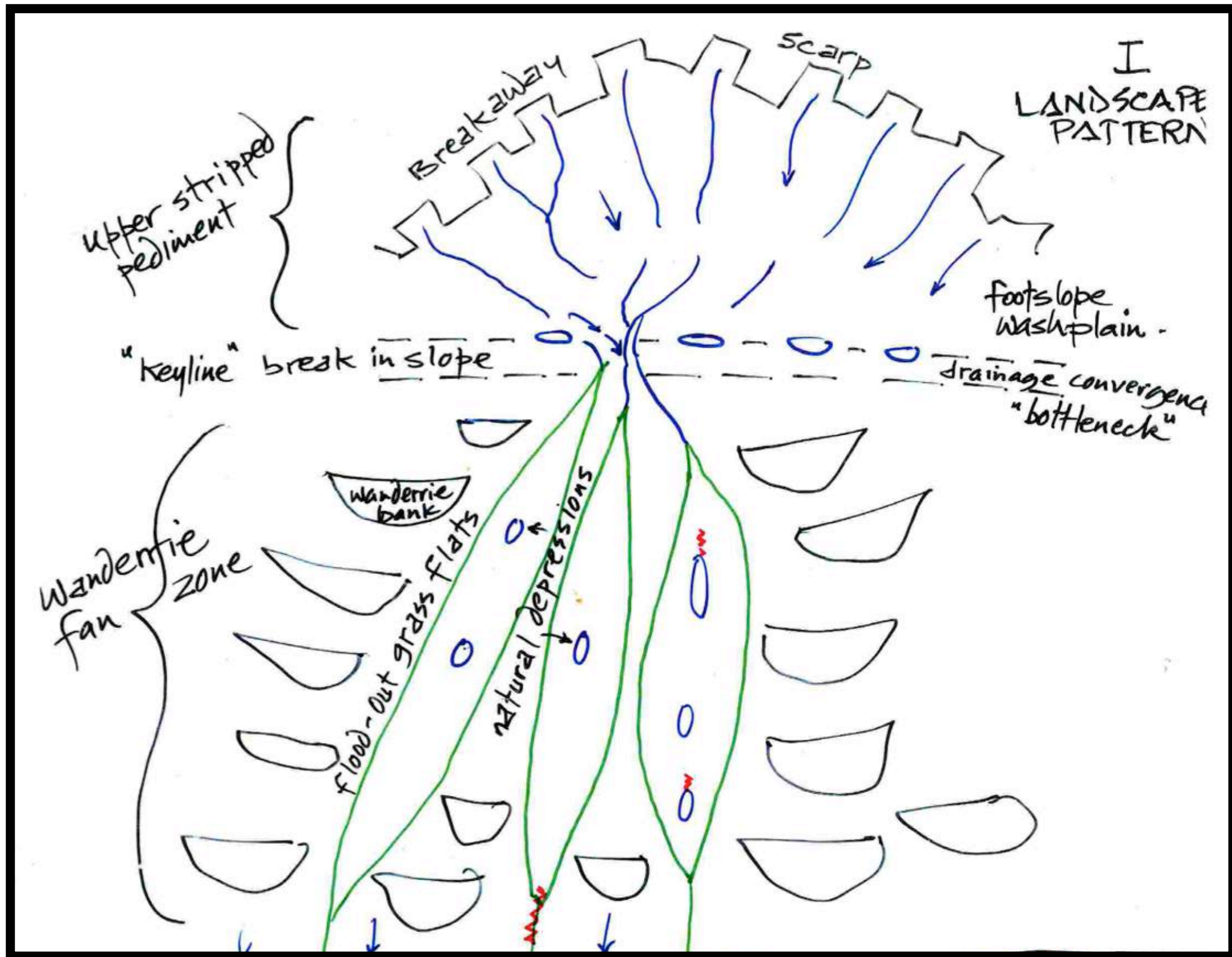


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Google earth



...and a landscape pattern.





# What Ecological Processes Occur in a Landscape?

- Water and Wind
  - Erosion
    - Gully, Sheet
  - Deposition
- Fauna
  - Grazing
  - Physical animal impacts
    - Trampling, digging
  - Predation
- Fire
  - Burning



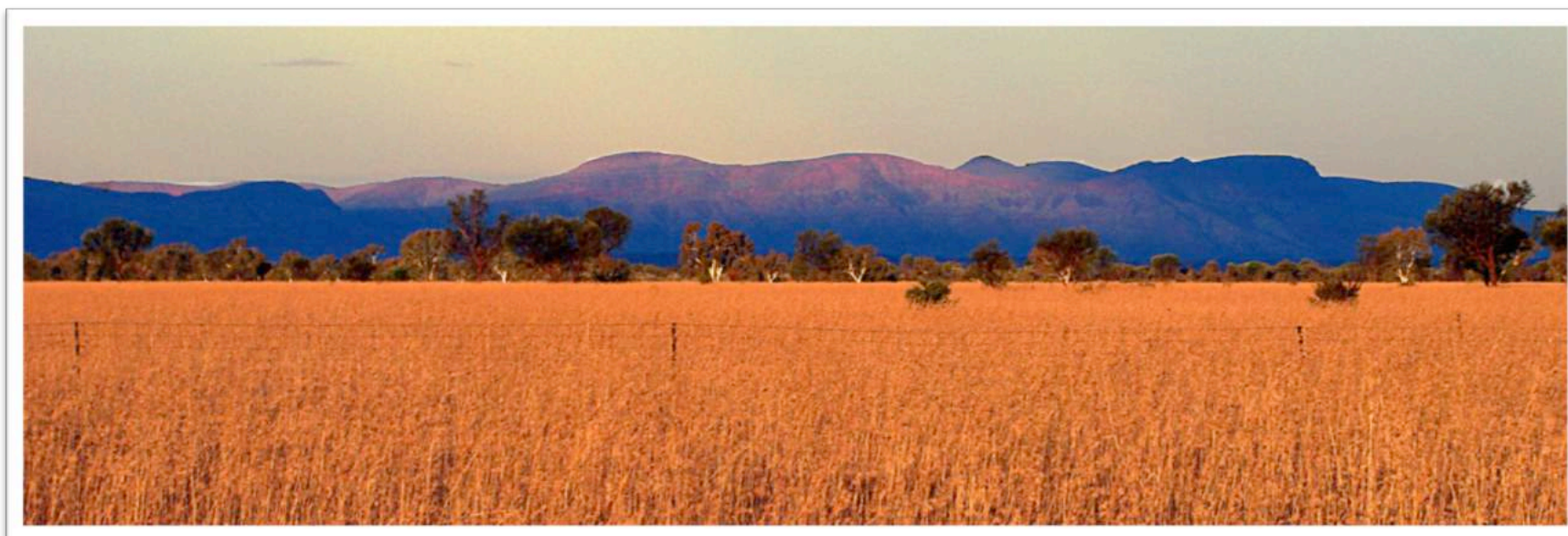
And many others!





# What Does A 'Good' Carbon Landscape Look Like?

- Carbon in the landscape is predominantly stored in the soil, and in the above and below ground vegetation biomass.
- Therefore a landscape with lots of carbon will be a landscape that has lots of healthy soil, and lots of healthy vegetation.
- That sounds a lot like the definition of a healthy landscape!
- Landscape health is directly related to ecosystem function.







# What Does A 'Good' Carbon Landscape Look Like?

- There are exceptions!



Image courtesy of pilbaramesquite.com.au

A functioning ecosystem?

Yes!



A good carbon landscape?

Yes!



A 'healthy' landscape?

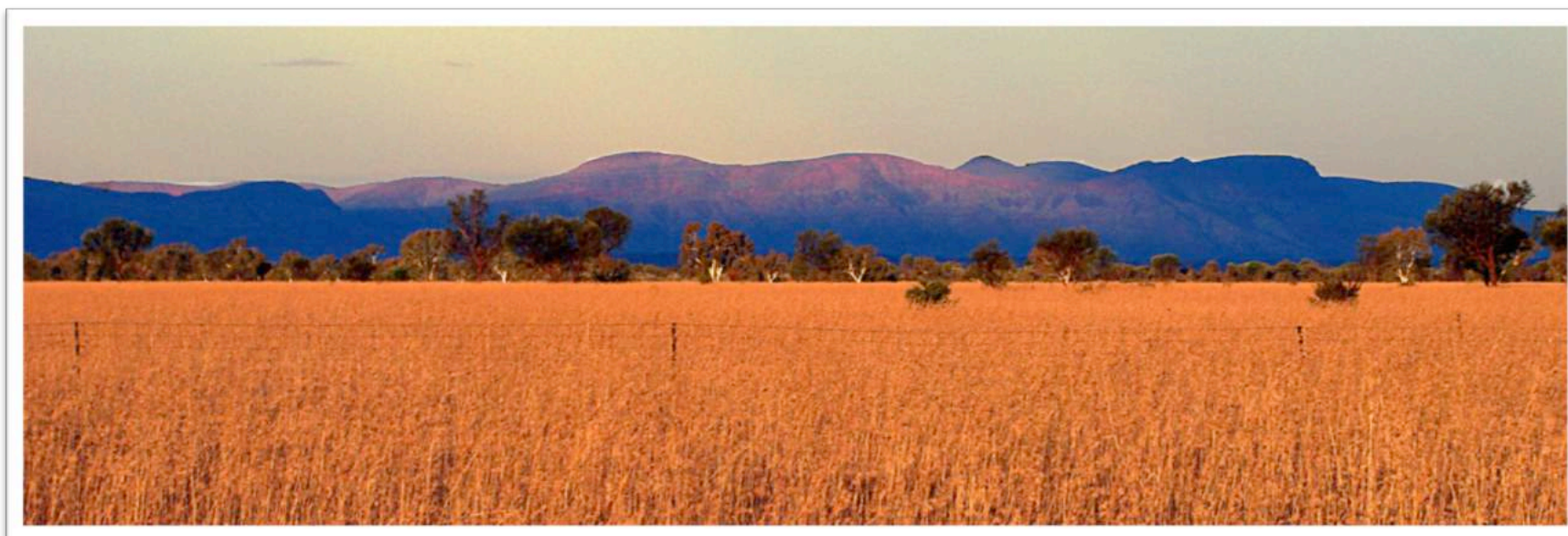
**Definitely not!**





# What Does A 'Good' Carbon Landscape Look Like?

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# What Does A 'Good' Carbon Landscape Look Like?

## A functioning rangelands ecosystem (Le Houérou 2006)

1. Production of above and belowground deciduous dry matter;
2. Production of litter;
3. Incorporation of litter into the soil (role of scavenging and burrowing);
4. Increase of organic matter content in the upper soil horizons;
5. Stabilisation of soil peds and of soil structure from increased organic matter content;
6. Increased permeability to air and water;
7. Increased water holding capacity due to increased OM;
8. Decreased compaction and bulk density;
9. Increased permeability and water intake;
10. Decreased runoff;
11. Improved water budget and balance;
12. Enrichment of earth in worms, microflora: bacteria, actinomycetes, fungi, and root symbionts, algae;
13. Development of the micro, meso and megafauna;
14. Increasing the turnover of geobiogene (essential) elements, hence increased fertility and primary productivity;
15. Increased above-ground phytomass, particularly of perennial plant species, more developed and complex vegetation structure, hence reduced wind speed, developed shading, reduced higher temperatures and higher low temperatures, reduced evapotranspiration and water consumption, greater water-use efficiency;
16. Enhanced ecosystem functioning, increased productivity and production.



# How do we Manage Areas for Carbon Sequestration

- By managing the manageable macro ecological processes that impact upon the landscape in which the carbon area occurs.

- Erosion and deposition



- Grazing and other animal impacts



- Burning regimes







**Management needs to be of all three.**

**There is no silver bullet solution.**





# How do we Manage Areas for Carbon Sequestration

- The Ecologically Sustainable Rangelands Management (ESRM) process is a planning tool for land managers to increase their understanding of the ecological processes occurring in their landscapes, and provide on ground management activities to achieve a desired landscape outcome.
- The process is grounded in science, with a focus on practicality.





# Managing water within a landscape







# Managing water within a landscape

- Rangelands rehydration techniques are used to repair eroded areas and rehydrate landscapes.

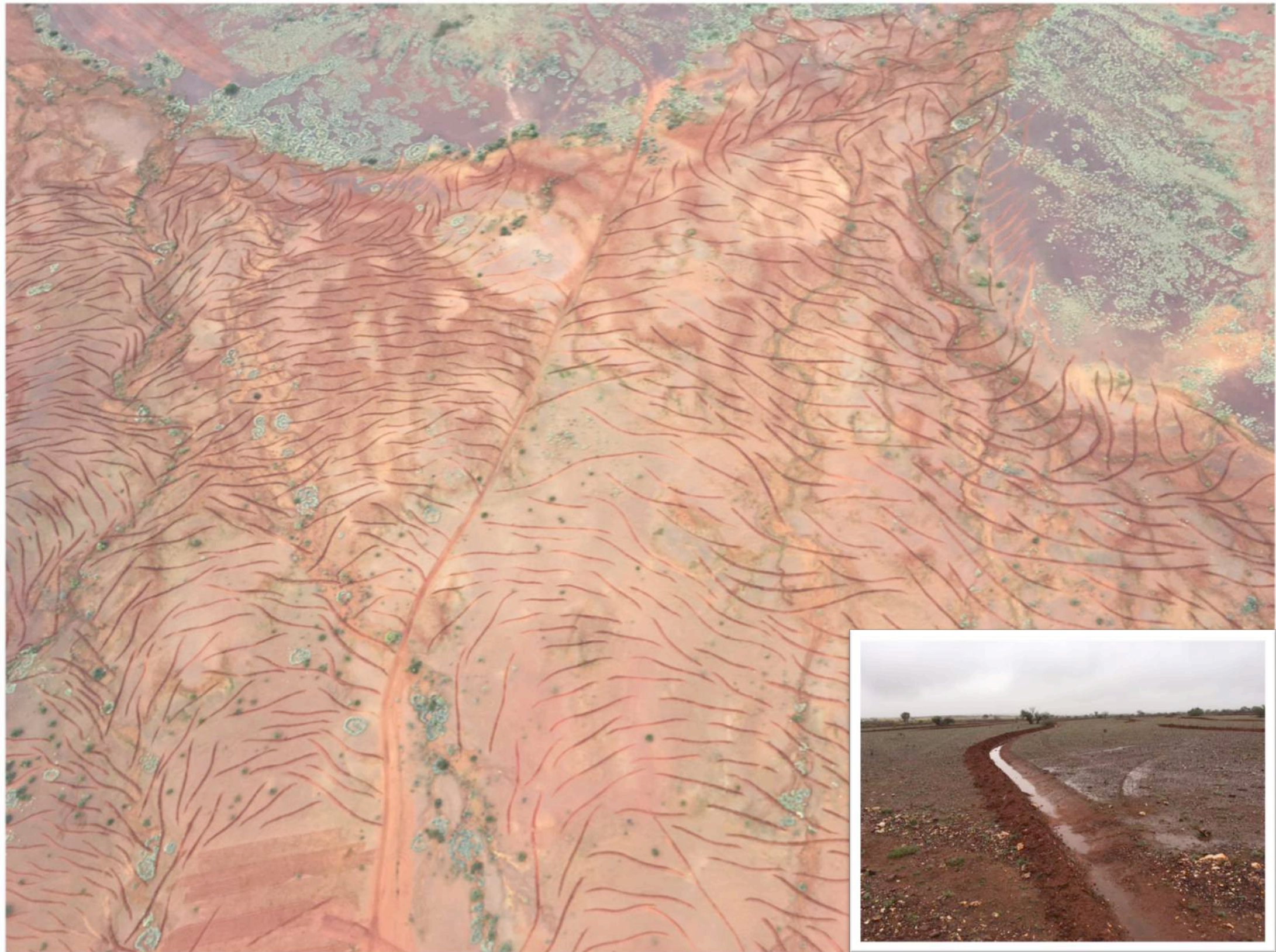
- Scrub Packing
- Sieve Structures
- Contour and Ponding Banks
- Track Bunds

Will be discussed in more detail in the following presentation





# Managing water within a landscape







# Managing water within a landscape





# Managing water within a landscape



A scalded flat in 1978



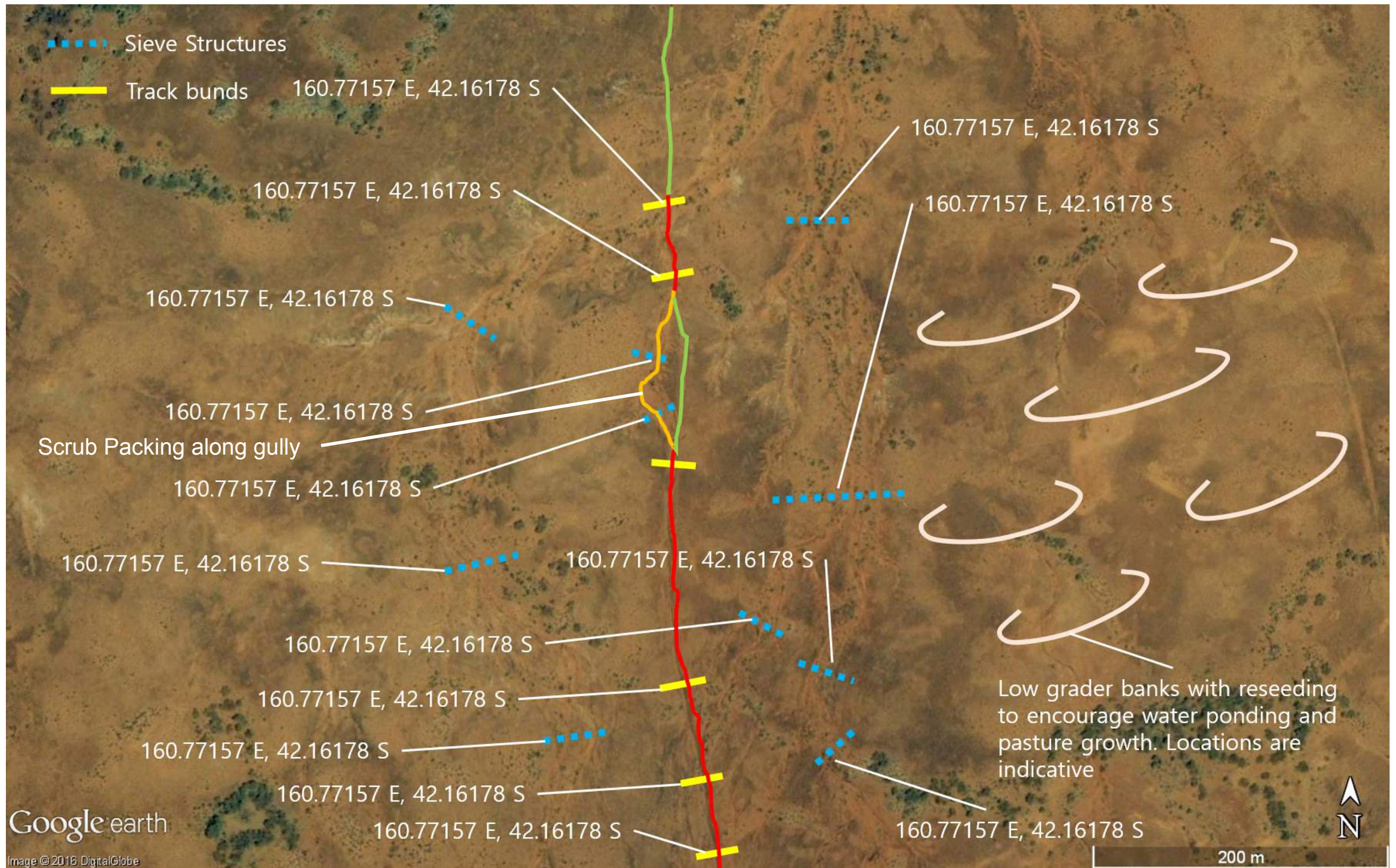
The same area in 2016, after contour banks were constructed in 2012







# Managing water within a landscape







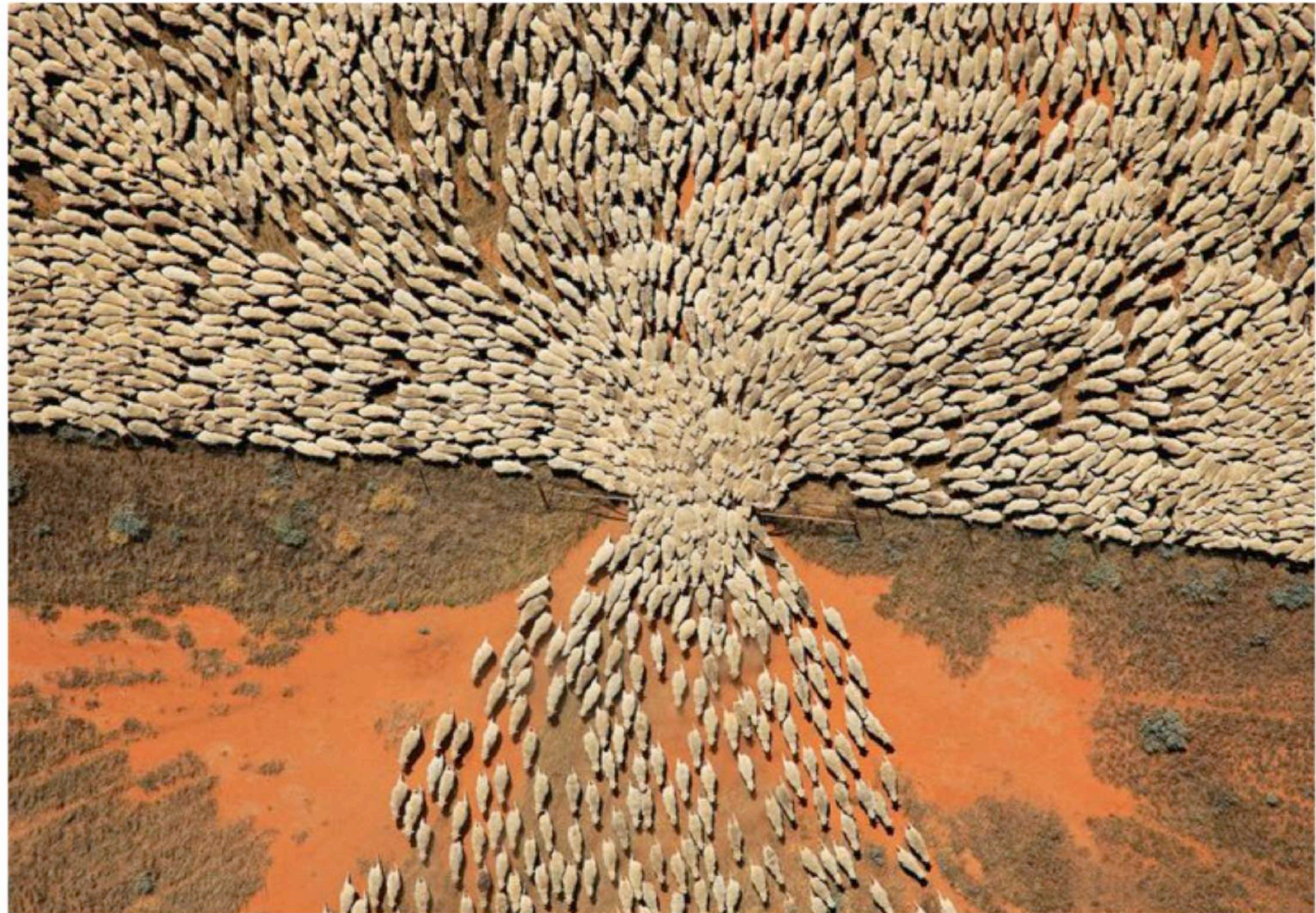
# Managing water within a landscape

- Of course the most effective way to minimise erosion in the first place is to maximise the level of groundcover across the landscape.





# Managing Animals within a landscape







# Managing Animals within a landscape

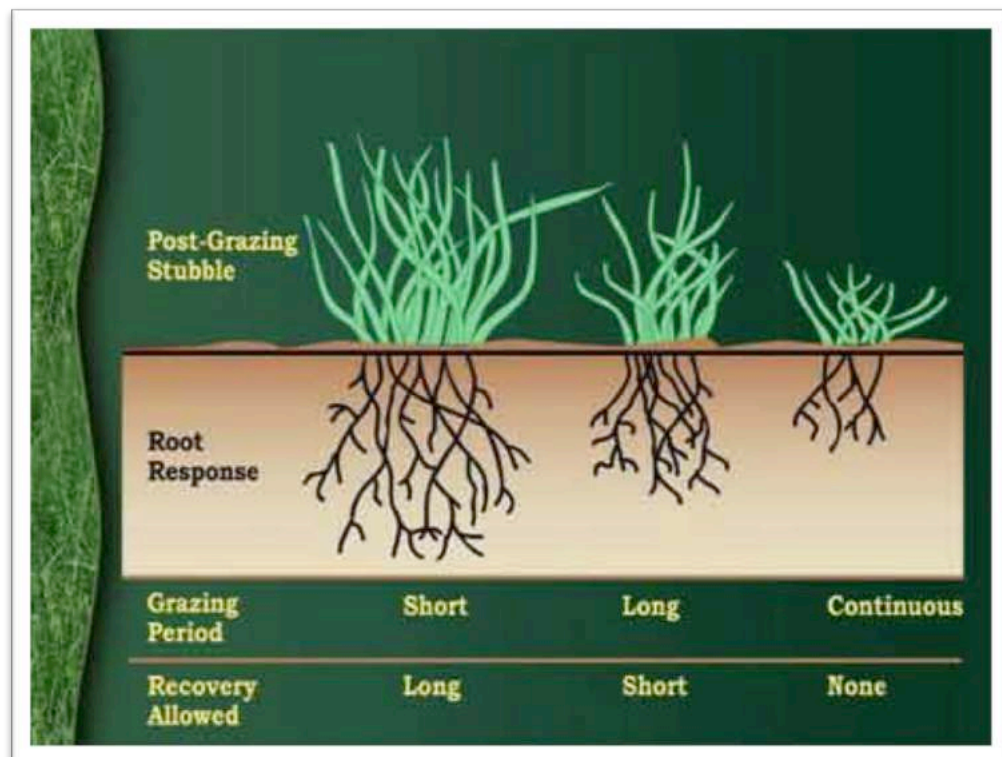
- Grazing and carbon sequestration are not necessarily exclusive landscape uses.
- The majority of carbon sequestered in vegetation is stored in the woody material of shrubs and trees (Russell 2015).
- Soil carbon sequestration requires healthy soil functioning, which requires more total vegetation biomass.
- There are two potential strategies:
  - Total grazing exclusion from the area.
  - Strategic grazing of the area with domestic stock.
- If grazing an area being managed for carbon sequestration:
  - Grazing should be restricted to a short, infrequent, heavy graze.
    - A short, heavy graze followed by prolonged rest promotes healthier root systems than continuous grazing
  - All non-domestic grazing should be excluded as much as possible. Strategies include:
    - Exclusion fencing (expensive, but effective if maintained)
    - Ground and aerial culling (less effective)
    - Use of natural predation from dogs (cost effective, but controversial and not a total solution)

Grazing a carbon farming area has three potential benefits:



# Managing Animals within a landscape

- Three potential benefits of grazing a carbon farming area:
  - If managed appropriately, grazing can enhance the landscape function of an area.
  - It is a useful tool to reduce fire loads within an area.
  - It can provide supplementary income from an area.
- And one major risk:
  - If managed inappropriately, grazing can quickly degrade the current carbon stores though vegetation removal, and future sequestration rates of an area, due to reduced landscape function.

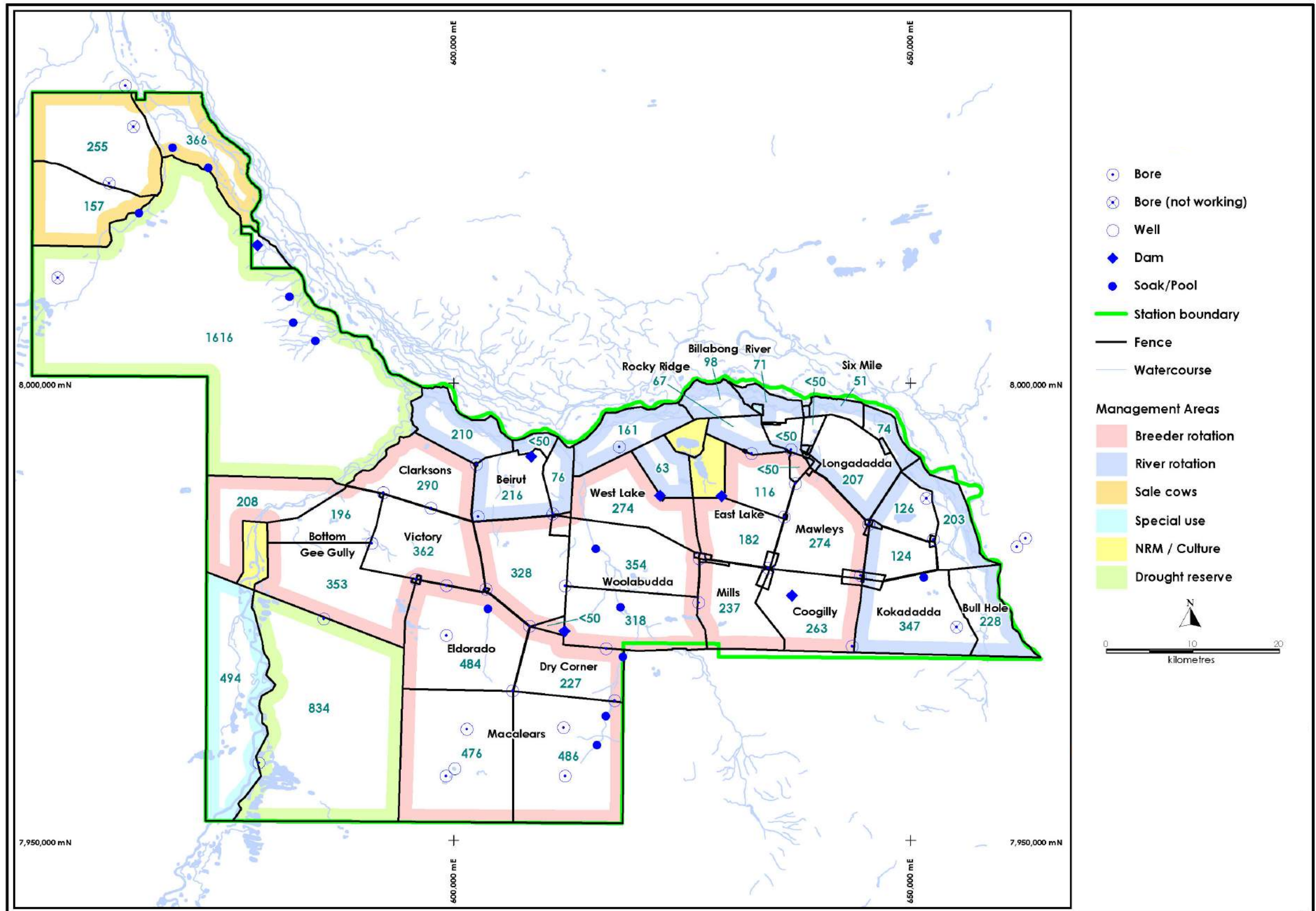


Colorado State University (2013)



Australian Wool Innovation, and Meat and Livestock Australia (2009).





# Managing Fire within a landscape





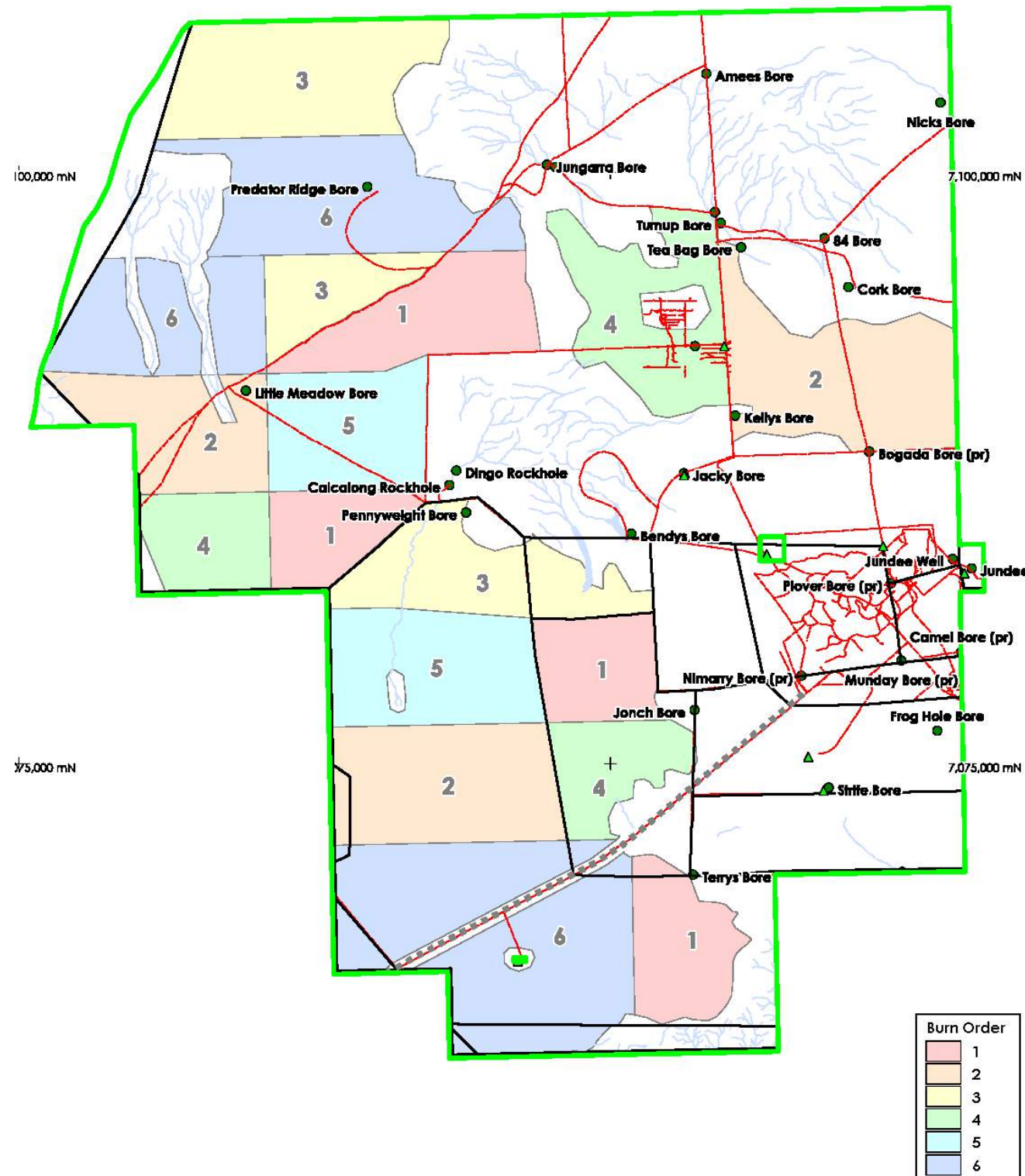


# Managing Fire within a landscape

- Generally fire management within carbon farming areas should follow the same principles as for other areas, namely:
  - Mulga shrubland – fire should be excluded, until such time as the fuel load within the area makes wildfire a risk, at which time a cool winter burn may be effective to refresh the understory vegetation.
  - Eucalypt woodland – Depending on the understorey:
    - Spinifex – a cool winter burn every 5-7 years.
      - If the area is larger than 10,000 ha then it may be necessary to carry out 10,000 ha burns in mosaic pattern.
    - Tussock grassland – fire should be excluded, until such time as the fuel load within the area makes wildfire a risk, at which time a cool winter burn may be effective to refresh the understory vegetation.
- More important is the fire management in the landscape surrounding the carbon farming area, to gain control over the burning regime.
  - Mosaic burning
  - Fire sacrifice areas
  - Firebreaks



# Managing Fire within a landscape





# References



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