Long-term land management effects on rangeland vegetation cover in the Strzelecki Desert

Adrian Fisher
Joint Remote Sensing Research Program, University of Queensland and Centre for Ecosystem Science, UNSW

Mike Letnic
Centre for Ecosystem Science, UNSW

Geoff Horn
Office of Environment and Heritage, NSW Government
Strzelecki Desert land management

Shrub covered dunes with patches of bare sand

Grassy inter-dunal swales
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[Map of the Strzelecki Desert with marked areas of interest, Queensland, South Australia, and New South Wales highlighted.]
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“Outside” the fence
- Dingoes common
- Cattle grazing
- Greater abundance:
  - Small mammals
  - Rabbits
  - Swale grasses

“Inside” the fence
- Dingoes rare
- Sheep and cattle
- Greater abundance:
  - Kangaroos
  - Feral foxes
  - Dune shrubs

No grazing since 1972 but kangaroos are abundant
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- shrub encroachment in NSW
- shrub encroachment in SA
Aerial photo interpretation has verified long-term dune shrub encroachment inside the fence.
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**Fort Grey**

- **Inside**
- **Outside**

**Hawker Gate**

- **Inside**
- **Outside**
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Aerial photo interpretation has verified long-term dune shrub encroachment inside the fence.

**Fort Grey**

- Average shrub cover sample unit^-1 (± 1 SE)
- Inside
- Outside

**Hawker Gate**

- Average shrub cover sample unit^-1 (± 1 SE)
- Inside
- Outside

**Tibooburra rainfall**

**30 years of Landsat**

- Monthly rainfall (mm)
- SPI (36 month lag)
Landsat fractional cover model

- 1171 field sites
- 3 endmembers derived from the data through regression modelling
- Constrained linear un-mixing
- Not sensitive to soil colour or moisture
- Applied to L5-TM, L7-ETM+ and L8-OLI

Data processing

- Level-2 Landsat data downloaded from the USGS
- Data normalised to surface reflectance
- Clouds, cloud shadows and water are masked
- Fractional cover is modelled
- Seasonal composites are created to fill gaps and reduce data using the medoid method
- Statewide mosaics are created and released through auscover.org.au

ftp://qld.auscover.org.au/landsat/seasonal_fractional_cover/fractional_cover/
Observations on the time-series

1. Seasonal compositing doesn’t work as well for these dry environments that respond quickly and dramatically to rainfall
2. Dry lake beds and clay pans have spuriously high dead cover (the unmixing algorithm needs improving)
3. Short-term changes are obvious, but can we see long term trends?

![Image of Autumn 1989 and Winter 1996 landscapes]
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198 sample points outside

133 sample points inside

391 sample points outside

395 sample points inside
Fort Grey

Graph showing the percentage cover of bare ground, green vegetation, and dead vegetation from 1990 to 2015. The graph distinguishes between data from inside and outside the Fort Grey area.
The small difference in 1999 does not match the aerial photo interpretation as dead vegetation cover is a mixture of shrubs and grasses.
During high rainfall, grasses increase and dead vegetation contains more grass.
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Fort Grey

During low rainfall, grasses decrease and dead vegetation contains more shrubs. Is there a slight upward trend?
Dead cover time-series decomposition

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Fort Grey
Fort Grey

Dead cover time-series decomposition

- Observed
- Trend
- Seasonal
- Residual

Outside and Inside plots for the years 1990 to 2010.
Hawker Gate

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- Bare ground
- Green vegetation
- Dead vegetation

Cover (%)


Outside
Inside
Hawker Gate

Not consistent with Fort Grey
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**Hawker Gate**

- **Bare ground**
- **Green vegetation**
- **Dead vegetation**

Fire burnt outside the fence
Hawker Gate has less shrubs than Fort Grey, so we can assume the dead vegetation signal relates more to grasses. Greater grasses outside the fence could relate to a crash in rabbit numbers after calicivirus was released in 1996.
Hawker Gate

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Hawker Gate

More shrubs inside
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Hawker Gate

Rainfall increases grasses on both sides

Graph showing observed, trend, seasonal, and residual data from 1990 to 2010 for outside and inside conditions.
Calicivirus kills off rabbits, which are more common on the outside, increasing grasses on the outside.
Conclusions
• The dead cover time series for the Fort grey area supports the observation of greater shrub cover on dunes inside the fence.
• The Hawker Gate area does not show the same patterns, perhaps due to the greater influence of rabbits and the impact of the calicivirus.

Problems
• Long term trends are difficult to observe due to short term responses to seasons, rainfall, fire and grazing pressure.
• The green fraction does not contain a very useful signal, as the seasonal compositing misses the quick growth after rain before the browning off.
• The dead fraction is composed of both shrubs and grasses, so it is not straightforward to compare the differences inside and outside the fence.

Future work
• Examine spatial variability in observed long term trends by sampling from smaller areas.
• Look at the swales, which may be simpler to understand as they lack shrubs.
• Compare Landsat fractional cover to field and drone measurements.