

Feeling the heat: A moving response of flying-foxes to heat events

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Background

The response of flying-foxes to periods of extreme temperatures is relatively well documented, with a distinct pattern of behaviour - fanning, shade seeking, and with mass fatalities reported at temperatures over approximately 43° C. However, some camps succumb more readily than others, in spite of broadly similar external environmental conditions, with some individual camps appearing to be remarkably resilient to heat stress events. In the Ku-ring-gai Flying-fox Reserve, in Gordon, Sydney, the resident flying-foxes react to days of high temperature by moving to a different area of the reserve. Detailed knowledge of what makes these areas more suitable for the bats on days of high heat is critical to the ongoing bush regeneration and habitat restoration program, and general maintenance in the reserve.

Initial study – December 2015: The Ku-ring-gai Flying-fox Reserve is located in Gordon, in northern Sydney, New South Wales. The Reserve, covering an area of approximately 15.5 hectares and located in a valley in the middle of an urban area, is home to a maternity camp of the threatened Grey-headed flying-fox *Pteropus poliocephalus*. The animals currently roost in close proximity to residences. In November 2015, on a day with forecast temperatures of 41° C, we deployed three Kestrel tracker portable weather stations in the reserve (Figure 1) to attempt to determine the differences between the area the flying-foxes normally roost in, and the area they move to. Camp extents were mapped during the day, and we noted that the bats retreated to a smaller area as the day heated up. The extreme forecast temperatures were not reached, however the data did show (Figure 2) that the lower reaches of the valley where the flying-foxes moved to were cooler and moister than the normal camp location.



Figure 1: Ku-ring-gai Flying-fox Reserve, showing the normal extent of the flying-fox camp (white shading), and the area moved to by the flying-foxes during high heat on the 20th November, 2015 (purple shading). The denser area of purple shading shows the main concentration of the animals. Locations of Kestrel Tracker weather stations are shown.

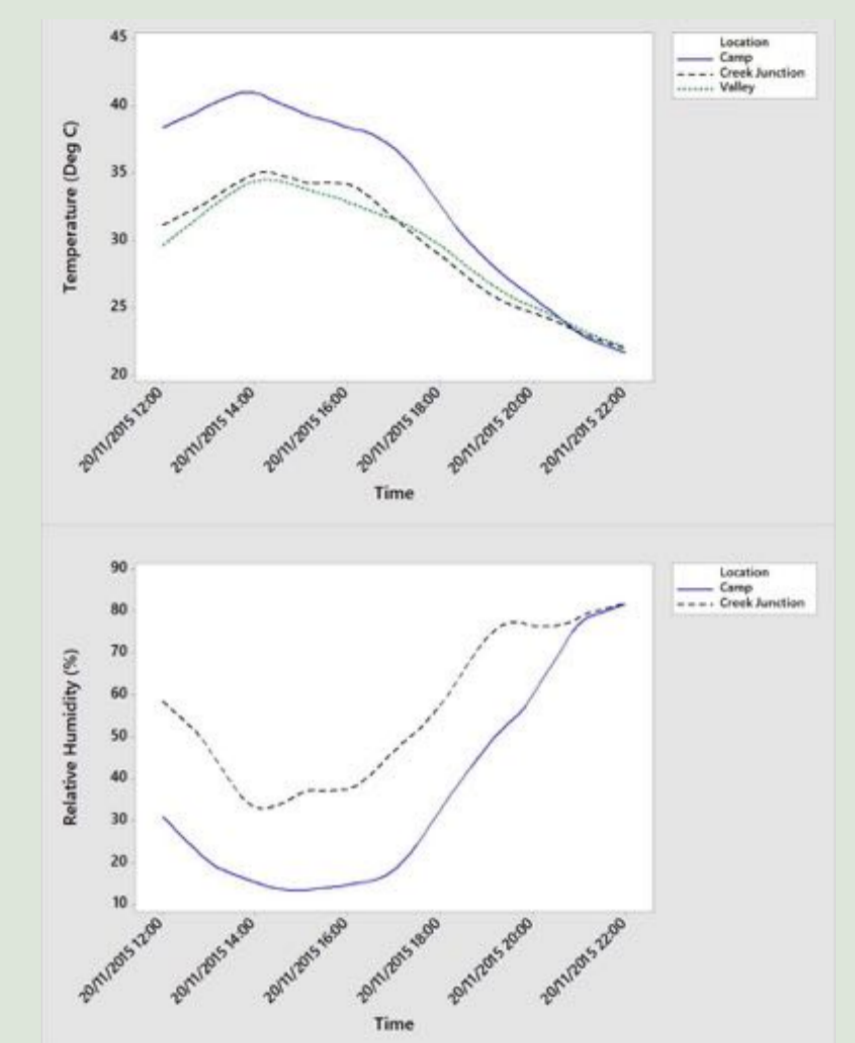


Figure 2: Temperature and Relative humidity logs from the Kestrel Tracker weather stations. (Note that due to a data error, the humidity data is missing for one station).

Changing conditions – December 2016:

In 2016, a decision was made to attempt habitat rehabilitation in one area of the reserve by complete weed removal, followed by a hot burn and natural regrowth. After clearing, a forecast day of high heat in late December allowed us to again deploy environmental monitors, this time in three locations - the normal roost area; the predicted area the animals would move to as a heat refugia; and adjacent to the cleared zone (Figure 3, Figure 4). Logs showed (Figure 5) that again the lower reaches of the valley (Creekline – vegetated) were cooler and moister than the normal camp area (Camp), however adjacent to the cleared area (Creekline – cleared) was hotter and drier than the refugia area, rendering it and the immediate surrounds unsuitable for flying-fox habitat until regrowth occurs.

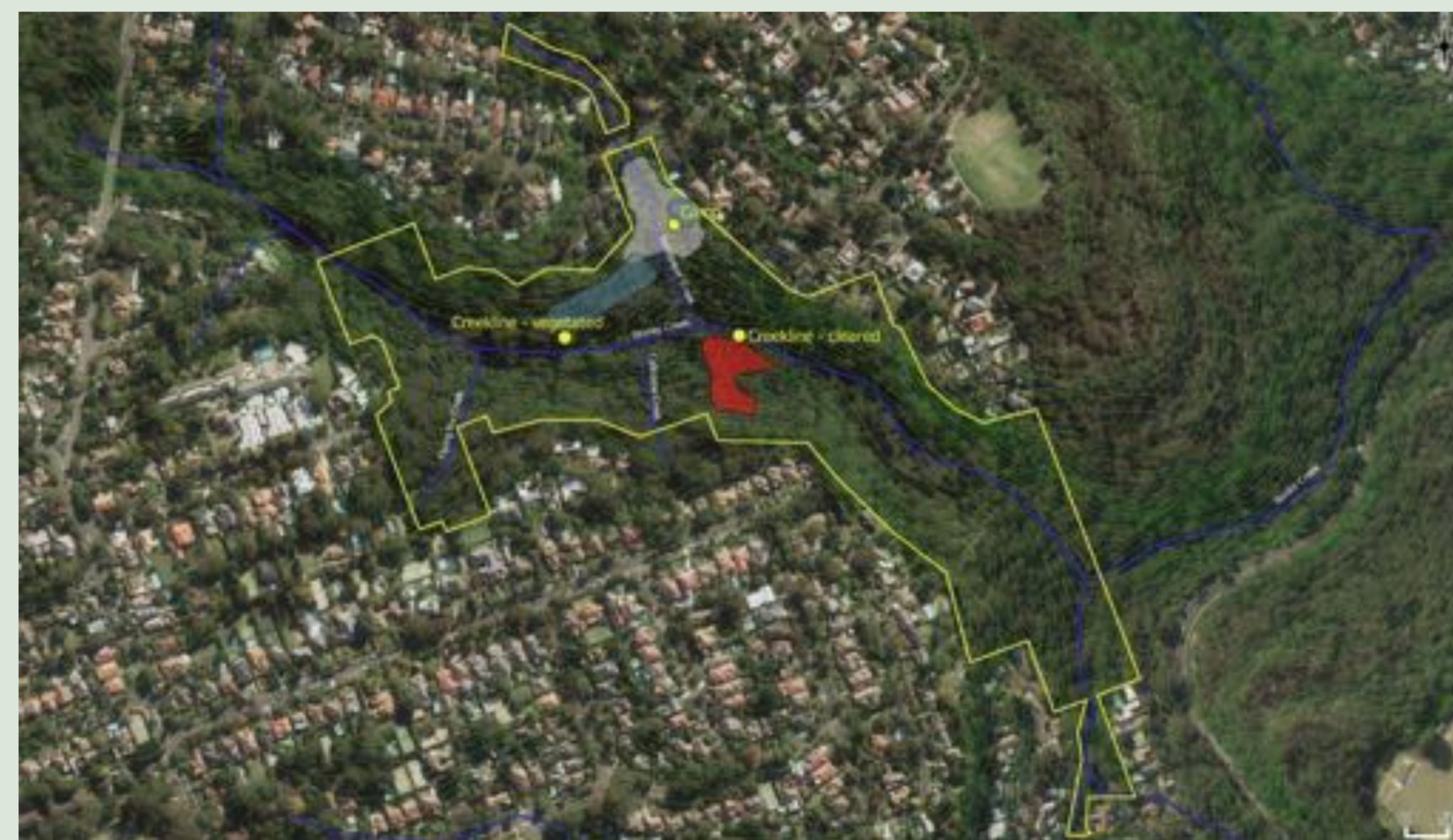


Figure 3: Ku-ring-gai Flying-fox Reserve, showing the normal extent of the flying-fox camp (white shading); the area moved to by the flying-foxes during high heat on the 29th December, 2016 (purple shading); and the cleared area of the reserve (red shading). Locations of Kestrel Tracker weather stations are shown.



Figure 4: Instrument locations. Top: Camp; Bottom left: Creekline – vegetated; Bottom right: Creekline – cleared.

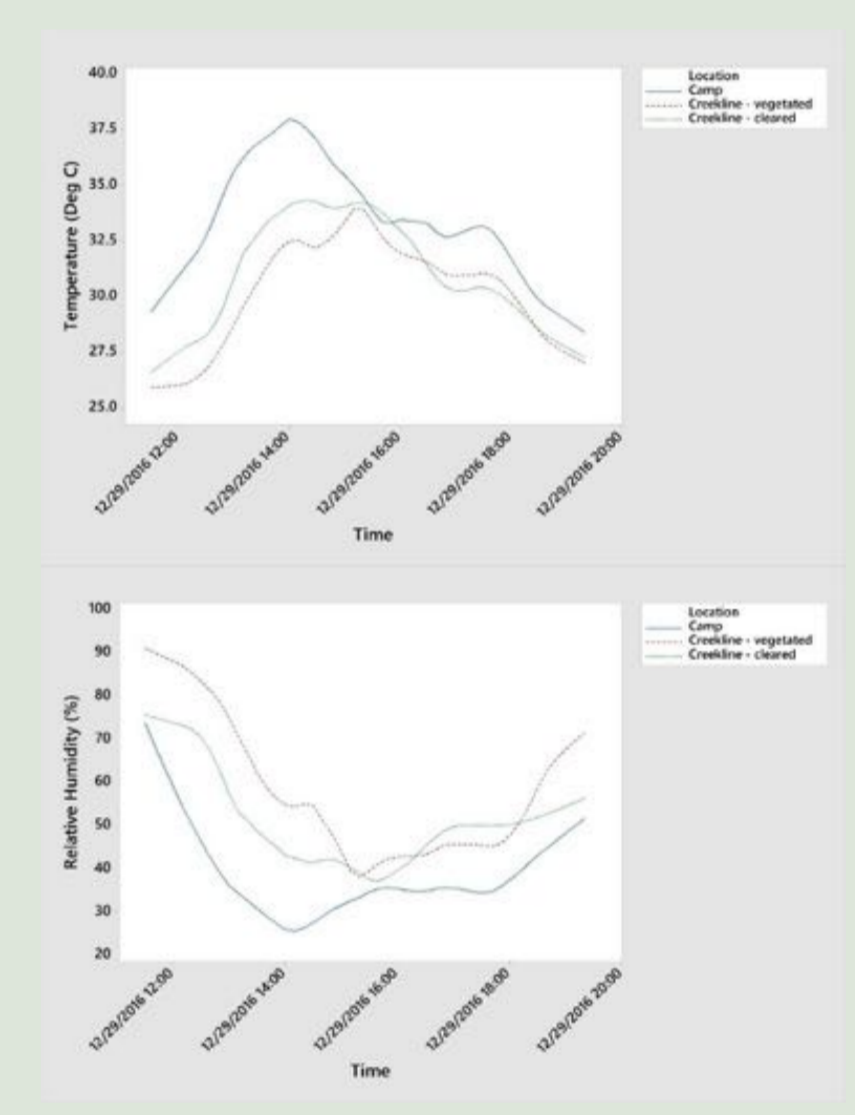


Figure 5: Temperature and Relative humidity logs from the Kestrel Tracker weather stations.

Further investigation, and current situation:

Further monitoring during days of high heat have suggested that from a threshold of roughly 35° C, the flying-foxes start moving from their normal camp area further down into the valley of the reserve, where it is typically 2-3° C cooler, and 5-10% RH moister. By roughly 40° C they have left the area of the normal camp entirely, to return later in the day when temperatures are lower.

A permanent weather station and remote temperature / humidity sensor have now been installed in the reserve (Figure 6, Figure 8).

No mass casualty events have been recorded in the reserve since 2013, even though other Sydney area camps have been affected on a number of occasions.

When developing plans for sites that flying-foxes roost in or visit, land managers need to consider not only the immediate roost area but also the surrounding areas as these may be used as heat refugia by the animals. It is worth considering some form of environmental monitoring to identify different vegetation classifications.

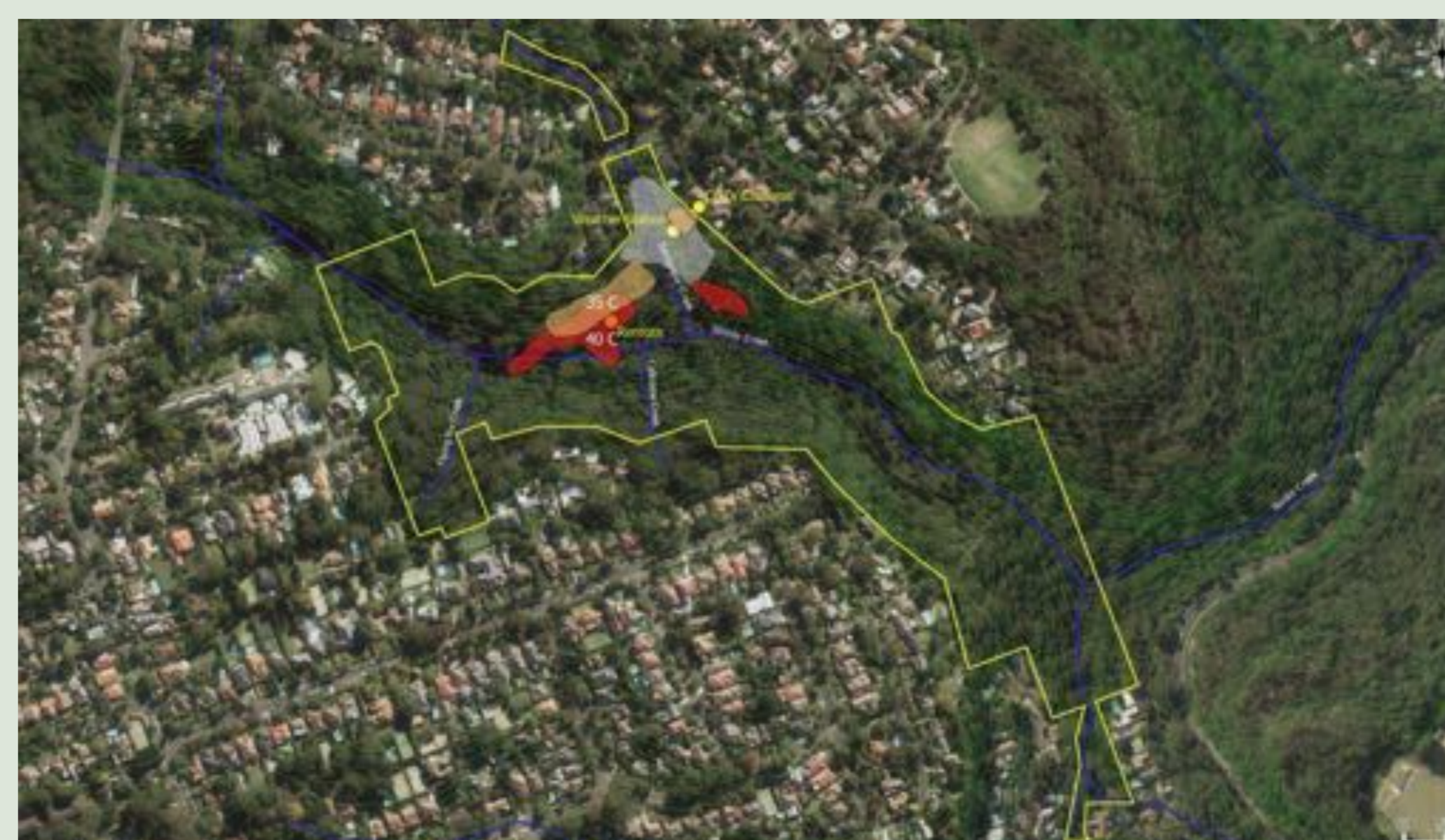


Figure 6: Ku-ring-gai Flying-fox Reserve, showing the normal extent of the flying-fox camp (white shading); the approximate areas moved to by the flying-foxes when temperatures exceeded approximately 35° C and 40° C; and the locations of current instrumentation.

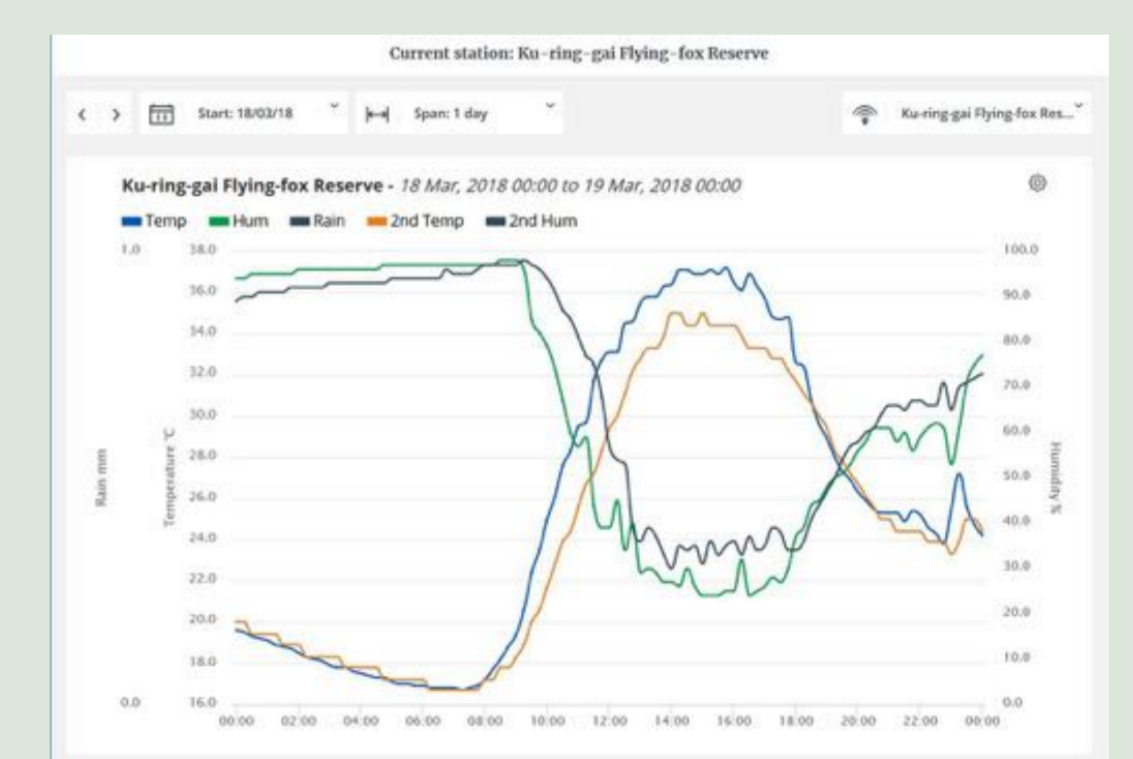


Figure 7: Temperature and Relative humidity logs from the permanent weather station and remote sensor (2nd Temp; 2nd Hum), showing variation between areas.



Figure 8: Permanent weather station (top) and remote sensor (bottom) locations in the Ku-ring-gai Flying-fox Reserve