



THE UNIVERSITY  
OF ADELAIDE  
AUSTRALIA

# On the spatial characterisation of drought events

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# Drought in Australia

- There is extensive literature on drought in Australia.
- Drought is influenced significantly by climatological factors.
- The climate appears to be changing for the worse.
- Australia requires a concise, quantitative definition of drought.



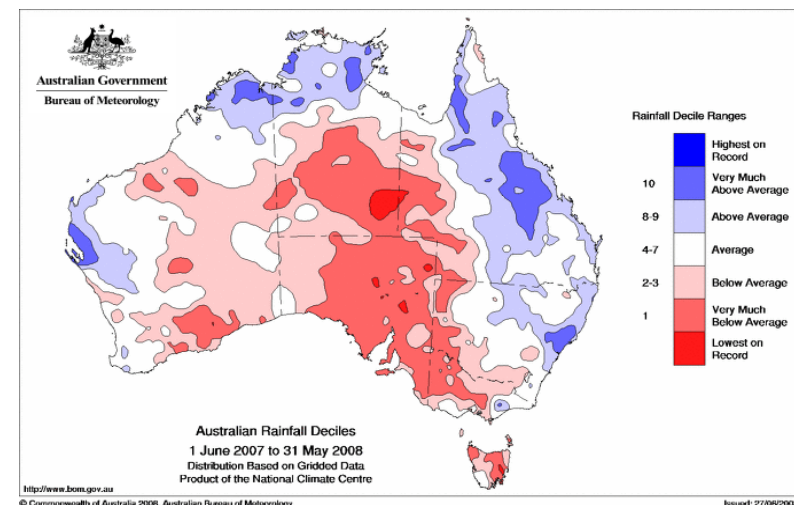


# Defining Drought in Australia

- Declaration of drought responsibility of State Governments.
- Use information provided by the Australian BoM regarding rainfall classification.
- Drought seems to be decided on a case by case basis.
- Recent developments include:
  - Setting up NAMS;
  - Work done by respective State Governments.

# Quantifying Drought

- Appreciates the significance of multi-scale rainfall deficits.
- Lacking appropriate quantitative nature.
- Lack of information regarding the spatial aspect of drought.
  - New research direction.
  - Bridge the gap between drought science and policy.





# Giving a Spatial Context to Drought

## Drought Severity-Area-Frequency curves

- Uses variously aggregated rainfall totals;
- Highlight relationship between severity and areal extent.

## Drought Perimeter-Area ratio

- Adds contiguity aspect to spatial drought studies.

## Correction for spatial correlation

- Highlights droughts in statistically significant regions.



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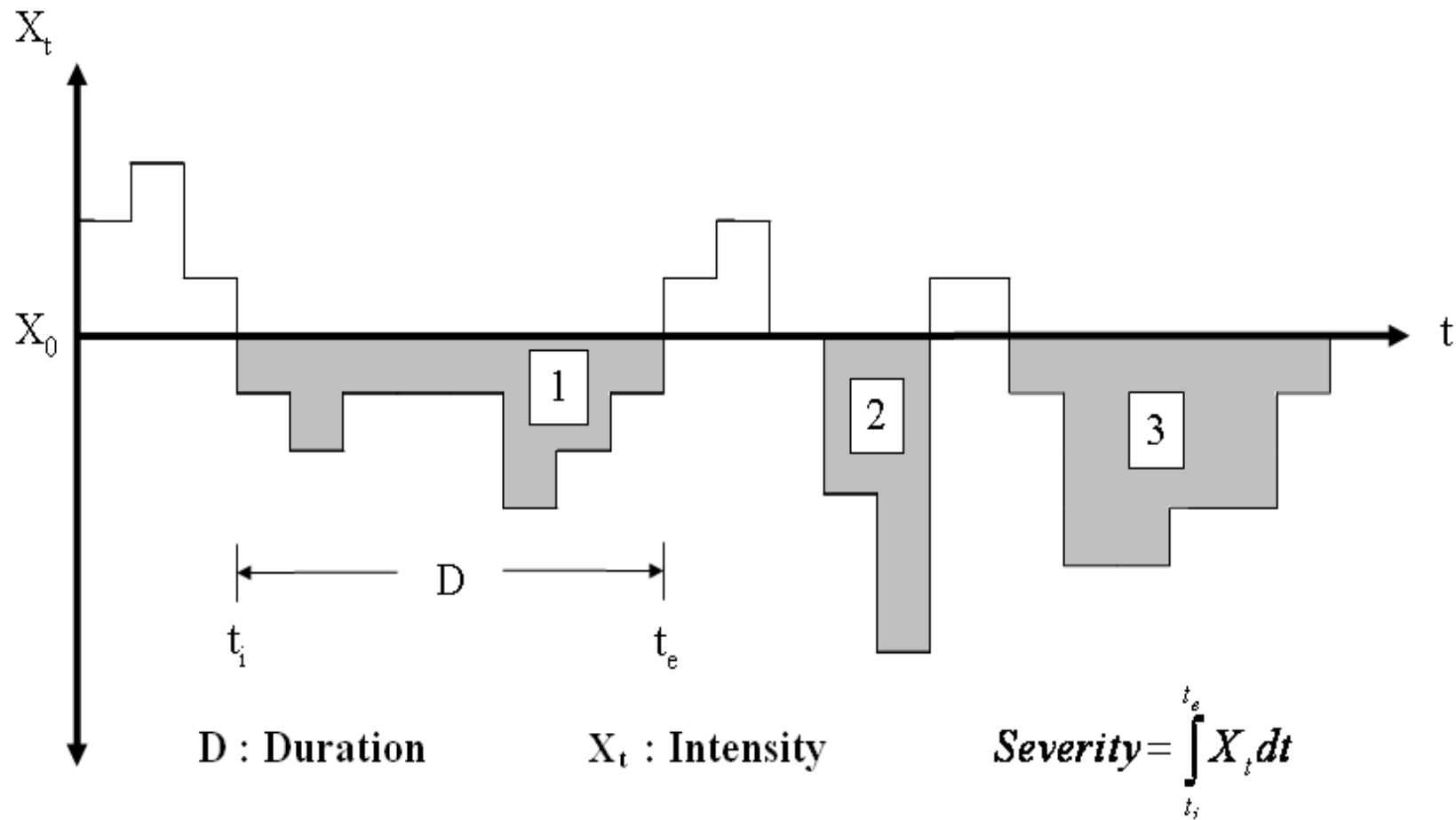
## Drought Perimeter-Area ratio

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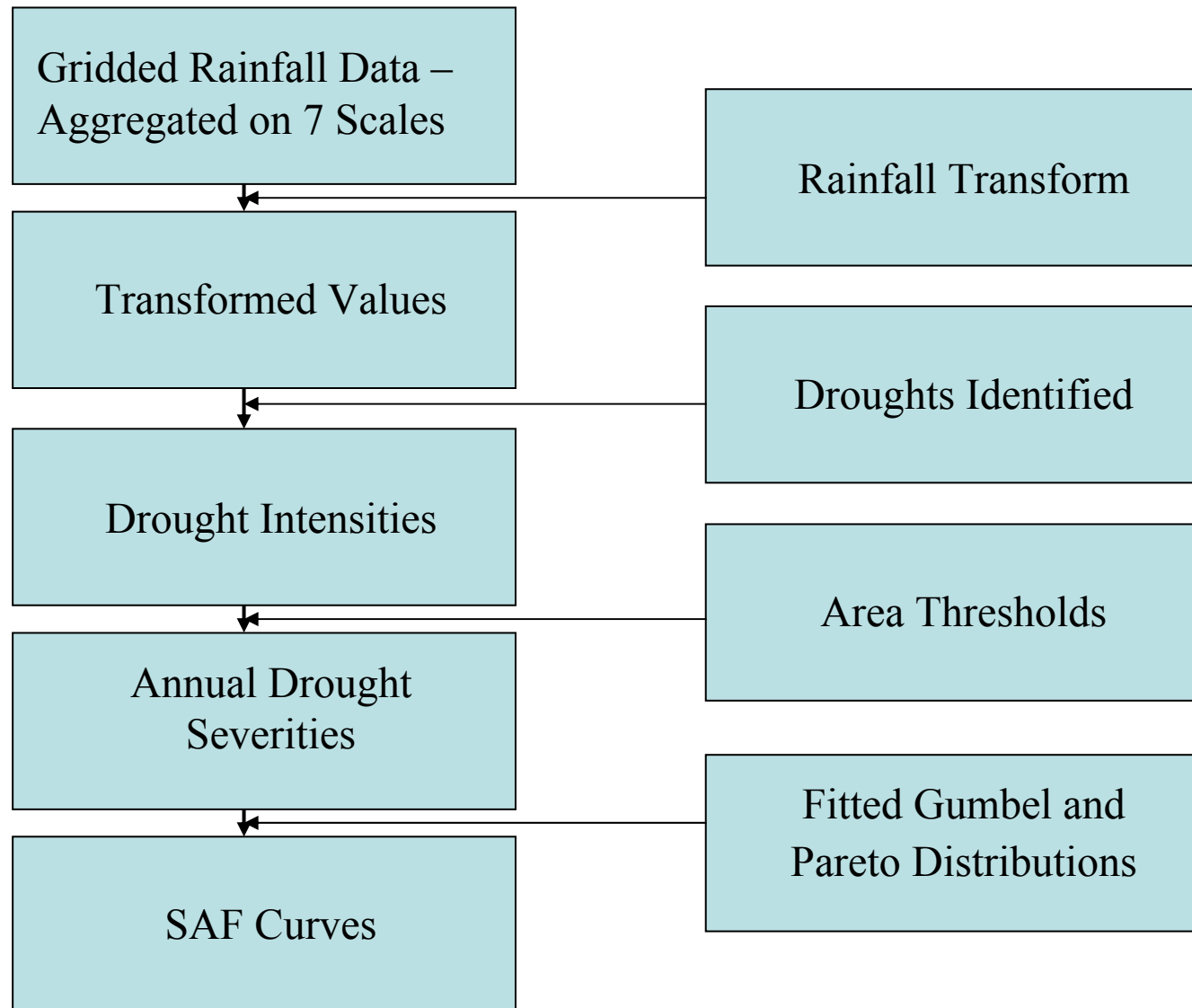
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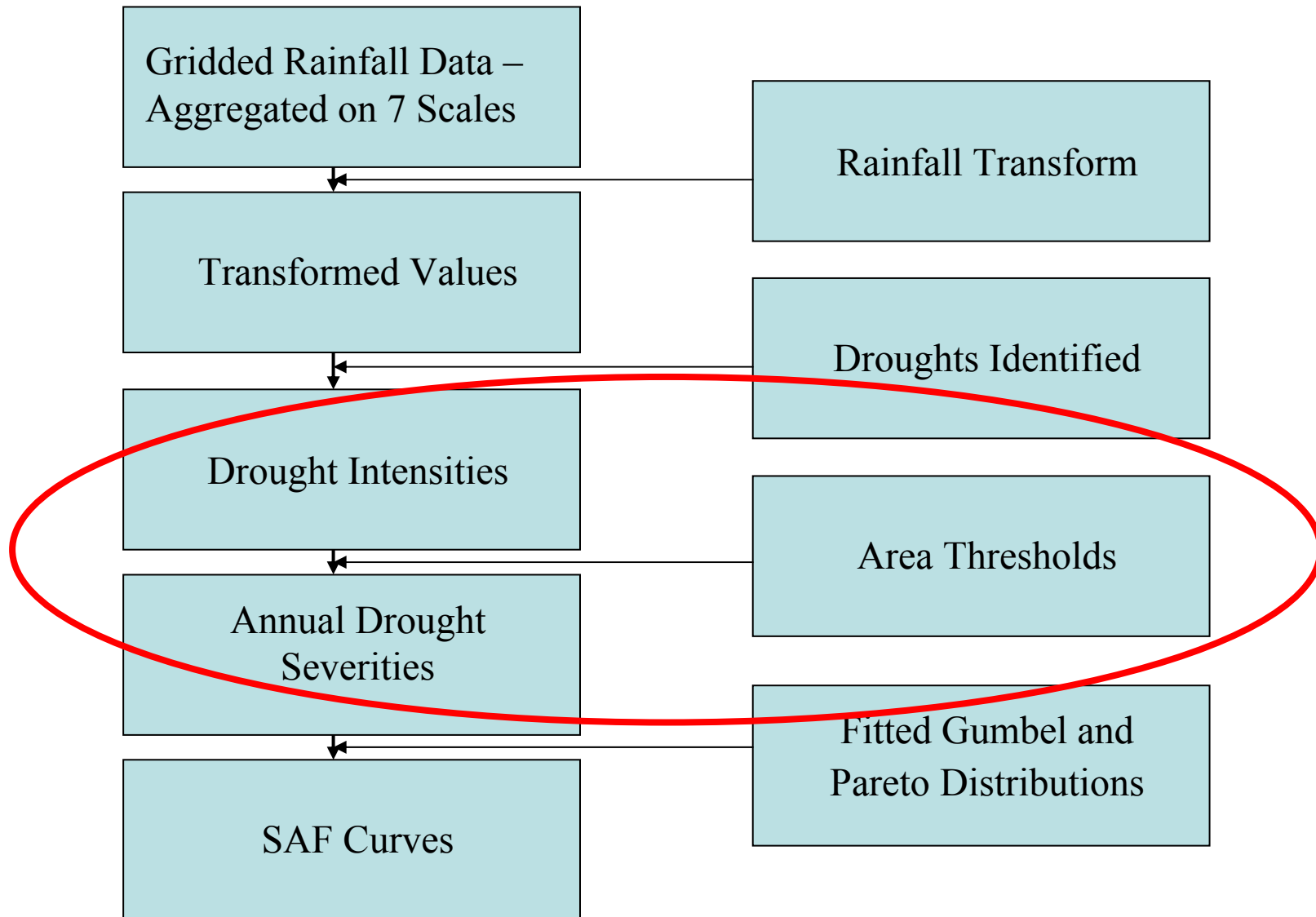
# Defining Drought – Run Theory



# Drought SAF Curves



# Drought SAF Curves



# Drought SAF Curves

Month	Average Intensity	Percentage of Area Affected (%)
1	10	1.5
2	5	22
3	0	0
4	10	47
5	5	68
6	0	0
7	0	0
8	5	19
9	5	7
10	5	91
11	10	73
12	0	0

Threshold 1%

No. Months 8

Severity 55

Calculated for 1, 2, 3, 6, 9, 12 and 24 month aggregated rainfall

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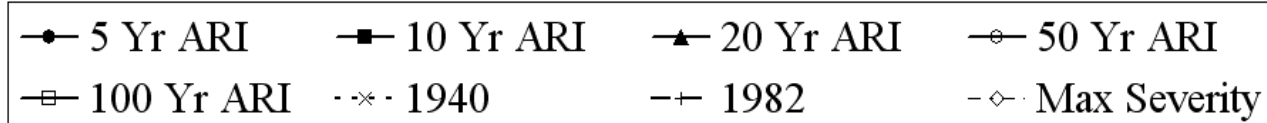
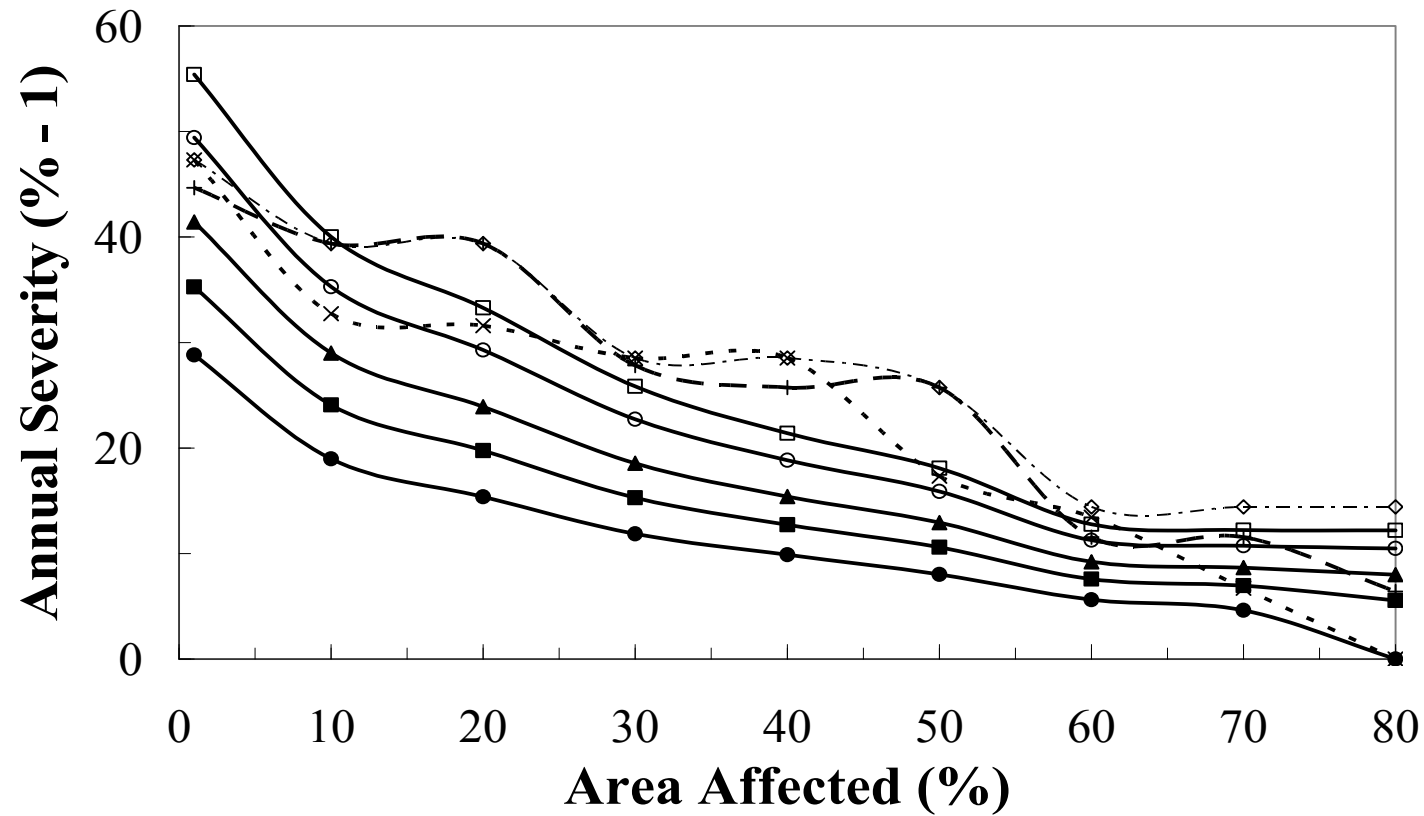
Threshold 60%

No. Months 3

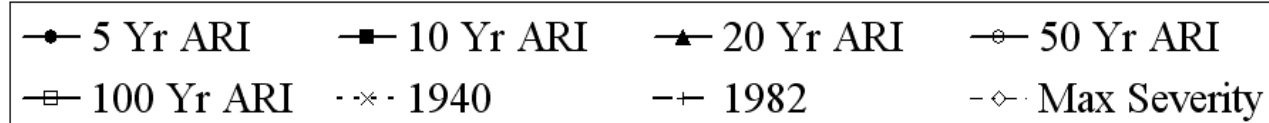
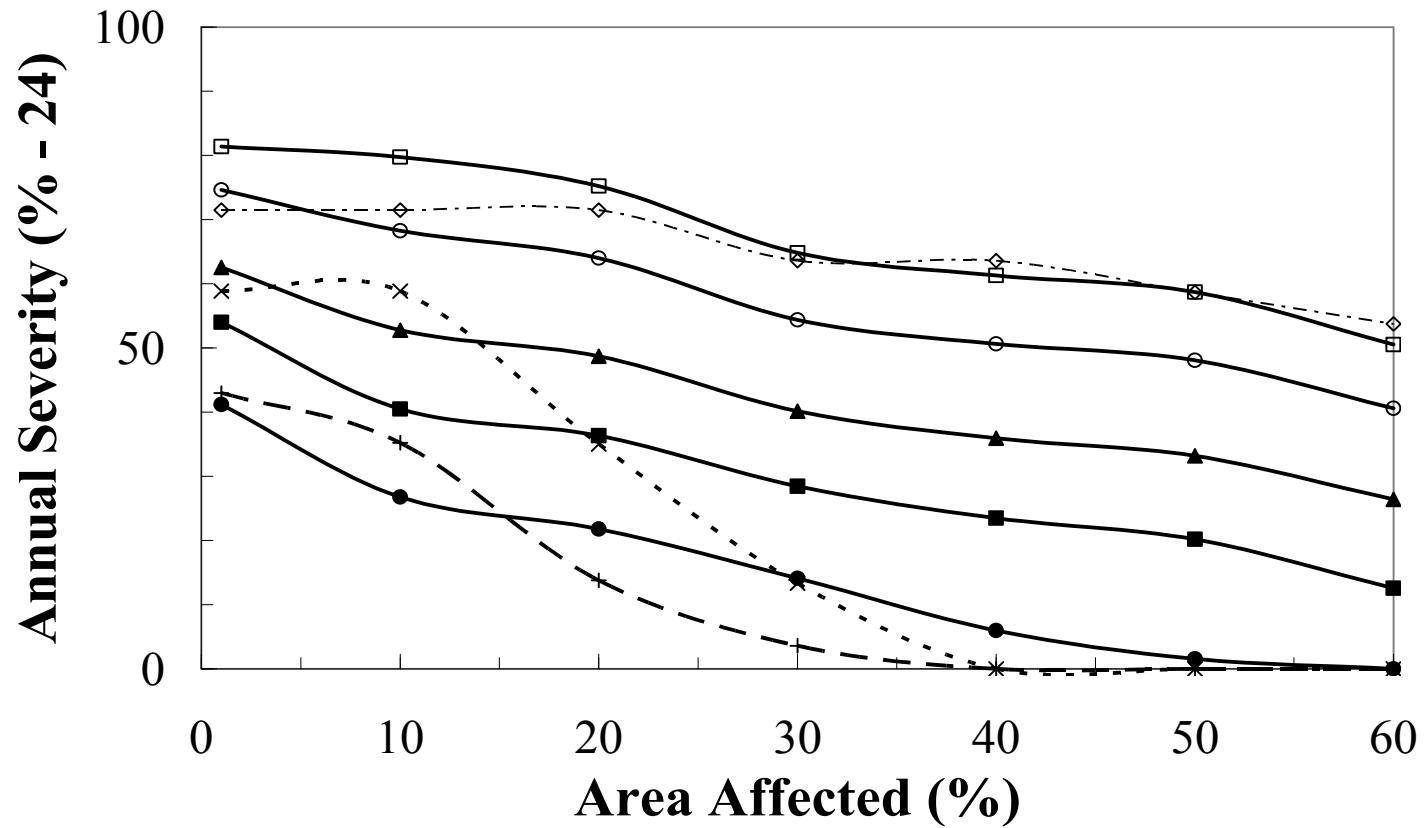
Severity 20

Calculated for 1, 2, 3, 6, 9, 12 and 24 month aggregated rainfall

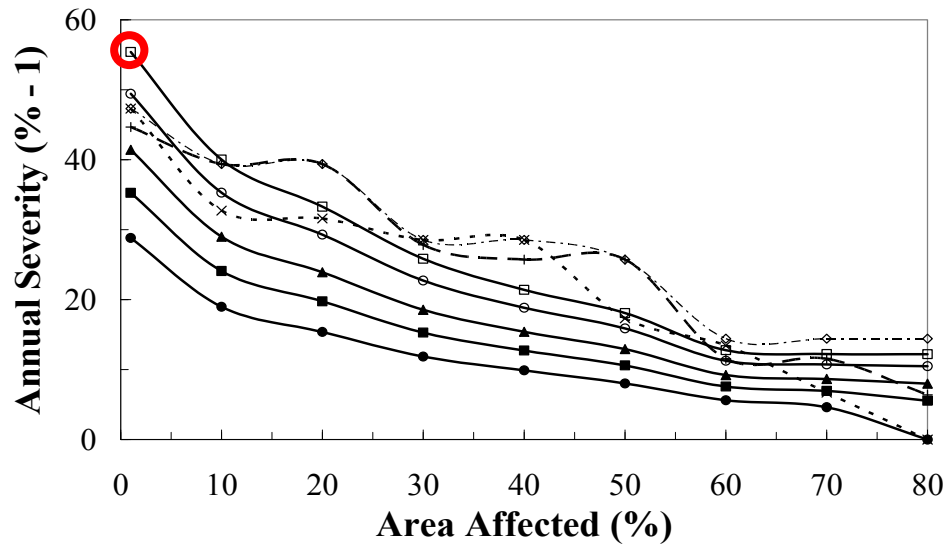
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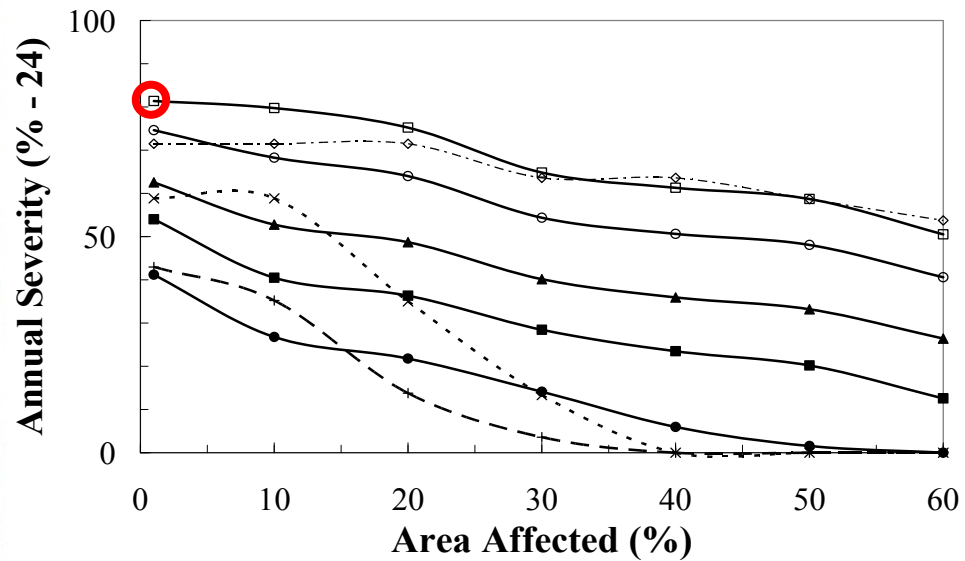
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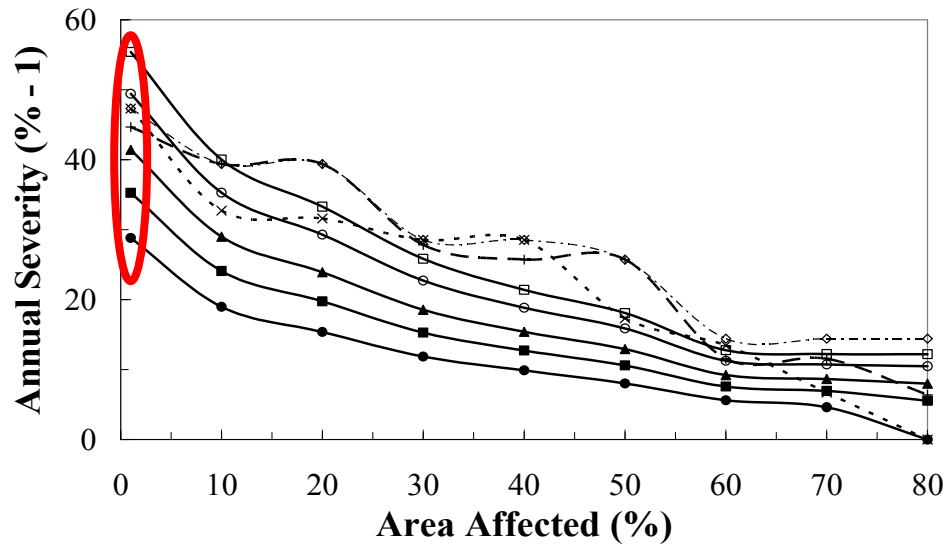


Max severity = 58



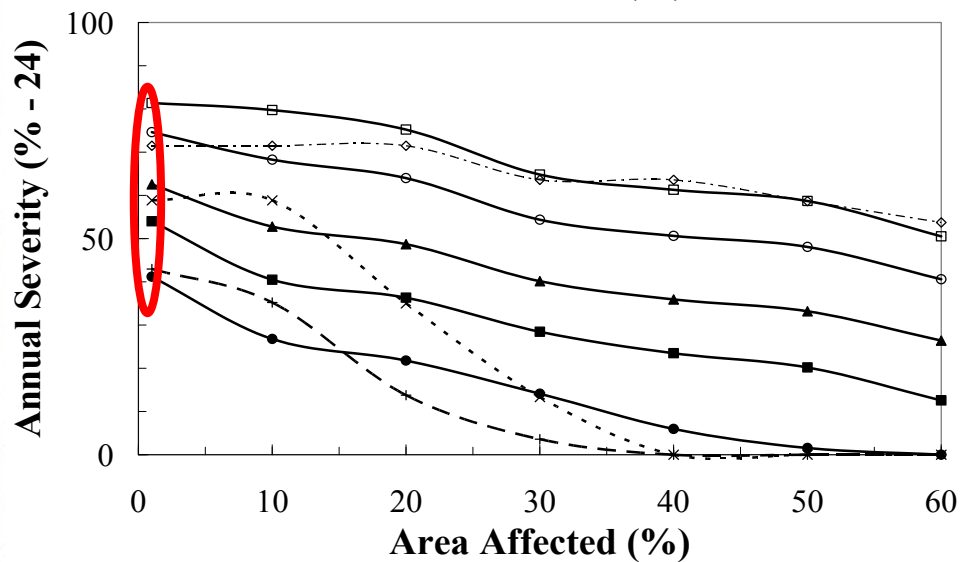
Max severity = 80

# Drought SAF Curves



Max severity = 58

Severity range = 30



Max severity = 80

Severity range = 40



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## Drought Perimeter-Area ratio

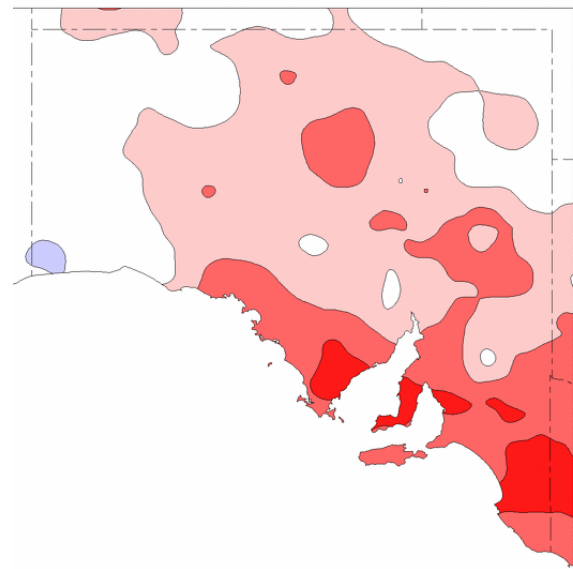
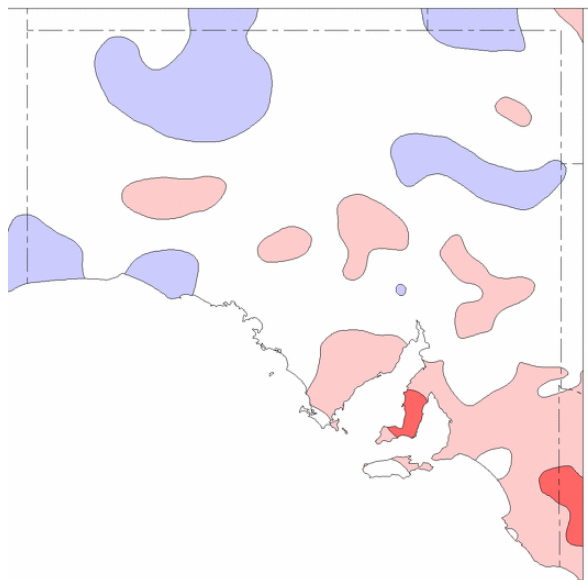
- Adds contiguity aspect to spatial drought studies.

## Correction for spatial correlation

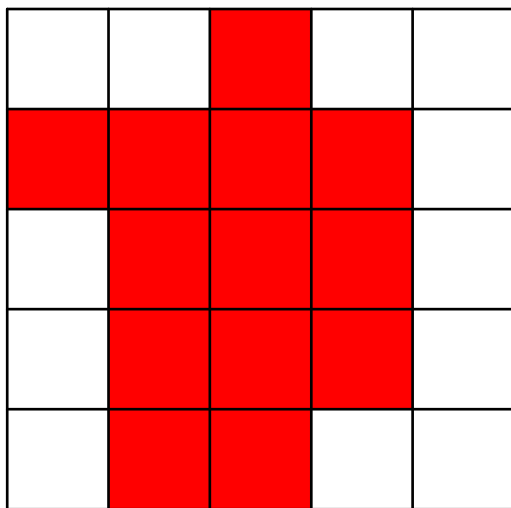
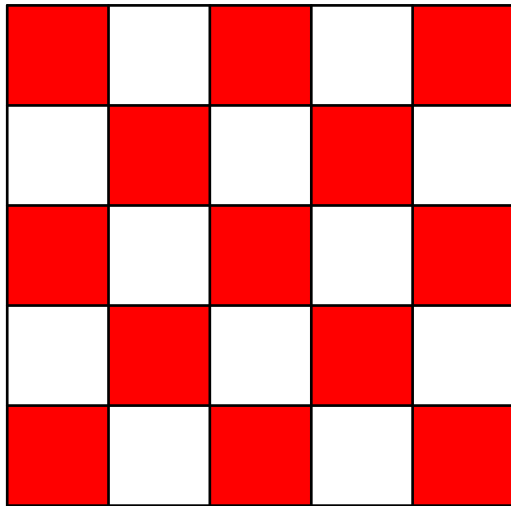
- Highlights droughts in statistically significant regions.

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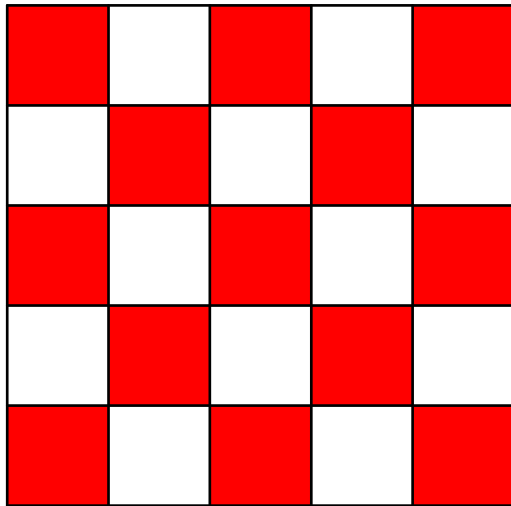
- Further addresses the need for a drought statistic.
- Measures the “patchiness” of droughts.
- Still in the developmental stage.
  - Case study for all Australia and MDB conducted.



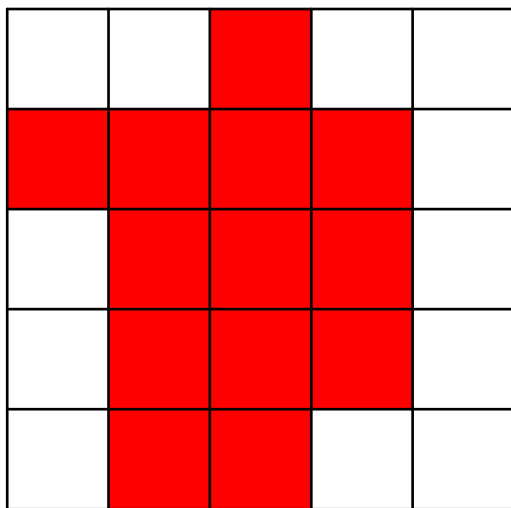
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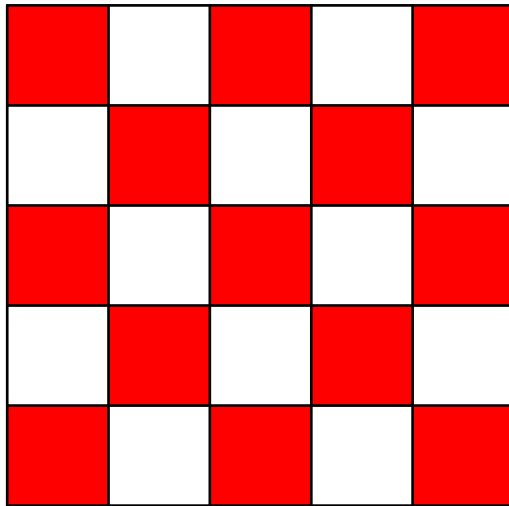


Area = 13 pixels



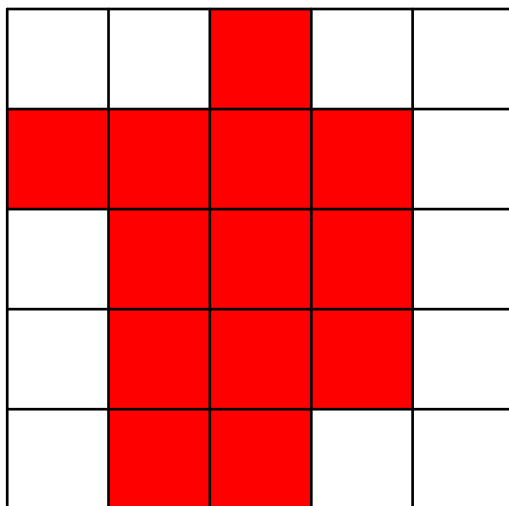
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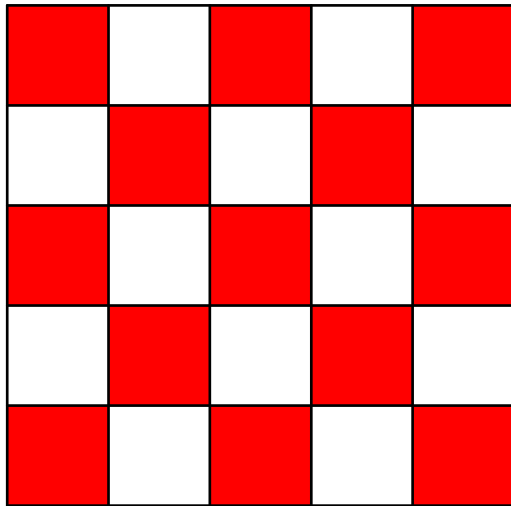
Perimeter = 52 pixel edges



Area = 13 pixels

Perimeter = 18 pixel edges

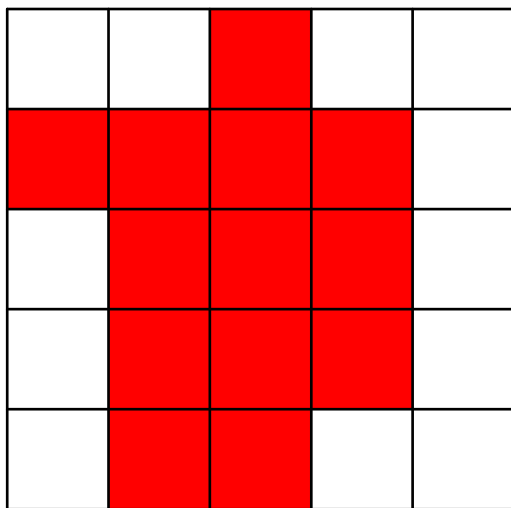
# Drought Perimeter-Area Ratio



Area = 13 pixels

Perimeter = 52 pixel edges

P/A = 4

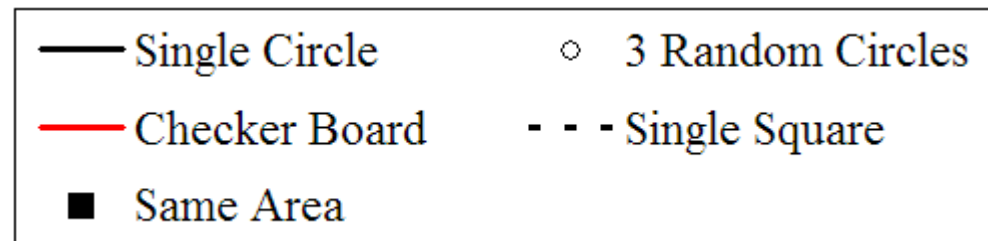
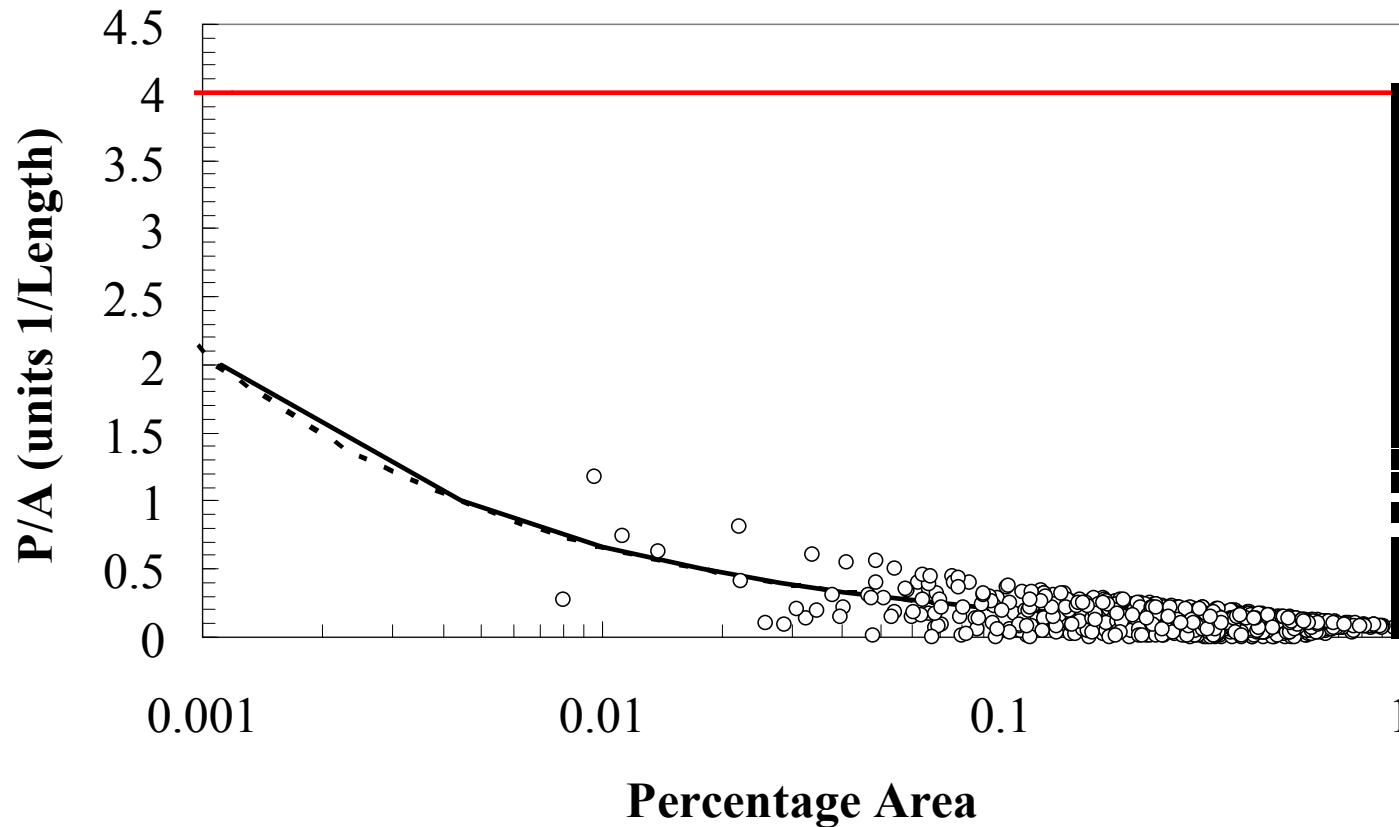


Area = 13 pixels

Perimeter = 18 pixel edges

P/A = 1.38

# Drought Perimeter-Area Ratio





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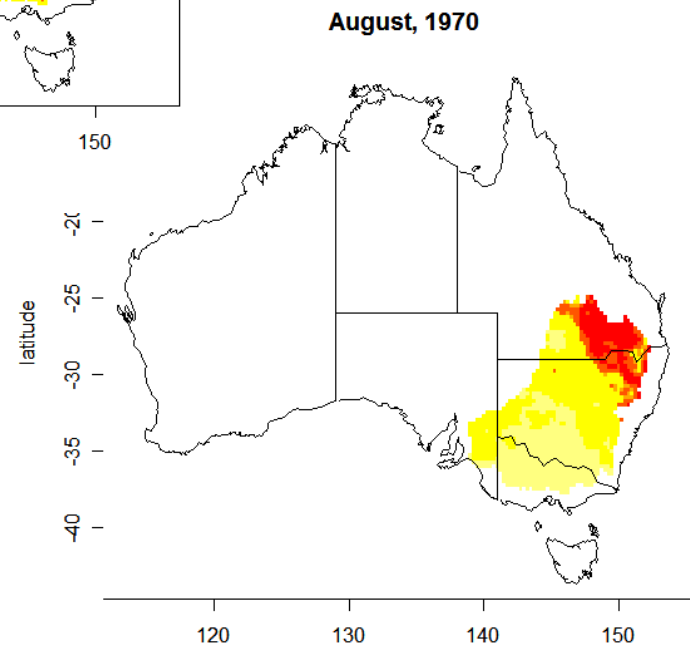
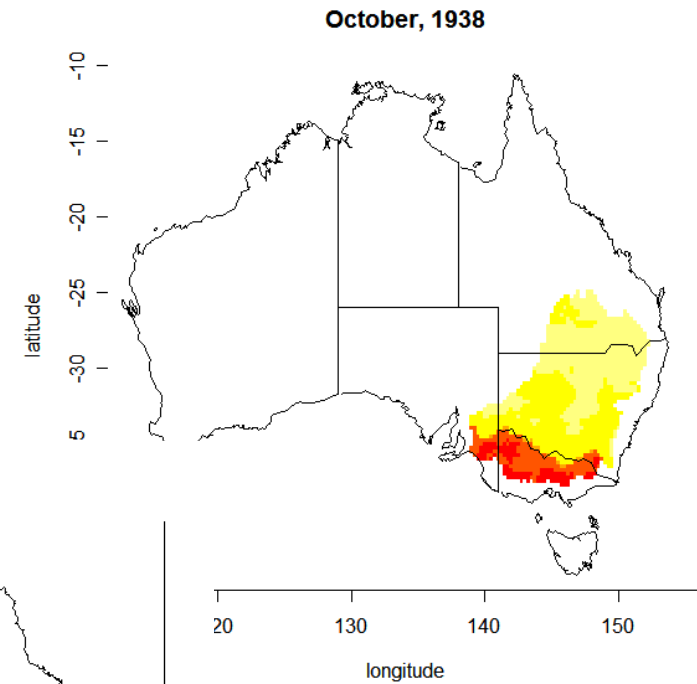
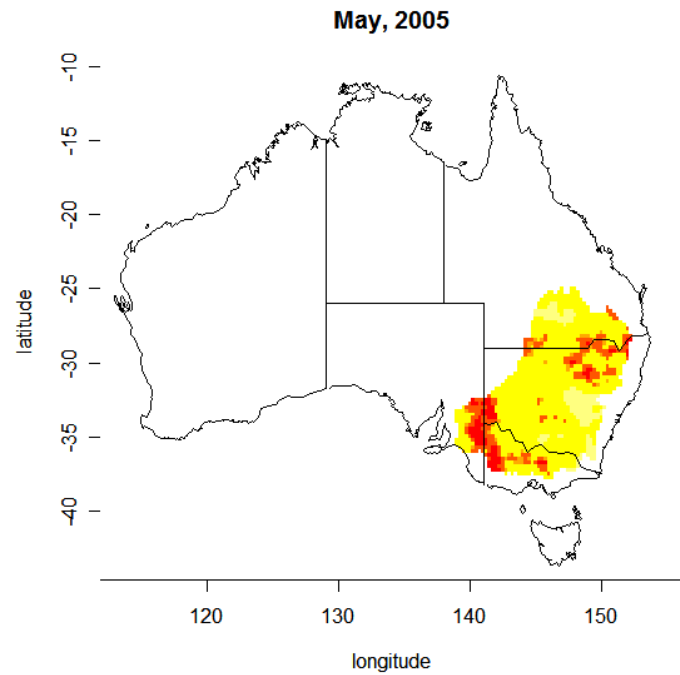
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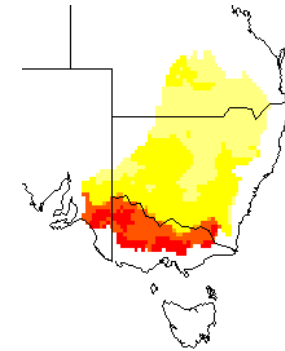
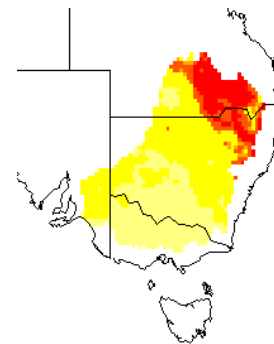
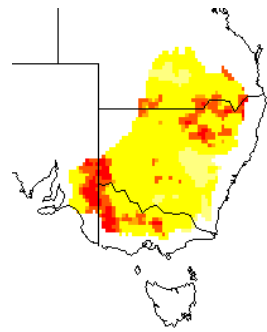
# Correction for Spatial Correlation

- The significance of a drought is related to where it occurs.
- Droughts in highly spatially correlated areas are less significant than droughts in uncorrelated areas.
  - Like areas are expected to behave as one.
- Can be incorporated by considering uncorrelated total area.
- Different regions of field can be assigned different weights.
- In this paper, average observed correlation used to distinguish otherwise similar droughts.
- Still in developmental phase.

# Using the Diagnostic Tools

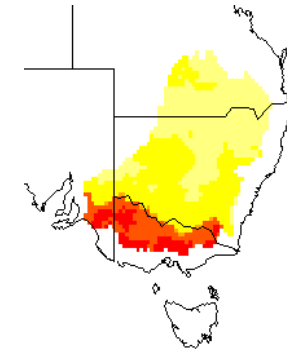
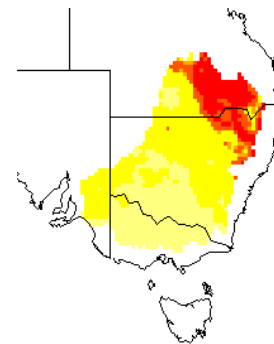
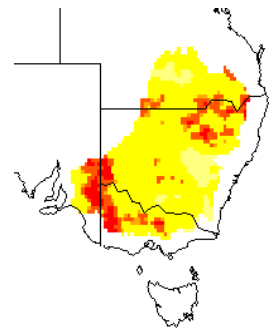


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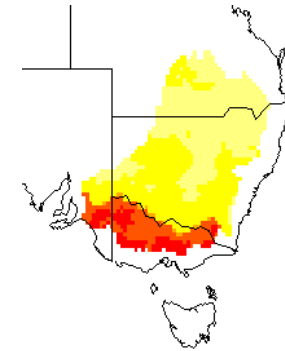
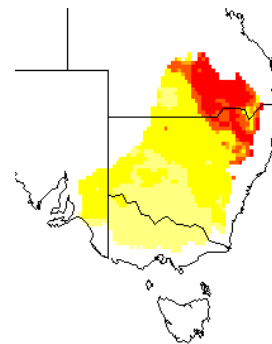
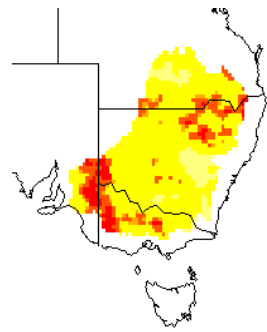
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Area (pixels)	29901	31110	29700
Area (%)	18.31	19.05	18.19

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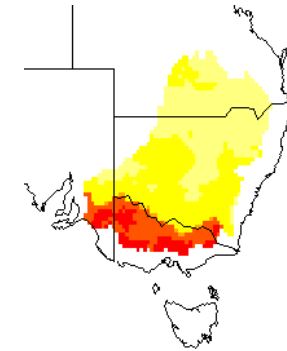
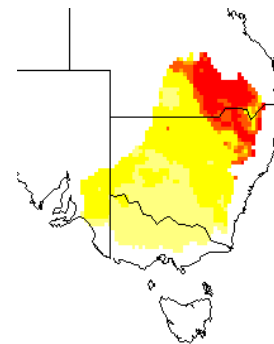
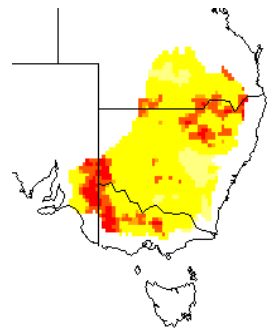
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SAF ARI	55	60	70
P/A	1.14	0.583	0.522
Correlation	0.349	0.763	0.701

# Summary

- Three statistical tools presented for drought characterisation;
- These tools are able to distinguish between different types of drought;
- Tools are designed to be used in conjunction with each another;
- Toolkit can be used to quantify droughts as they occur;
- Or be used to inform a drought preparedness plan;
- This work is a small part of an ongoing focus on drought including:
  - Spatial characterisation of drought through different stats;
  - Use of climate information to better inform models; and
  - Use large scale forecasts to give meaning at a local level.

