

# THERMAL DRONE SURVEYS: A NEW METHOD FOR ESTABLISHING AN INDEX OF ANNUAL FLYING-FOX REPRODUCTION

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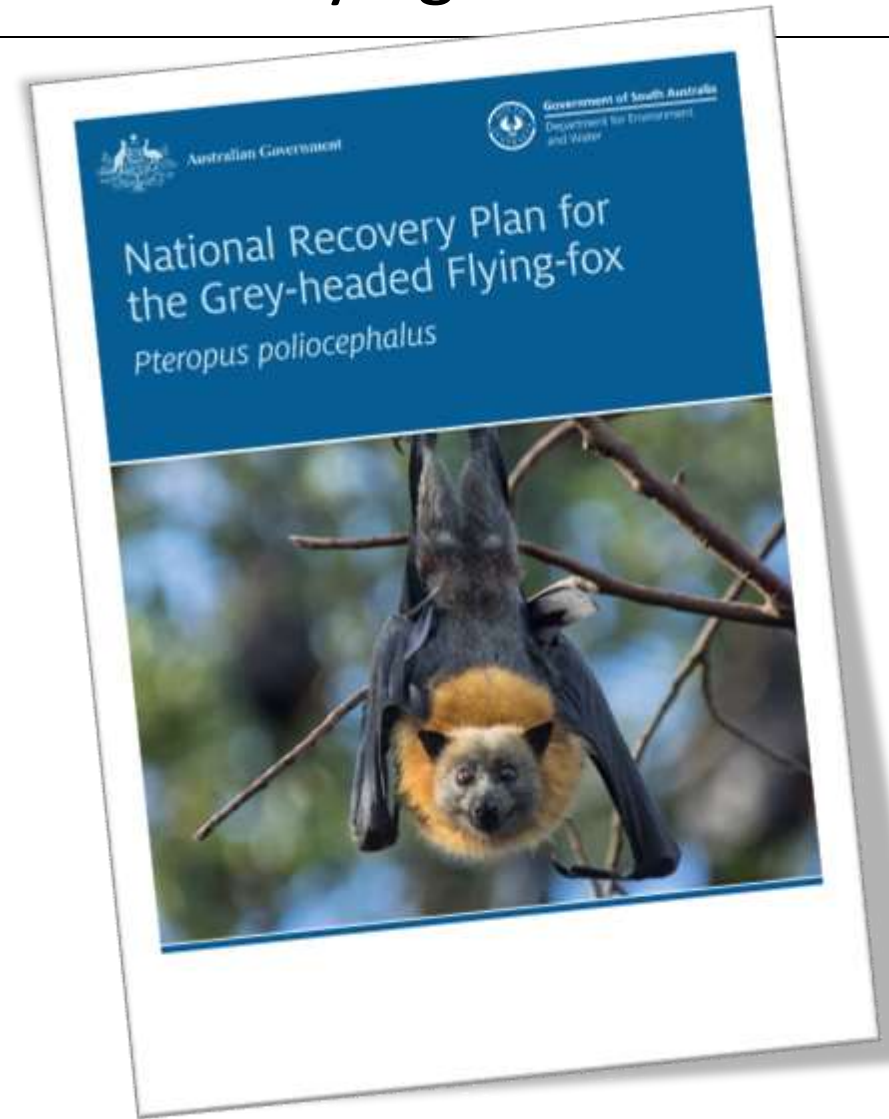
<sup>1</sup>Hawkesbury Institute for the Environment, Western Sydney University; <sup>2</sup>Wildlife Services, Ecosure



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# National Recovery Plan for the Grey-headed Flying-fox

- *“To improve [its] national population trend by reducing the impact of the threats through habitat identification, protection, restoration and monitoring.”*
- Despite the emphasis on improving population trends, current recovery management does not include assessments of annual recruitment.



DAWE 2021, National Recovery Plan for the Grey-headed Flying-fox 'Pteropus poliocephalus', Department of Agriculture, Water and the Environment, Canberra, March 2021

# Flying-foxes are extremely mobile



Welbergen et al. *BMC Biology* (2020) 18:101  
<https://doi.org/10.1186/s12915-020-00829-w>

BMC Biology

RESEARCH ARTICLE Open Access

Extreme mobility of the world's largest flying mammals creates key challenges for management and conservation

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\*Check for updates

Grey-headed flying-fox (Vul)



Black flying-fox

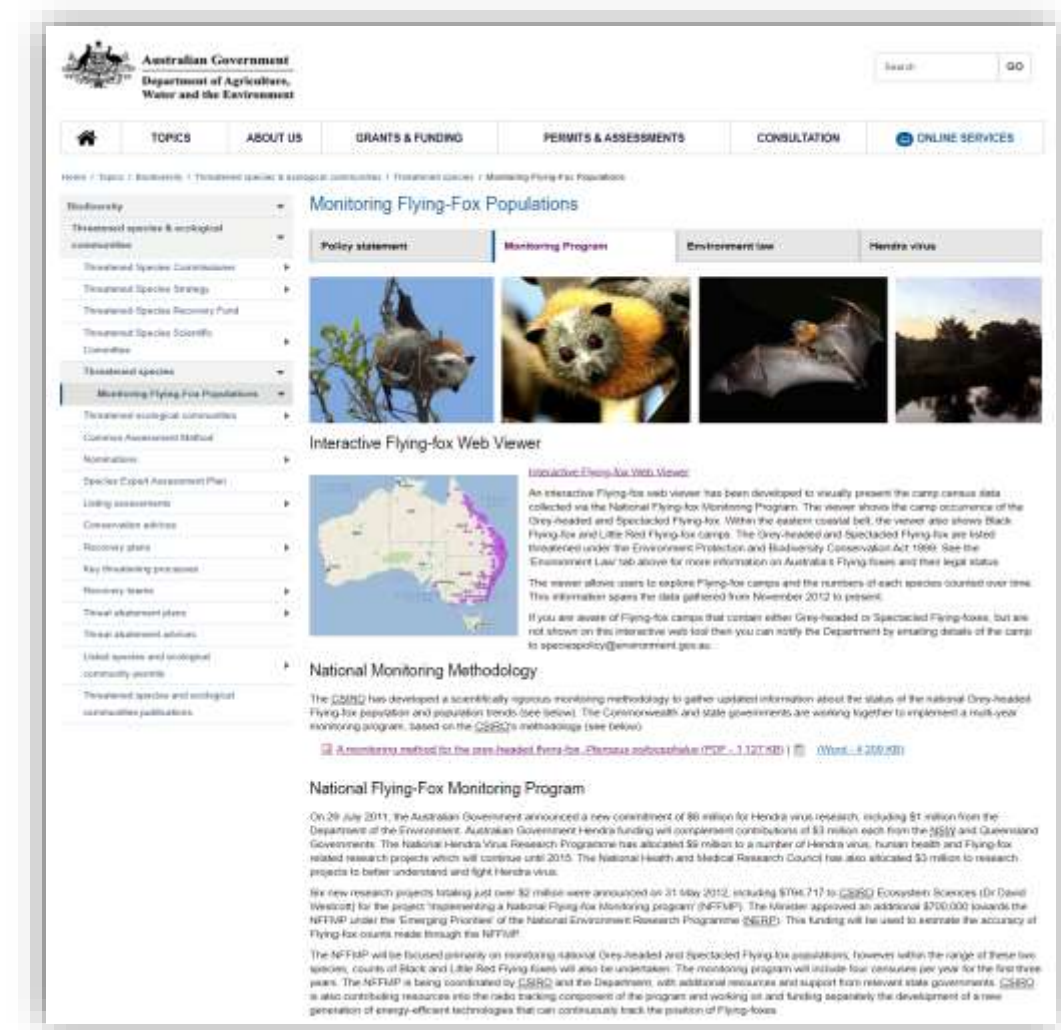


Little red flying-fox



# Population monitoring: ground/fly-out counts

- The National Flying-Fox Monitoring Program (NFFMP) aims to monitor all known flying-fox roosts quarterly, but accuracy and precision are limited.<sup>1,2</sup>



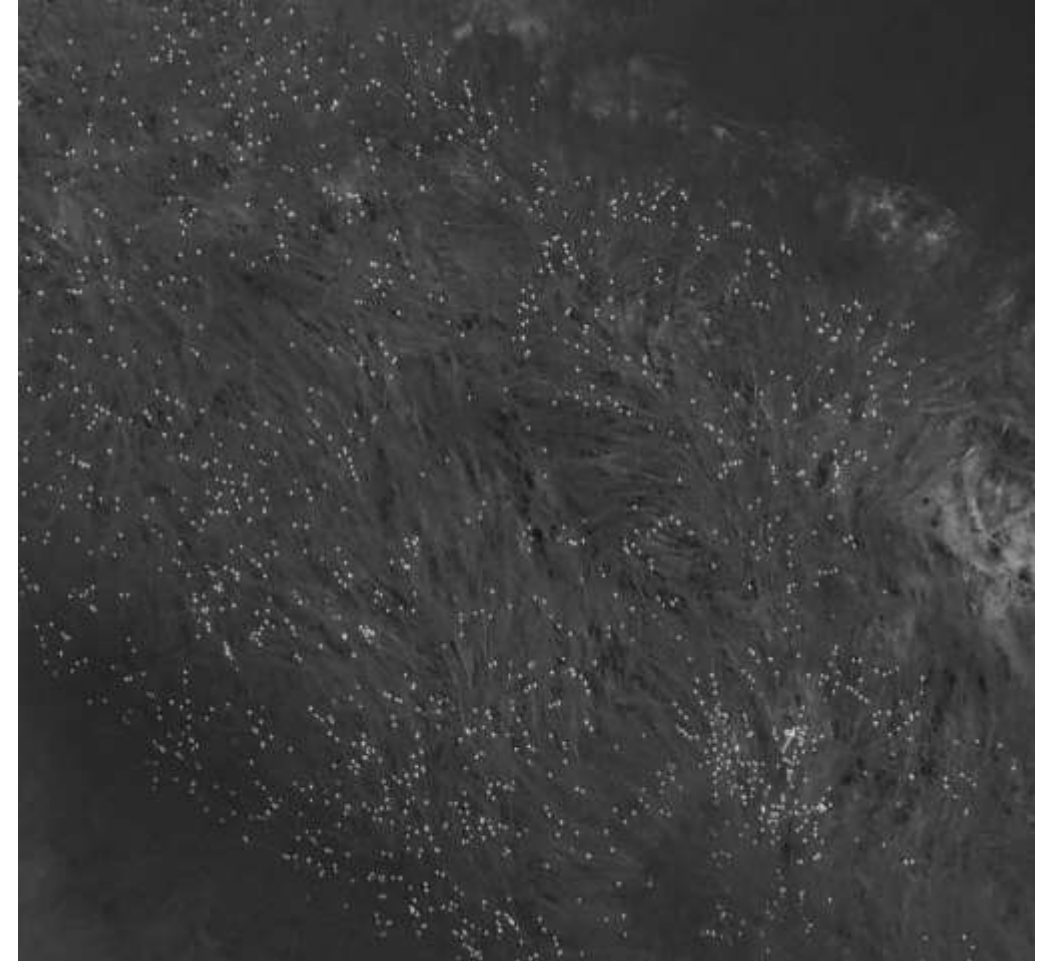
1. Westcott et al. (2015). Implementation of the national flying-fox monitoring program. Rural Industries Research and Development Corporation, Canberra.
2. McCarthy, Martin, Boer & Welbergen (2022). Wildlife Research: <https://doi.org/10.1071/WR21120>

# Population monitoring: thermal drone data

- Thermal imagery from drones can be used to count flying-foxes at roosts semi-automatically and with *high accuracy and precision*.<sup>1,2</sup>



- Provides a low-impact, reliable and cost-effective alternative for monitoring flying-fox colonies.



# Population monitoring: thermal drone data

- Drone-acquired counts indicate that the accuracy and precision of ground-based counting methods are considerably lower<sup>1</sup> than previously assumed<sup>2</sup>.
- Drone-acquired counts can help shorten trend detection timeframes and so enable conservation management to respond with greater immediacy to threats.<sup>1</sup>



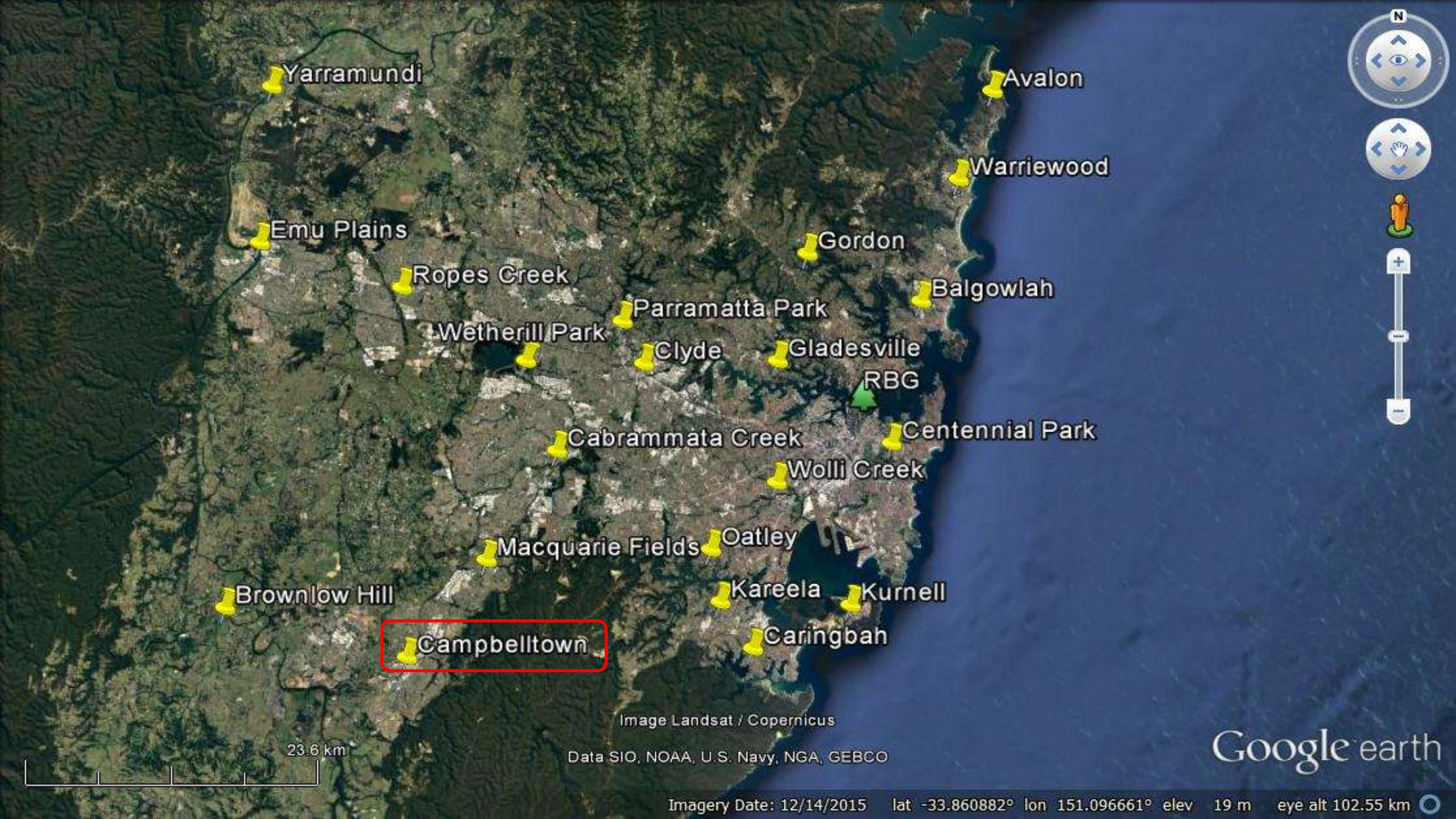
1. McCarthy, Martin, Boer & Welbergen (2022). Wildlife Research: <https://doi.org/10.1071/WR21120>

2. Westcott et al (2012). Ecological Applications, 22, 374-383

# Population monitoring: thermal drone data

- We suggest here that thermal imagery from drones can also help us assess annual levels of recruitment.
- Outputs can inform our understanding of:
  - Site-specific impacts (e.g., roost disturbance) potentially affecting recruitment locally.
  - Broadscale impacts (e.g., wildfires, extreme heat) potentially affecting recruitment into the GHFF population as a whole.





Yarramundi

Avalon

Emu Plains

Warriewood

Ropes Creek

Gordon

Wetherill Park

Parramatta Park

Balgowlah

Clyde

Gladesville

RBG

Cabrammatta Creek

Centennial Park

Wolli Creek

Macquarie Fields

Oatley

Brownlow Hill

Kareela

Kurnell

Campbelltown

Caringbah

Image Landsat / Copernicus

Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

23.6 km

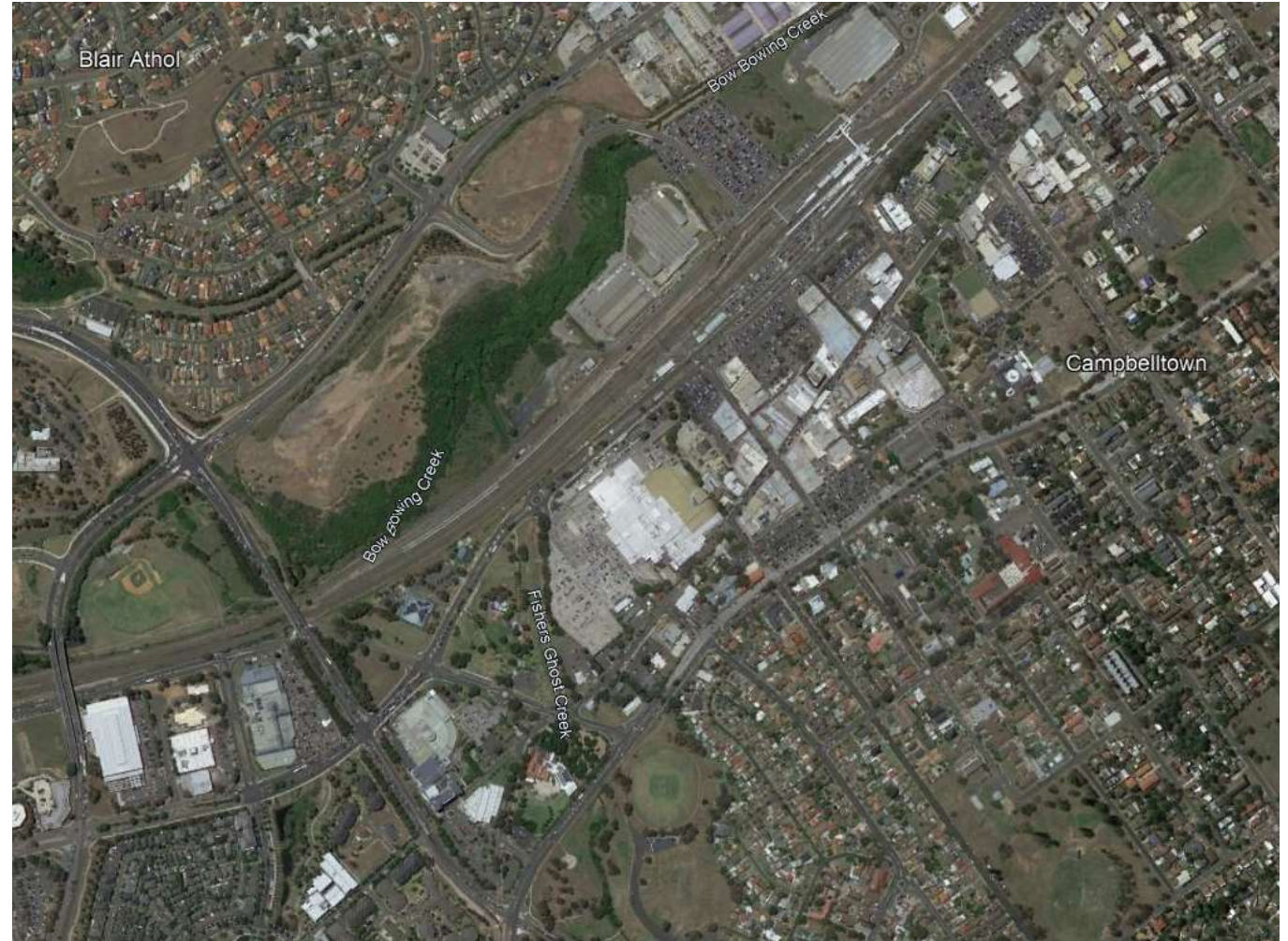
Imagery Date: 12/14/2015 lat -33.860882° lon 151.096661° elev 19 m eye alt 102.55 km

# Pilot study – 15 December 2022

Location: **Campbelltown, NSW**

## Methods:

1. Diurnal colony composition survey using traditional on-ground observation methods
2. Diurnal survey of colony using drone
3. Nocturnal drone of colony using drone



# Pilot study – 15 December 2022

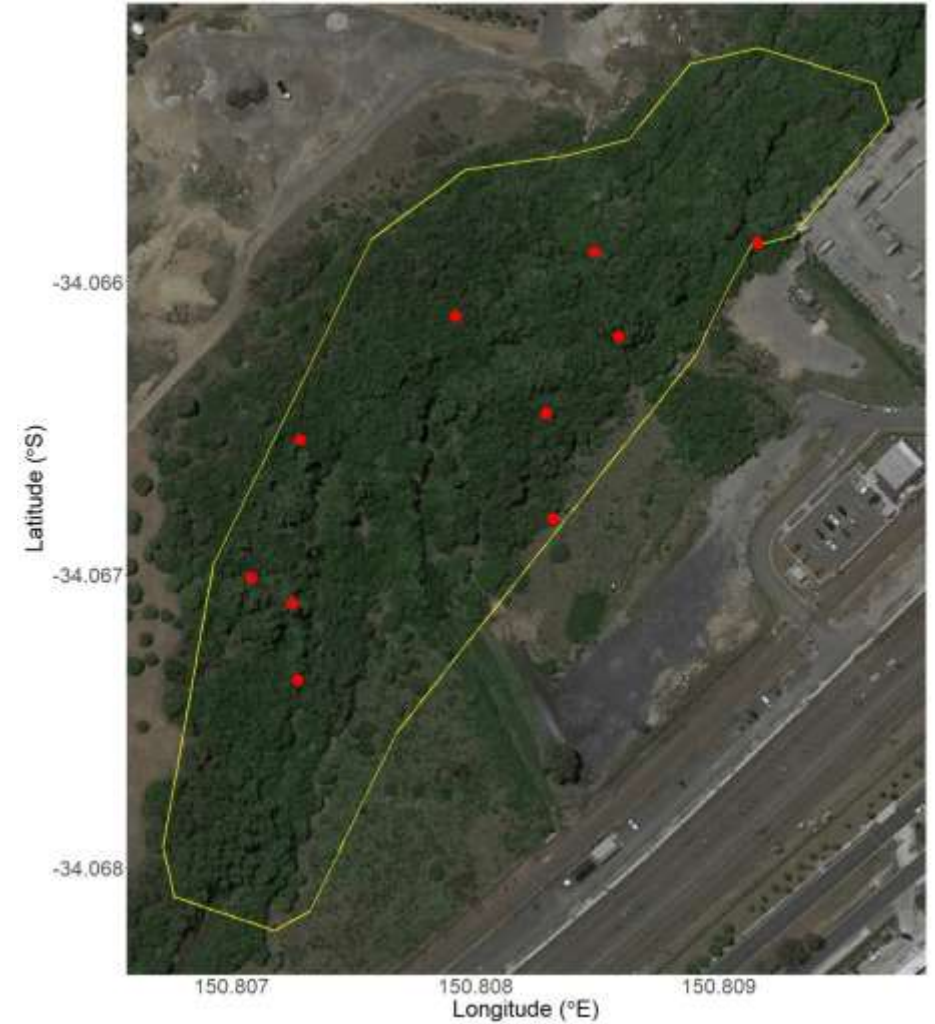
## Diurnal colony composition survey

### Results

|           | Female | Male | Total |
|-----------|--------|------|-------|
| Adult     | 194    | 139  | 333   |
| Sub-adult | 9      | 18   | 27    |
| Pup       | -      | -    | 161   |
| Total     |        |      | 521   |

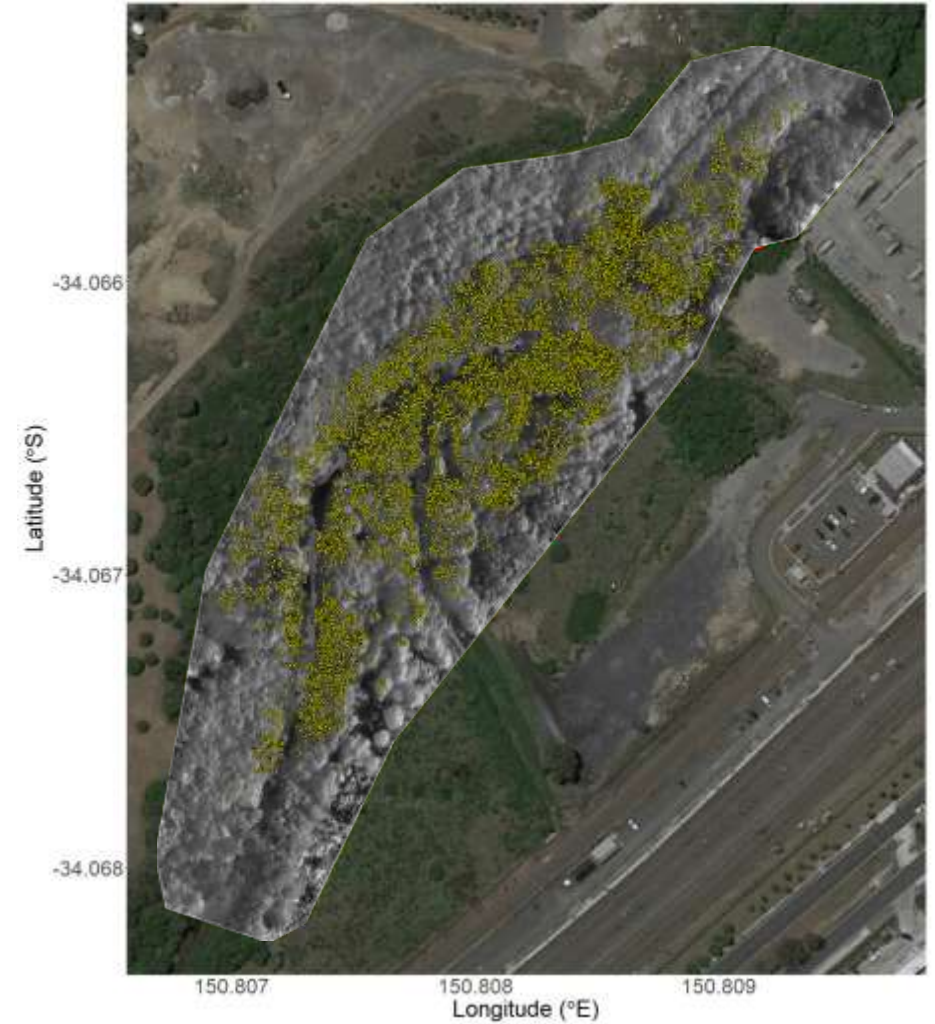
adult sex ratio (F:M) = 1.4:1.0

#pups/adult female = 0.83



# Pilot study – 15 December 2022

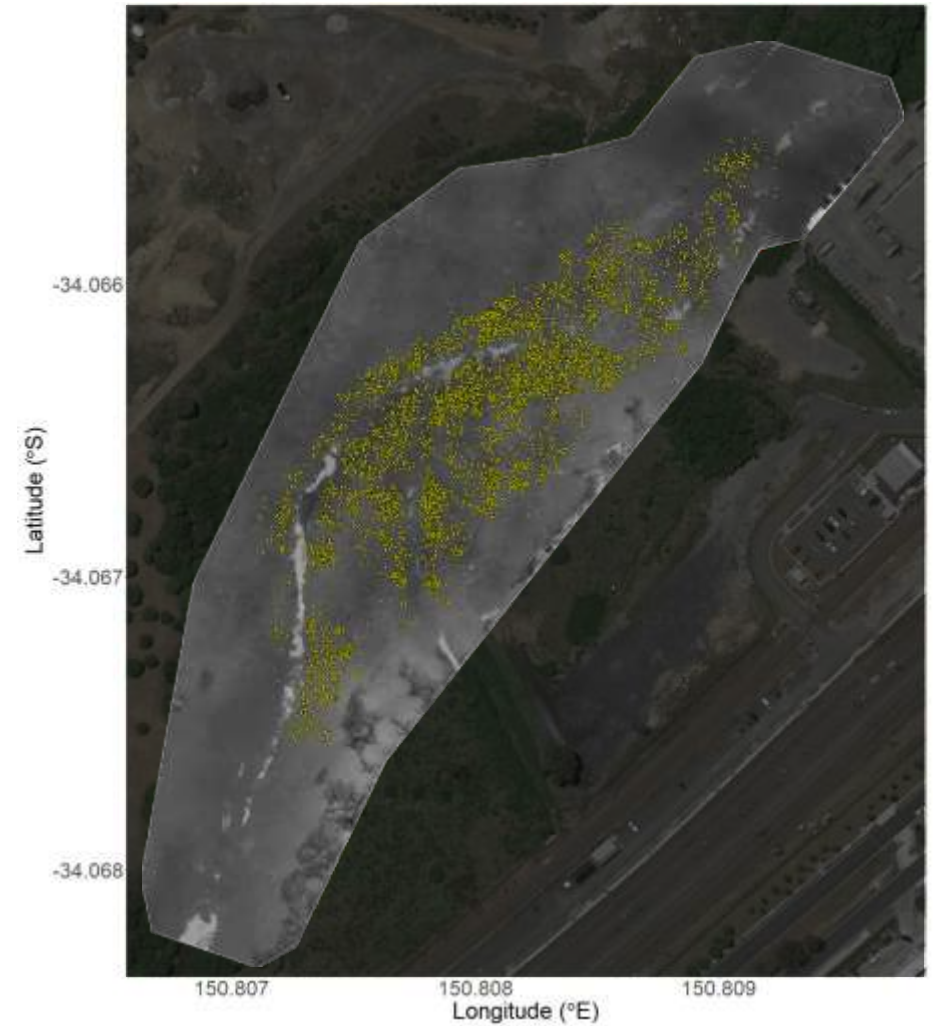
- Diurnal survey of colony using drone



For methods, see: McCarthy, Martin, Boer & Welbergen (2021) *Remote Sensing in Ecology and Conservation*: <https://doi.org/10.1002/rse2.202>

# Pilot study – 15 December 2022

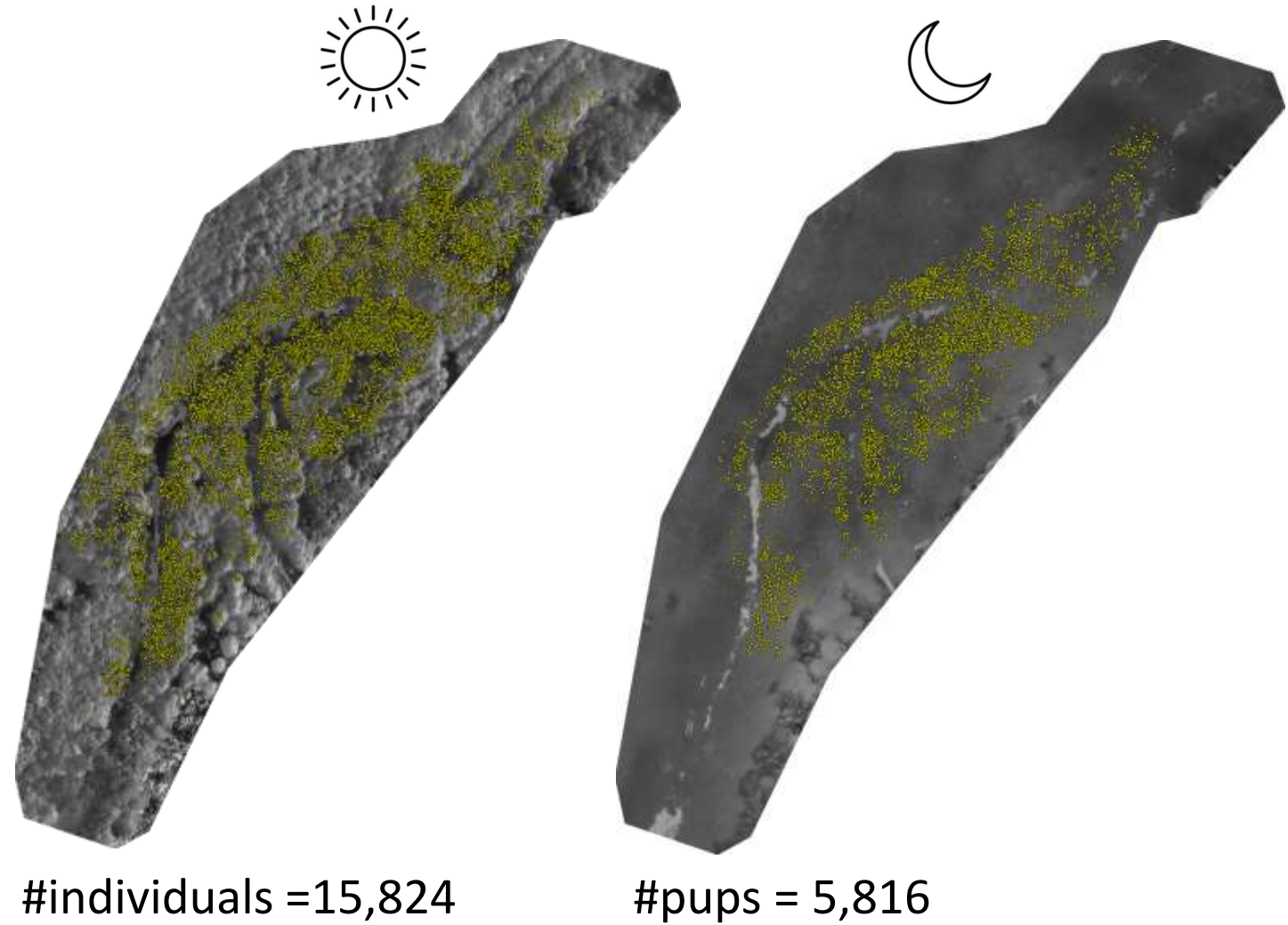
- Nocturnal survey of colony using drone



For methods, see: McCarthy, Martin, Boer & Welbergen (2021) *Remote Sensing in Ecology and Conservation*: <https://doi.org/10.1002/rse2.202>

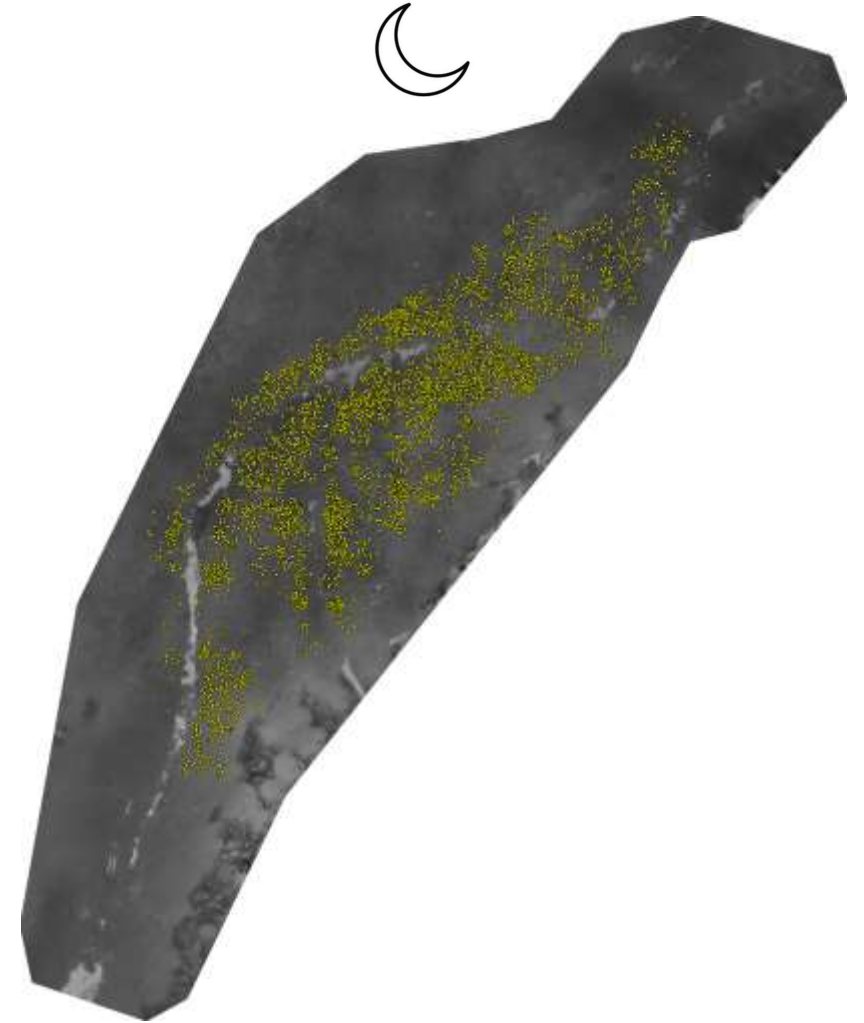
# Pilot study – 15 December 2022

- Diurnal vs nocturnal drone counts



# Future work

- Proportion of pups left in the roost at night likely varies through summer
- Spatial distribution of pups in the roost at night likely varies through summer as well (crèches, no crèches?)
- Repeated drone surveys are needed to better understand these patterns -> focus of future work



# Drone counts can as yet not differentiate between species

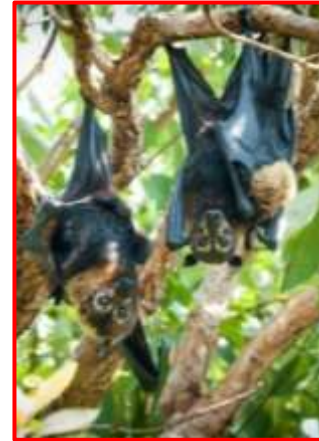
Grey-headed flying-fox (Vul)  
*Pteropus poliocephalus*



Black flying-fox  
*P. alecto*



Spectacled flying-fox (En)  
*P. conspicillatus*



Little red flying-fox  
*P. scapulatus*



# Conclusion

- Nocturnal surveys of colonies using drones present a promising new method for monitoring annual recruitment.



- Annual recruitment is a missing piece of the puzzle to enable proactive conservation management to “*improve the Grey-headed Flying-foxes’ national population trend*”<sup>1</sup>.



1. DAWE 2021, National Recovery Plan for the Grey-headed Flying-fox ‘Pteropus poliocephalus’, Department of Agriculture, Water and the Environment, Canberra, March

# Thanks!



# The 20<sup>th</sup> International Bat Research Conference (IBRC)



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