Developing new methods for more accurate counts of flying-foxes in their roosts

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Currently, we estimate flying-fox colony size through daytime ground counts and dusk fly-out counts. However, this is no easy feat, and population estimates from these methods have been shown to be inaccurate and imprecise (Forsyth et al., 2006; Westcott & McKeown, 2004).

Remotely piloted aircraft systems (RPAS), such as drones, model aeroplanes and balloons, allow researchers to go above and beyond in the pursuit of ecological knowledge and have been used for accurate monitoring of seals (Seymour et al., 2017), seabirds (Francis et al., 2020), and monkeys (Kays et al., 2019). Infrared cameras allow for remote observation of object temperatures. Bats tend to have distinct heat signatures that can be easily distinguished from a cooler background. Researchers have previously used infrared cameras to film cave the emergence of Brazilian free-tailed bats in the USA (Betke et al., 2008), and the common and southern bent-wing bat in Australia (Brown et al., 2008; Lumsden & Jemison, 2015).

My Master of Research thesis at Western Sydney University, supervised by Assoc. Prof. Justin Welbergen, Dr. John Martin and Assoc. Prof. Matthias Boer, combines drone technology and thermal sensors and investigates the use of thermal drones as an effective new tool for conservation and management of flying-fox colonies. The Paddy Pallin-sponsored ABS grant awarded to me in 2019, contributed to the costs associated with gaining my remote pilot's license, an essential for all researchers wanting to use drones.

In this project I developed and tested methods for counting the number of flying-foxes in roosts. I flew a drone equipped with a thermal camera over roosts, collecting hundreds to thousands of thermal photos at a time. These photos were then stitched together to form thermal photo maps, or orthomosaics, depicting an aerial view of each colony. Individual flying-foxes are resolvable in orthomosaics and can be counted either manually or automatically to save time through machine learning and computer vision. I conducted more than 50 drone surveys at eight flying-fox roosts throughout the Greater Sydney region and did not notice any observable effect of the drone on flying-fox behaviour. The findings of my study will be published shortly in two academic journal articles.

More accurate and precise monitoring of colony flying-fox numbers enhances the evidence base for more effective conservation of this group of species. The precision of this new method means that changes in population trends can be detected earlier and with greater confidence. In future studies, researchers may more effectively monitor temporal changes in colony size to understand how flying-foxes use the Australian landscape, the magnitude of their ecosystem services in an area or to monitor the direct impact of extreme weather events, such as extreme heat; on colony populations. From these studies, researchers can expand the knowledge base on drivers of flying-fox redistributions for proactive conservation and management.

Left: Drone flies over the Centennial Park colony. Right: Infrared image depicting an aerial view of a flying-fox colony; here individual flying-foxes are visible as white circular objects.

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