Invert endemism analysis summary

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Scope:

Investigate the area the 2019/20 black summer wildfires burnt regions of high invertebrate endemism.

Datasets:

Notes from Payal Bal

- GEEBAM fire severity: layer that has been reprojected to 250m. sq at Albers equal area and extent to cover islands and offland territories, then clipped to NVIS native vegetation and finally clipped to the Preliminary Analysis Area. Severity classes were then reclassified so high (4) and very high (5) were combined.
- Species presence data: Unique species field = **spfile**. Please note that this is the field to be used for unique species identification. The number of unique species by scientificName will be less because there are duplicates. Spfile instead indicates unique IDs by each scientificName-class-family combination. The data in WGS84 and was masked using 1km resolution WGS84 mask to Australia.

Total species:

```
length(unique(invert.point$spfile))
```

```
## [1] 45529
```

- Species distribution data: polygons created where > 3 records for species above. Total species:

```
length(species_polys)
```

```
## [1] 22754
```

- Preliminary Analysis Area: analysis area from DAWE.
- Github repro for this project: invert_endemism

Calculation of endemism

The `phyloregion 1.0.4` package was used to calculate the weighted endemism (species richness inversely weighted by species ranges). Point data (presences only) and species distribution data (polygons) were converted to composition data by calculating the species composition per 0.5 degree cell size across Australia. The abundance and species richness was also calculated per grid cell. To correct for different survey effort across Australia for invertebrates, the corrected weighted endemism index was calculated by:

weighted endemism per cell/ species richness of that cell

See: Crisp et al. 2001: J. Biogeography

Calculate area burnt

To calculate the area burnt across increasing rates of invertebrate endemism, the corrected weighted endemism index above was categorised into percentiles (0-20%, 20-40%, 40-60%, 60-80%, 80-100%), with 80-100% representing the highest and 0-20% representing the lowest endemism. The fire severity classes were then extracted from each 0.5 degree cell that contained an endemism percentile and area calculated using the `exactextractr 0.6.1` package.

All data was re-projected to Albers equal area and clipped to the Preliminary Analysis Area.

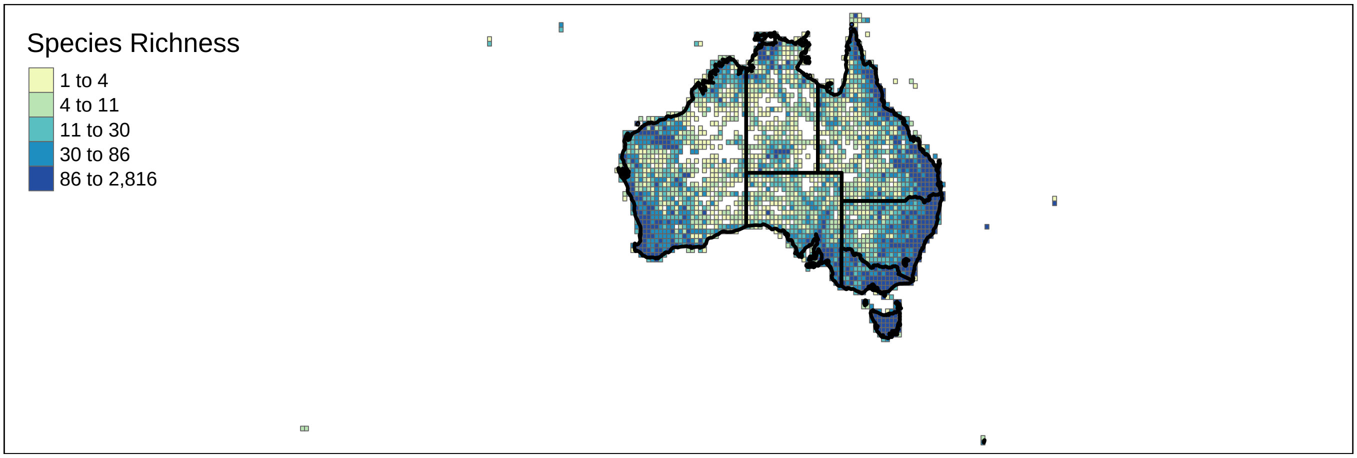
Results

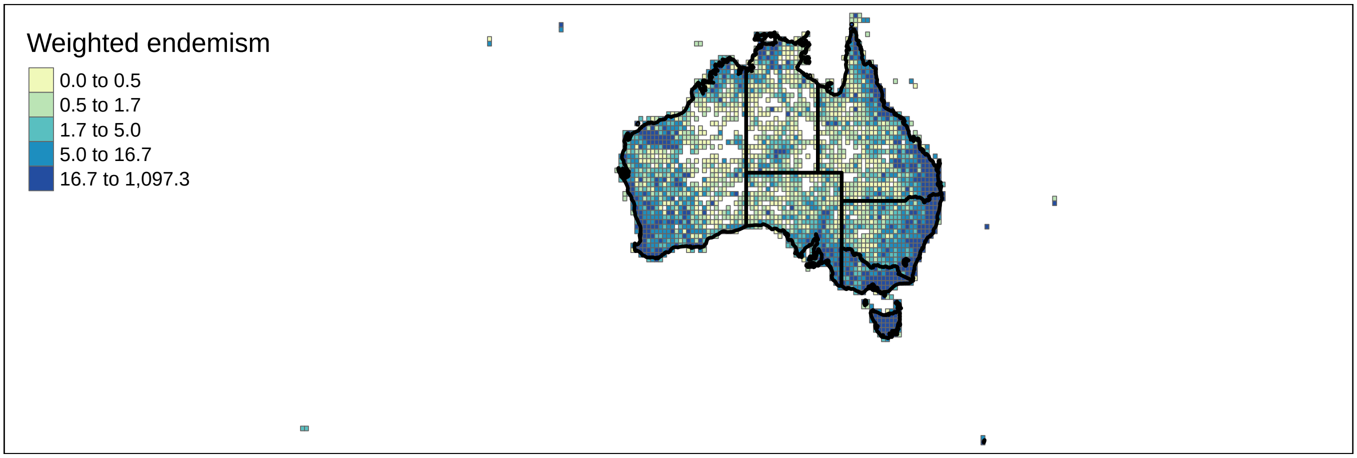
Endemism: Point data

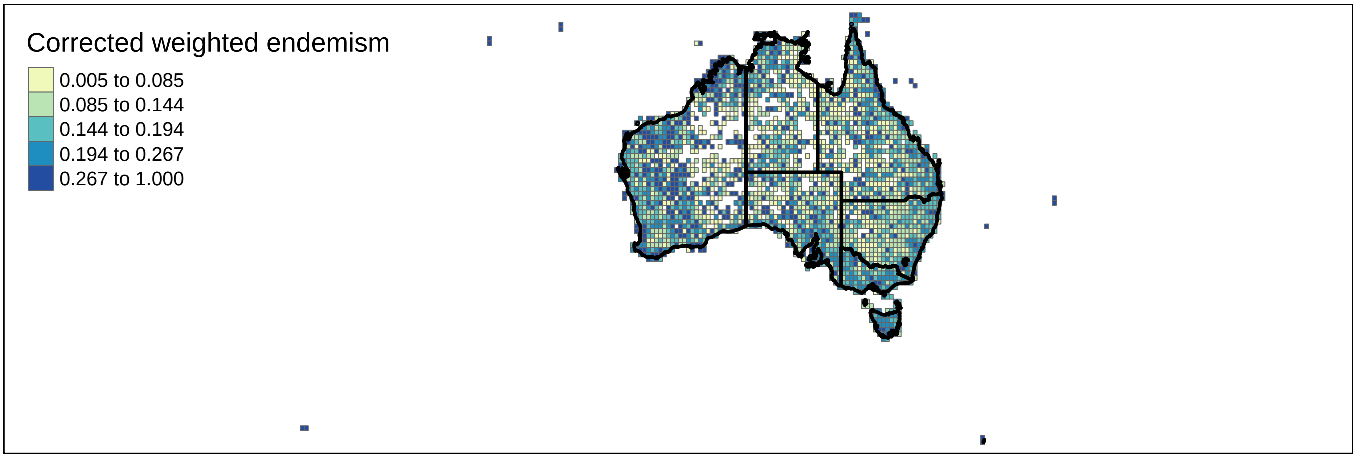
Note break points for visialisation are based on quantiles.

```
point.maps
```

```
## Linking to GEOS 3.8.0, GDAL 3.0.4, PROJ 6.3.1
```

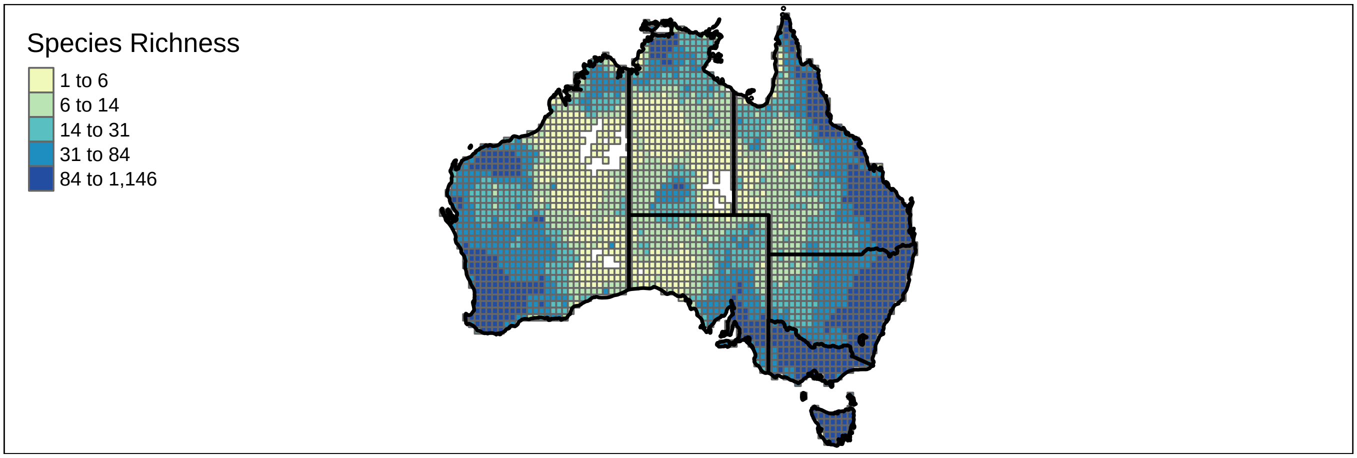


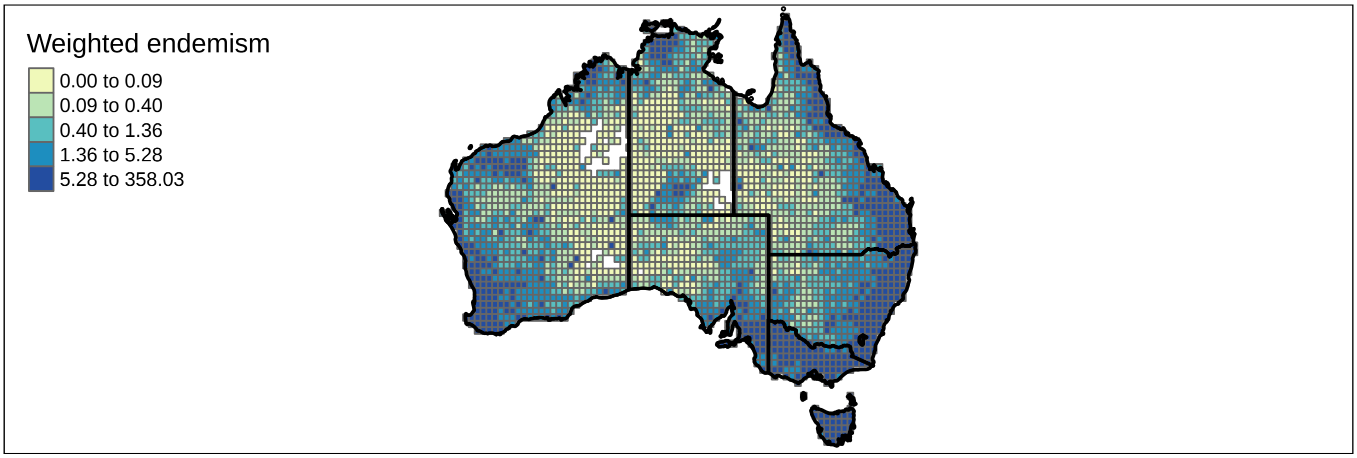


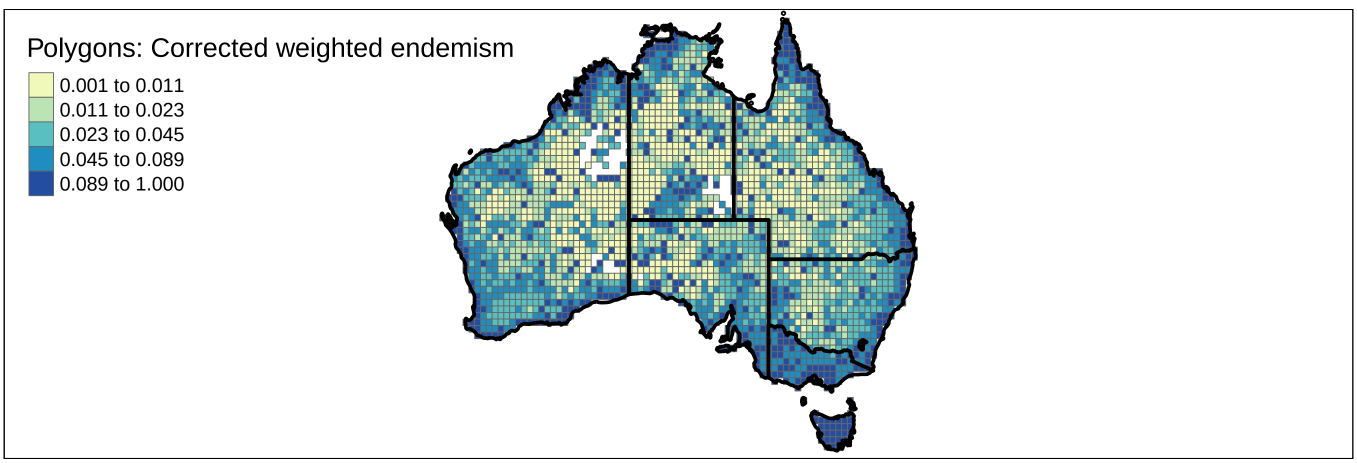


Endemism: Distribtion data

```
maps.poly
```







Moran's I test To determine if patterns of endemism were randomly distributed across Australia or showed patterns of spatial autocorrelation, the Moran's I test was calculated using the spdep 1.1-5 (Roger et al. 2013). Spatial autocorrelation was calculated as a function of distance from the neighbouring polygon centres for each cell, with a search radius within 200 km. P-values were calculated using a Monte Carlo Test using 10,000 permutations (Roger et al. 2013). If corrected weighted endemism showed significant autocorrelation, it was assumed that patterns of invertebrate endemism were not randomly distributed and clustered into hotspots (Crisp et al. 2001).

```
MI
```

```
##
##  Monte-Carlo simulation of Moran I
##
## data:  m1$corrected_endemism
```

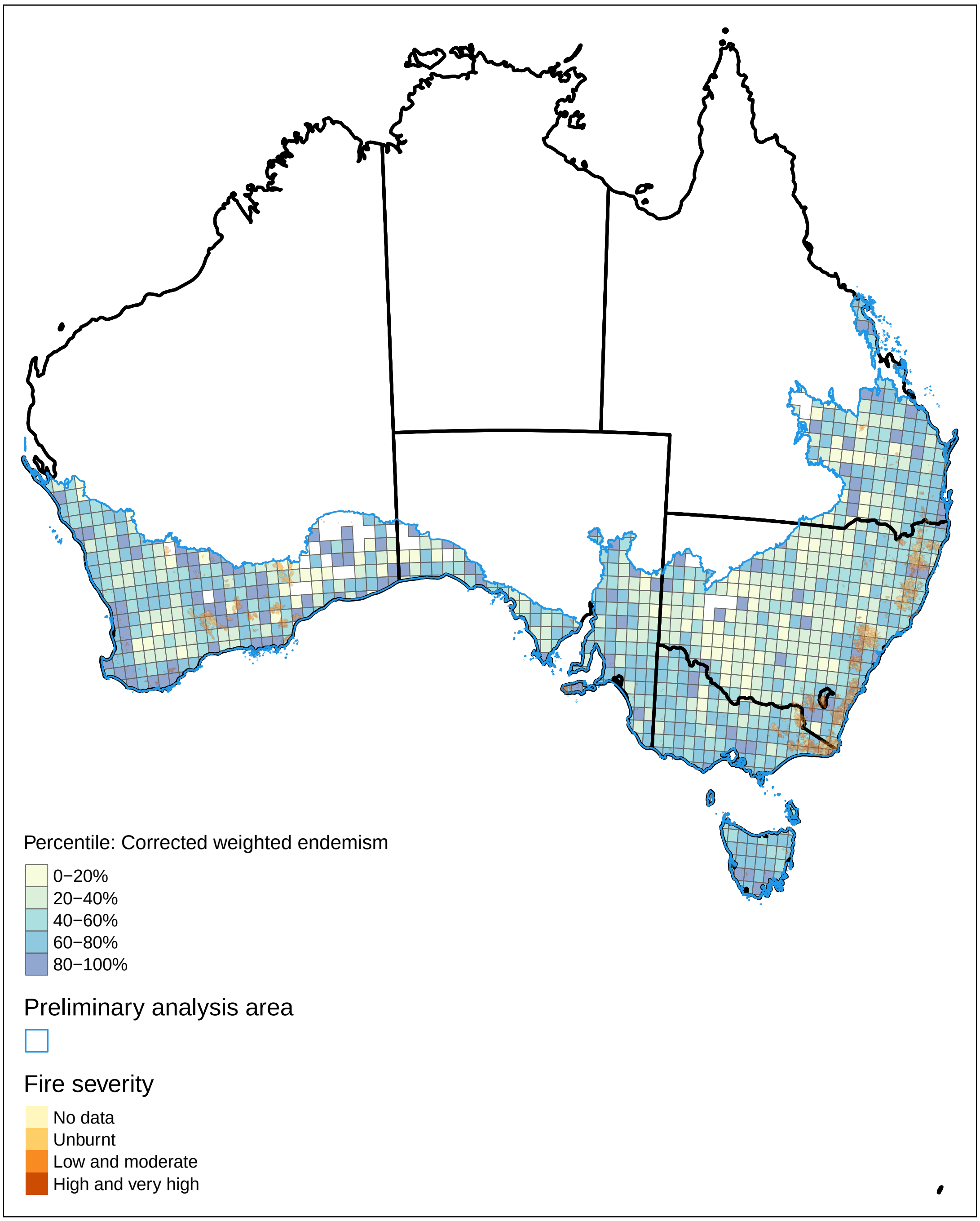
```
## weights: lw
## number of simulations + 1: 10000
##
## statistic = -0.00038197, observed rank = 9996, p-value = 4e-04
## alternative hypothesis: greater
```

Endemism: Area burnt

Note this has only been done for point data at 1 degree scale (so far).

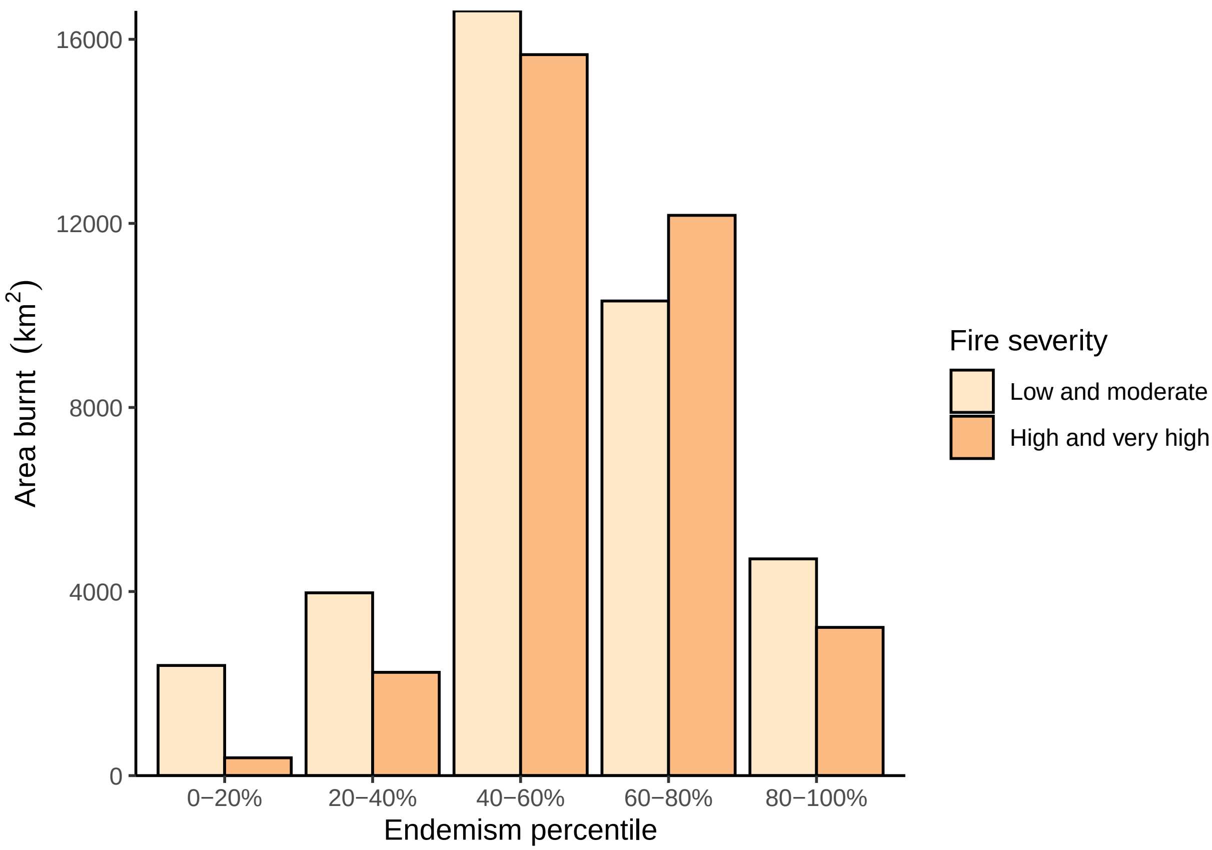
```
input.map
```

```
## stars_proxy object shown at 1417 by 706 cells.
```



Datasets used to calculate the area burnt for each endemism category.

```
burnt.endemism.area.plot
```



Area burnt within each fire severity class for each endemism category/quantile.

```
## `mutate_if()` ignored the following grouping variables:
## Column `corrected_endemism_quantile`
```

Table 1: The area burnt (km^2) from the 2019/20 Black Summer wildfires for each endemism class and fire severity. Endemism class calculated from percentiles of the corrected weighted endemism (0-20%,20-40%, 40-60%,60-80%, 80-100%; from lowest to highest rates of endemism)

corrected_endemism_quantile	fire.severity	burnt.area.km	percent
0-20%	No data	2.91	0.00
0-20%	Unburnt	239358.77	98.85
0-20%	Low and moderate	2393.54	0.99
0-20%	High and very high	387.30	0.16
20-40%	No data	125.29	0.02
20-40%	Unburnt	515095.69	98.78
20-40%	Low and moderate	3972.40	0.76
20-40%	High and very high	2244.28	0.43
40-60%	No data	335.33	0.06
40-60%	Unburnt	520751.47	94.11
40-60%	Low and moderate	16618.37	3.00
40-60%	High and very high	15667.26	2.83
60-80%	No data	378.36	0.07
60-80%	Unburnt	533023.84	95.89

corrected_endemism_quantile	fire.severity	burnt.area.km	percent
60-80%	Low and moderate	10314.06	1.86
60-80%	High and very high	12174.91	2.19
80-100%	No data	61.54	0.02
80-100%	Unburnt	265217.68	97.07
80-100%	Low and moderate	4709.85	1.72
80-100%	High and very high	3220.84	1.18