## Recipe for Citizen Science reveals meteorological determinants of frog calling at a continental scale -

## Bring together frog call data

* Download FrogID data

https://www.frogid.net.au/explore

### Check for outliers in the frog ID script and have them reviewed by an expert

(check\_frogID\_clean\_data\_for\_outliers.R)

update the clean\_data if temporally odd records turn out to be misidentified

### Assign frog ID data to grids

(assign\_frogid\_reccords\_to\_grids.R)

Prereq: raw\_frogid\_data.csv

Output: FrogID\_griddata.csv

### Use the frogid\_griddata output file as the input to find in range observations

(subset\_data\_to\_in\_range\_obs.R)

Prereq: Data/clean\_frogid\_data\_with\_grids/FrogID\_griddata.csv

Output: Data/clean\_frogid\_data\_with\_grids/in\_range\_observations.csv

### Use the output from that as the input for suncalc to assign sun and moon cycle information to each grid (script\_to\_run\_suncalc\_and\_mooncalc\_data.R)

Prereq: Data/clean\_frogid\_data\_with\_grids/in\_range\_observations.csv

Output: Data/clean\_frogid\_data\_with\_grids/in\_range\_observations\_with\_moon\_sun.csv

## Download BOM data (Separate, can be before or after frog data)

Rainfall <http://www.bom.gov.au/jsp/awap/rain/archive.jsp?colour=colour&map=totals&period=daily&area=nat>  
Mean Maximum and Minimum Temperature <http://www.bom.gov.au/jsp/awap/temp/archive.jsp?colour=colour&map=maxave&period=daily&area=nat>

9 am Vapour Pressure  
[http://www.bom.gov.au/jsp/awap/vprp/archive.jsp?colour=colour&map=vprph09&period=daily&area=nat](https://aus01.safelinks.protection.outlook.com/?url=https%3A%2F%2Furldefense.proofpoint.com%2Fv2%2Furl%3Fu%3Dhttp-3A__www.bom.gov.au_jsp_awap_vprp_archive.jsp-3Fcolour-3Dcolour-26map-3Dvprph09-26period-3Ddaily-26area-3Dnat%26d%3DDwQGaQ%26c%3DUDk80sNTkE1d7izd_F57bQ%26r%3D3pvcn8xLmf-GVBps2JNwP6N5CTdoDidRrJe-kOqcdFA%26m%3DnZ1BpgzD0pQT0N6uffdefVNVsqQL1swR903MPiapW2c%26s%3D6NkmHQLiYRtX8CwBfmap50K4cPMfdcyN6UJ_wU3JtsM%26e%3D&data=02%7C01%7Cmaureen.thompson%40austmus.gov.au%7Cd003f1eb2aec412d86f208d7cf827636%7C6ee75868f5d64c8cb4cda3ddce30cfd6%7C0%7C0%7C637206031569860804&sdata=OErzMSG3gbFjrMRNqN6avDIuR30W%2FSd7luZui1ki8lM%3D&reserved=0)

### Clean Climate Zone shapefile

(cleaning\_climate\_zone\_shapefile.R)

Prereq: Data/spatial\_data/climate\_zones/climate\_zones.shp

Output: Data/spatial\_data/climate\_zones/climate\_zones\_clean.shp

### Name Format weather data

Unzips, renames, and changes file format of BOM data downloads

Prereq: Data/new weather data\* (temp\*)

Output: Data/ min\_temp\_data/…, Data/max\_temp data/…, Data/min\_temp\_data/…, Data/rainfall\_data/…, Data/9am\_vapour\_pressure/…

### Convert\_ASCII\_to\_sf\_RDS\_files – converts data from BOM format to a useful one

(convert\_ASCII\_environmental\_data\_to\_sf.R)

Prereq: Data/max temp data/… et al/

Output: Data/max temp data\_sf\_RDS/… et al

Prereq: Data/min temp data/…

Output: Data/mintemp data\_sf\_RDS/…

Prereq: Data/rainfall data/…

Output: Data/rainfall data\_sf\_RDS/…

Prereq: Data/9am vapour pressure data/…

Output: Data/9am\_vapour pressure data\_sf\_RDS/…

### Add columns that create a mean of ten days worth of data to min\_temp\_data and max\_temp\_data files

(10\_day\_max\_and\_min\_temp\_for\_BRT.R)

Prereq: Data/RDS outs/max\_temp\_data\_summarized.RDS

Data/RDS outs/min\_temp\_data\_summarized.RDS

Output: Data/chunked\_results/max\_temp/….RDS (chunks 1 through 8)

Data/chunked\_results/min\_temp/….RDS (chunks 1 through 8)

### Add columns that tally previous days rainfall to rainfall summary file

(get\_cumulative\_rainfall\_values.R)

Prereq: Data/RDS outs/rainfall\_data\_summarized.RDS

Output: Data/RDS outs/rainfall\_data\_cumulative.RDS

### Rejoin weather data that ran in batches, because it’s too big.

(rejoin weather RDS out\_BRT.R)

Prereq: Data/chunked\_results/max\_temp/….RDS (chunks 1 through 8)

Data/chunked\_results/min\_temp/….RDS (chunks 1 through 8)

Output: Data/RDS outs/max\_temp\_with\_10.RDS

Data/RDS outs/min\_temp\_with\_10.RDS

### Summarize environmental data to frog ID grids

(BOM girds need to be aggregated to FrogID grid size)

(summarize\_max\_temp\_data\_to\_frogid\_grids.R, summarize\_min\_temp\_data\_to\_frogid\_grids.R, summarize\_rain\_data\_to\_frogid\_grids.R, summarize\_vapour\_to\_frogid\_grids.R)

Prereq: Data/rainfall\_data\_sf\_RDS/…

Output: Data/RDS outs/rainfall\_data\_summarized.RDS

Prereq: Data/max temp data\_sf\_RDS/…

Output: Data/RDS outs/max\_temp\_data\_summarized.RDS

Prereq: Data/min temp data\_sf\_RDS/…

Output: Data/RDS outs/min\_temp\_data\_summarized.RDS

Prereq: Data/9am\_vapour\_pressure\_sf\_RDS/…

Output: Data/RDS outs/vapour\_data\_summarized.RDS

## -------Bring it all together-------

### Get presence of all species with species X’s range, to get presence/absence recordings

(get\_species\_model\_range\_dat.R)

Prereq: Data/clean\_frogid\_data\_with\_grids/in\_range\_observations\_with\_moon\_sun.csv

Output: Data/species\_range\_model\_data/", species\_name, ".RDS

### Bring all the data together to create model inputs on a species level

(BRT\_create\_mod\_data.R)

Prereqs: EVERYTHING listed above, plus ("R/global\_functions.R")

Outputs: Data/mod\_data/species\_name.RDS (100 files)

**\*provided in this repository, so you can start here**

* Create raw data jitter plots to visualize patterns/in appendix

(BRT\_jitterplots.R)

Prereqs: Data/species\_range\_model\_data/species\_name.RDS

Output: figures/BRT\_raw\_data\_plots/species\_name.PNG (100 files)

### Run boosted regression tree models for all 100 species

(BRT\_function\_annual\_all\_species.R)

Prereqs: Data/mod\_data/ species\_name.RDS (100 files)

Outputs: Data/BRT\_results/species\_name.RDS

Data/BRT\_results/interactions\_tables/species\_name.RDS

**\*provided in this repository**

Data/BRT\_results/pd/species\_name,.RDS

figures/BRT\_plots/species\_name.png

Data/BRT\_results/model\_summaries/species\_name.RDS

**\*provided in this repository**

* Create figure 2 and day species list

(BRT\_create\_violin\_plots\_and\_day\_species\_list.R)

Prereqs: Data/BRT\_results/species\_name.RDS(100 files)

Output: Data/BRT\_results/day\_species\_list.RDS

Figure 2

### Run boosted regression tree models for seasonal species

(BRT\_day\_only\_mod.R)

Prereqs: Data/BRT\_results/day\_species\_list.RDS

Data/mod\_data/ species\_name.RDS (100 files)

Outputs: Data/BRT\_day\_results/species\_name.RDS

**\*provided in this repository**

Data/BRT\_day\_results/interactions\_tables/species\_name.RDS

**\*provided in this repository**

Data/BRT\_results/pd/species\_name,.RDS

figures/BRT\_day\_plots/species\_name.png

Data/BRT\_day\_results/model\_summaries/species\_name.RDS

### Explore interaction effects among variables of annual all species model and create figure 3

(Interaction\_summary\_tables\_heatmap.R)

Prereqs: Data/BRT\_day\_results/interactions\_tables/species\_name.RDS

Output: Figure 3

### K means clustering of model results – to explore patterns among species and create Figure 4

(BRT\_ K\_means\_clustering.R)

Prereqs: "BRT\_model\_results/species\_name.RDS",

Output: Figure 4