

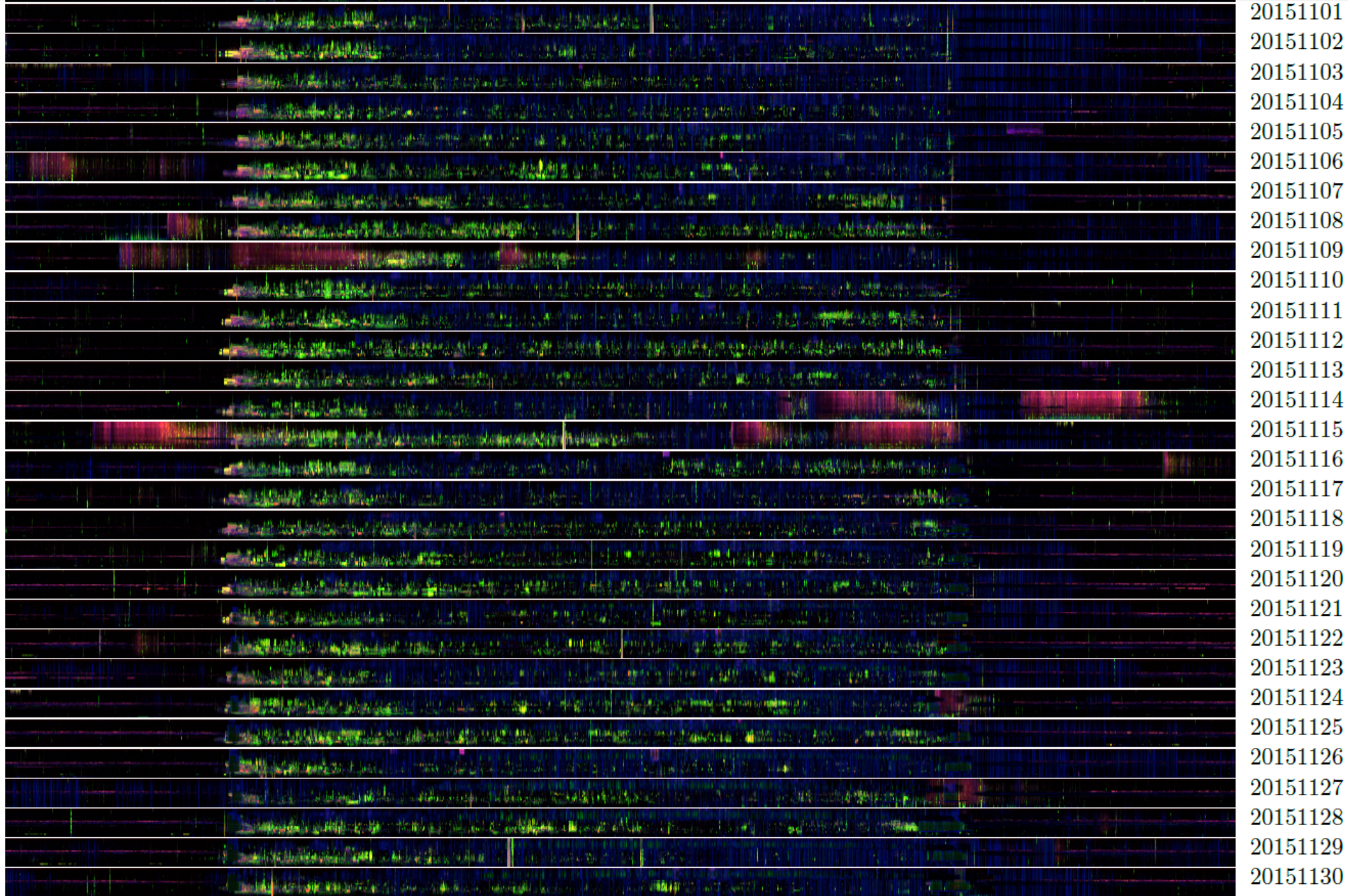
# Content description of very-long-duration recordings of the environment



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# Ribbon plots: Gympie National Park, November 2015



Courtesy of Yvonne Phillips

Resolution = 60s

Indices = ACI-ENT-EVN

Data reduction  $10^3$ - $10^5$

## Need more data reduction!

Cluster vectors of 12 *summary* acoustic indices

- use  $k$ -means
- $10^7$ - $10^9$  reduction
- new imaging possibilities

... but, how many clusters?

Phillips, Towsey, et al. (2018) Plos One. **13** (3): e0193345.

Phillips, Towsey and Roe (2017) *IEEE Int. Symposium on Big Data Visual Analytics*, Adelaide, 26-29 Sept 2017.

Sankupellay, Towsey, et al. (2015) *IEEE Int. Symposium on Big Data Visual Analytics*, Tasmania, 22-25 Sept 2015.

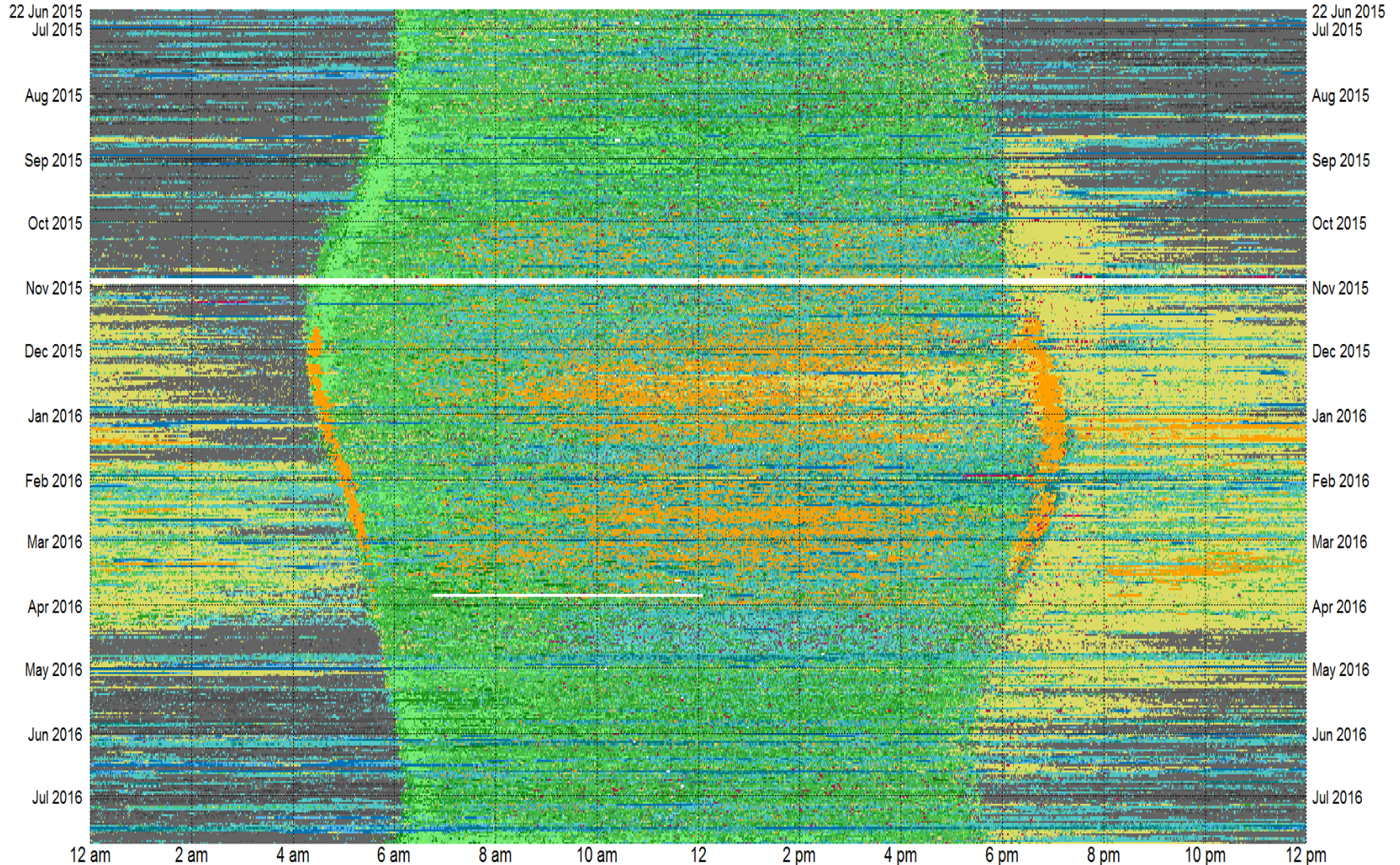


# Diel plot: 13 months audio from Gympie National Park.

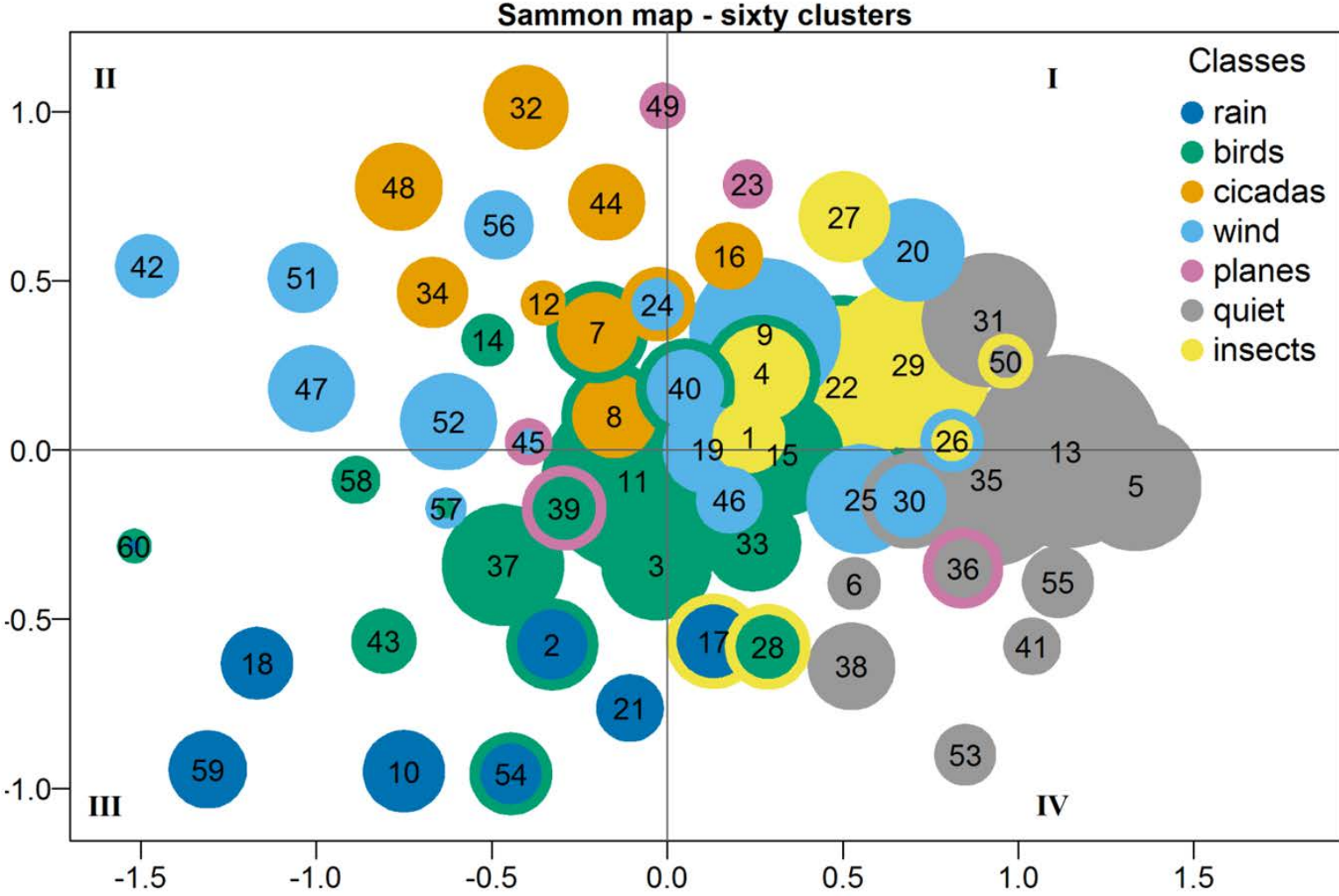
Quiet    Birds/Chorus    Orthoptera    Cicadas    Wind    Rain    Aircraft

Cluster plot - Gympie NP 22 June 2015 - 23 July 2016

Summary Indices: BackgroundNoise, Snr, Activity, EventsPerSecond, HighFreqCover, MidFreqCover, LowFreqCover, AcousticComplexity, EntropyOfAverageSpectrum, EntropyOfPeaksSpectrum, EntropyOfCoVSpectrum, ClusterCount

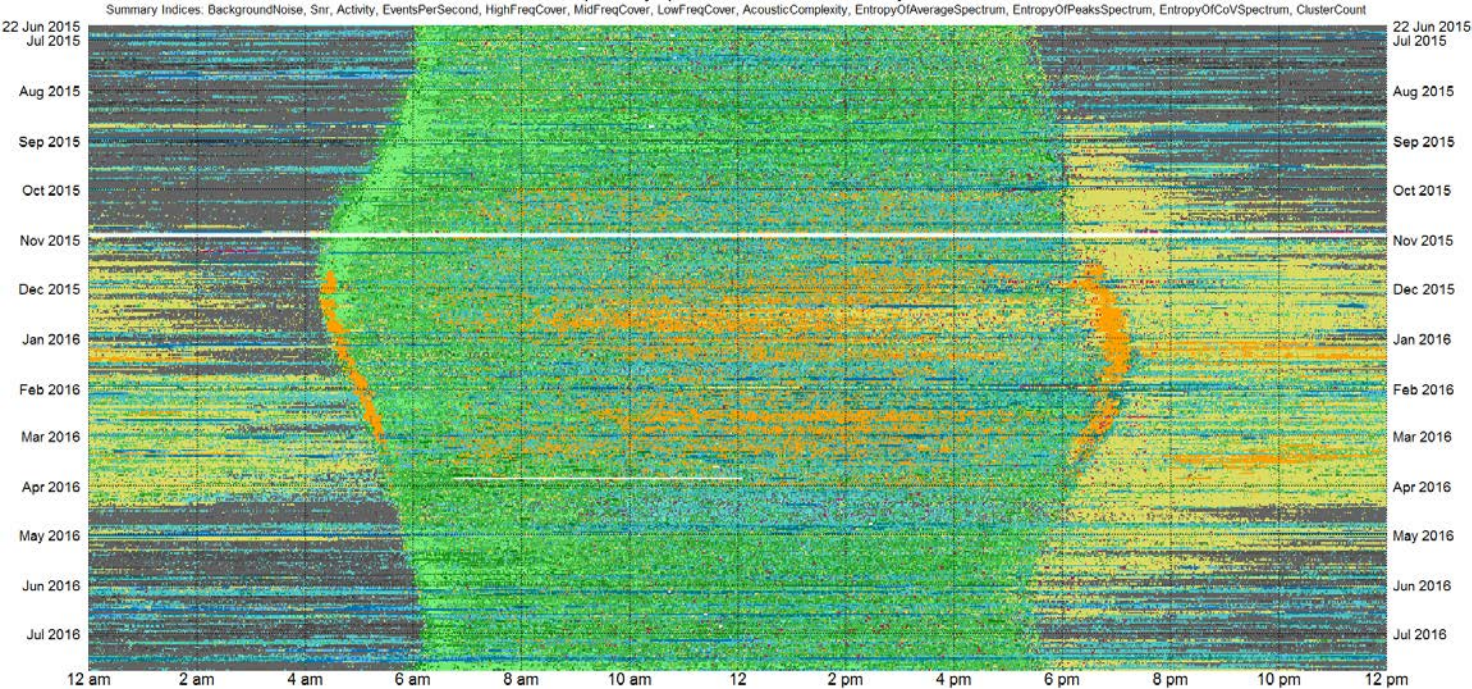


# 60 acoustic clusters



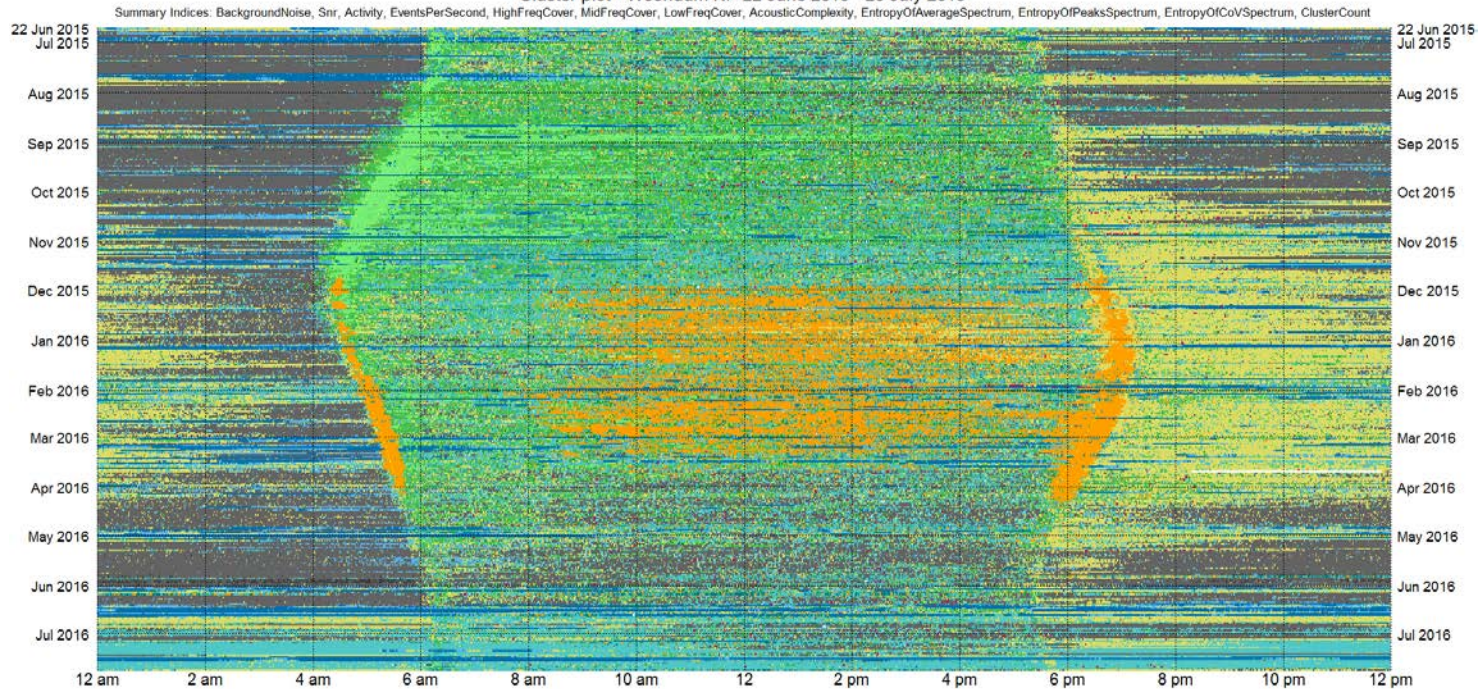


Cluster plot - Gympie NP 22 June 2015 - 23 July 2016



Gympie NP

Cluster plot - Woondum NP 22 June 2015 - 23 July 2016



Woondum NP

# Four questions

**Question 1:** Can we reduce the amount of listening / ground truthing?

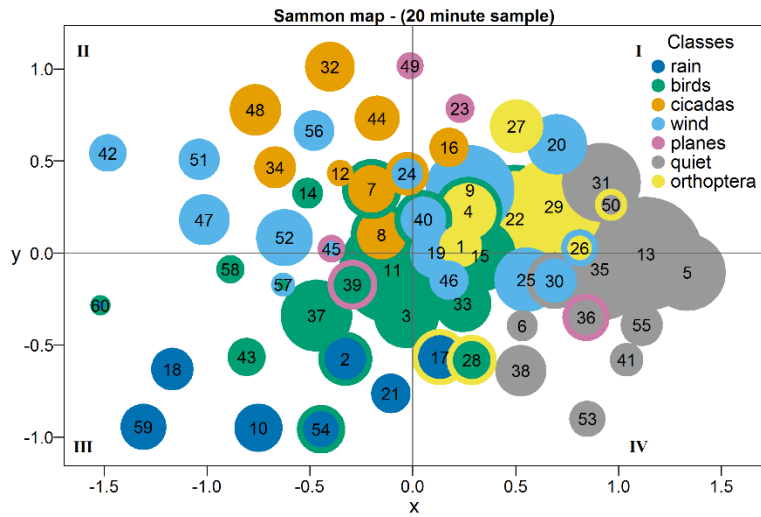
20 one-minute instances

selected randomly from each of 60 clusters  
requires >20 hours of listening.

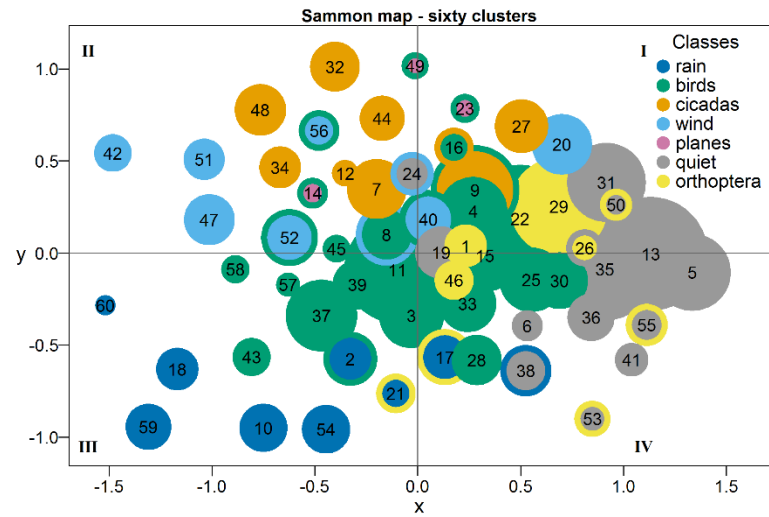


# Answer 1: Try listening only to medoid minutes

20 random minutes per cluster



One medoid minute per cluster





**Question 2:** What is the sensitivity to different runs of k-means?

**Answer 2:** a little, but not much!

	Number of clusters	Percent of minutes
Labels exactly similar	49	82.5%
One common label	7	10.8%
No common label	4	6.7%

# Question 3: What is the effect of different acoustic feature sets?

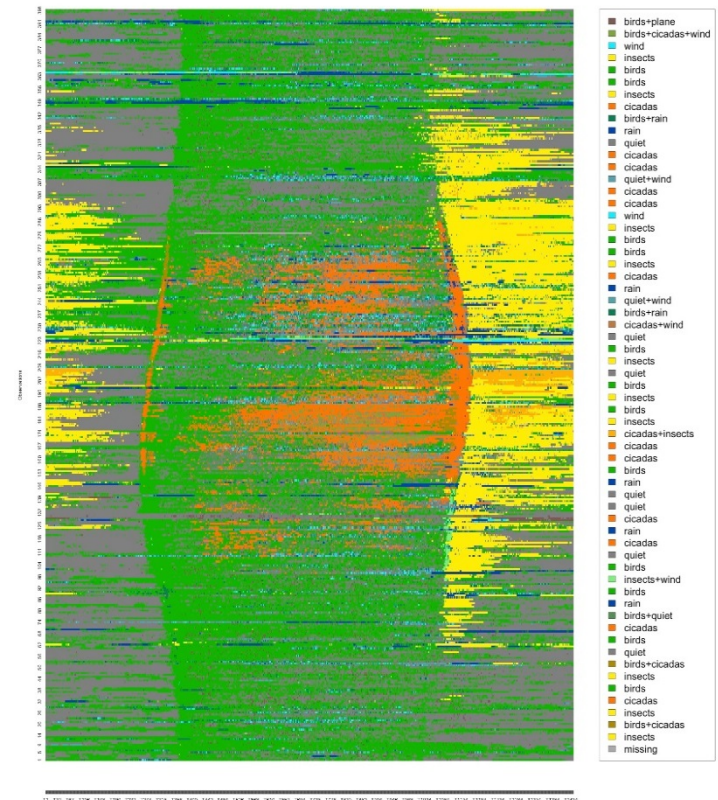
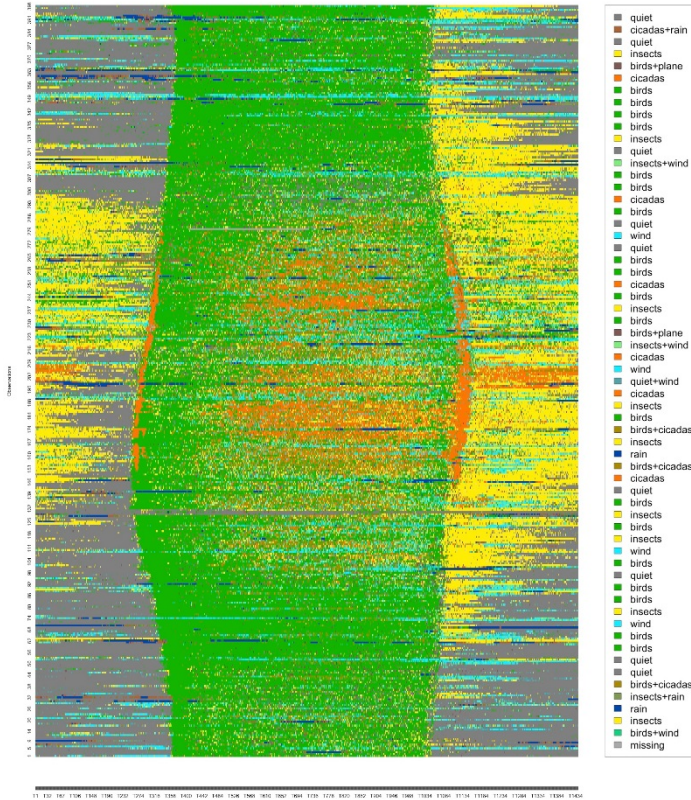
12 summary indices



12 values

6 spectral indices × 256 linear  
freq bins × 16 DCT coeff's

↓  
96 values



Birds: 35% minutes in 20 clusters;  
Cicadas: 5% minutes in 5 clusters;  
Wind: weak wind clusters gone to quiet category.

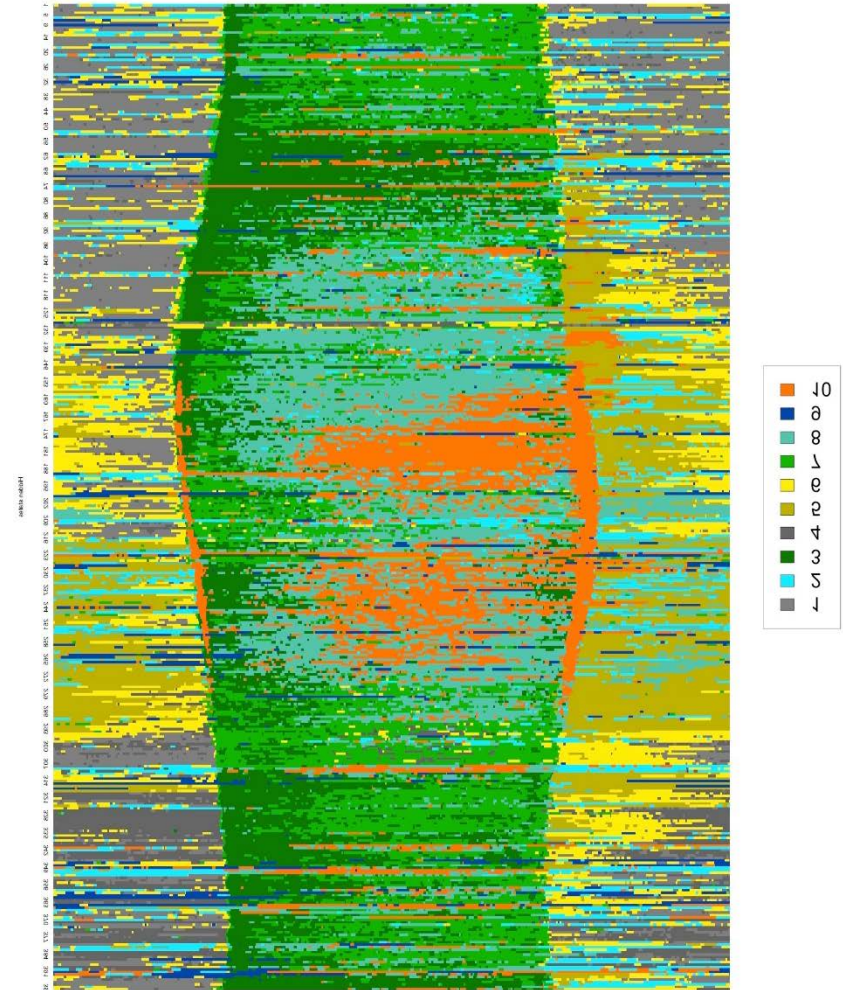
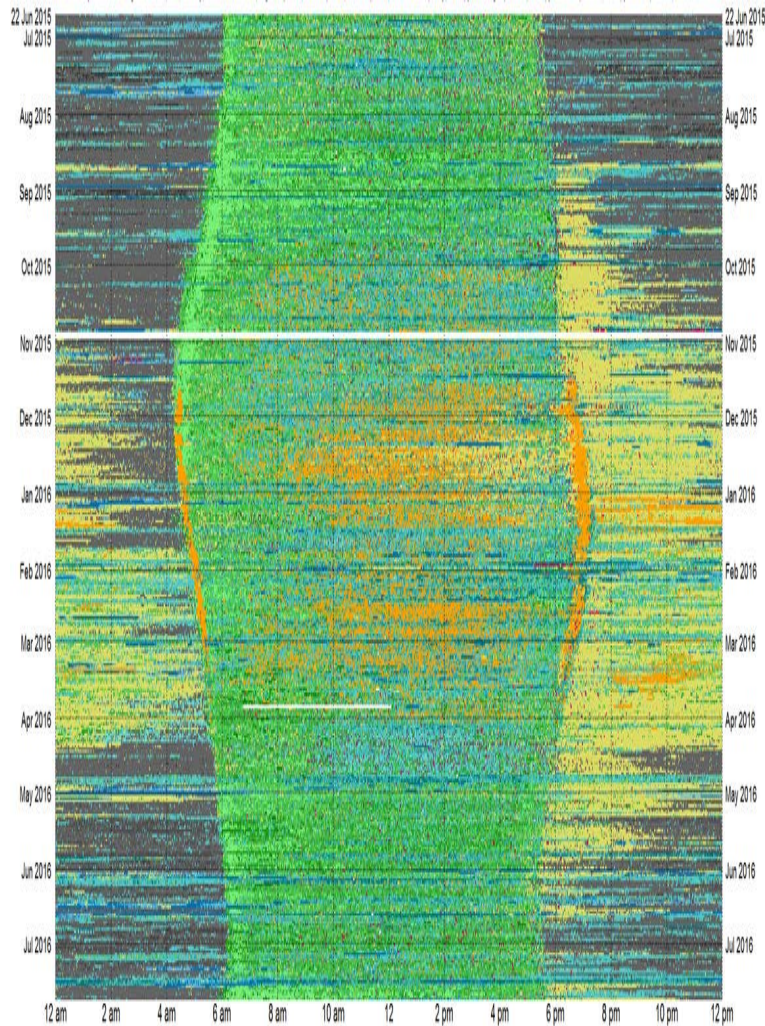
38% minutes in 12 clusters.  
5% minutes in 11 clusters.



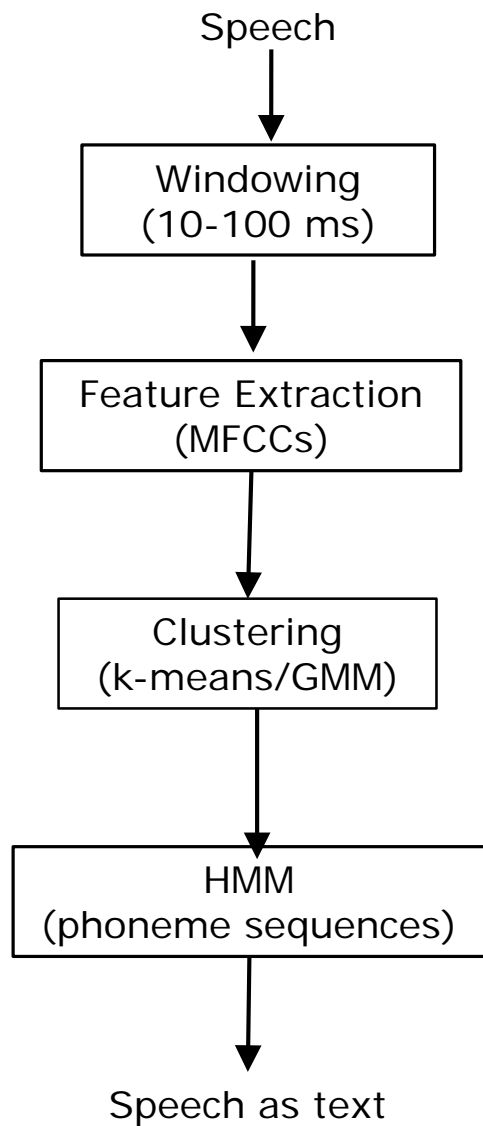
# Question 4: Can we identify underlying acoustic communities?

## Answer 4: Try using HMMs

One year recording → time series, length=525,600; alphabet=60 acoustic states



## Speech Processing



## Soundscape processing

