RIGOROUS AND REPEATABLE CAMERA TRAP MONITORING; PROJECT UPDATE AUGUST 2017

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Since I last posted here, I have tested the effect of small differences in mounting height and angle on the performance of Reconyx Ultrafires and Cuddeback C1s. Very often camera traps have to be mounted at different heights and leaning at different angles depending on the slope of the ground, the shape of trees trunks, or the straightness of poles, but nobody has ever looked at whether this affects their image capture rates. This lack of hard data has forced the elaborate statistical models that are used to analyse camera trapping data to be based on untested assumptions about camera trap performance.

Reconyx Ultrafire's are no-glow video cameras that are used to record behaviour (they also do still pictures but if that is all you want there are cheaper ways of doing it). Cuddeback C1s are fast triggering, white xenon flash cameras that are used to gather sight-resight and occupancy data for population estimates. The Cuddebacks' video trigger is way too slow for recording behaviour. All the tests were carried out in daylight, shooting still images (as a proxy for video on the Ultrafires) and so their illumination systems did not affect the results.

TEST METHOD

The tests were improved versions of the earlier comparative shootouts, using six cameras of the same make mounted close together at different heights and angles. For each camera model the tests generated repeatable results where the only variable was camera mounting. Mounting differed in three ways; height (at 20 cm increments) (Fig 1), angle of dip (the angle below the horizontal that the camera is aimed) (Fig 2) and tilt (the angle that the camera is leaning to the left when viewed from behind) (Fig 3).

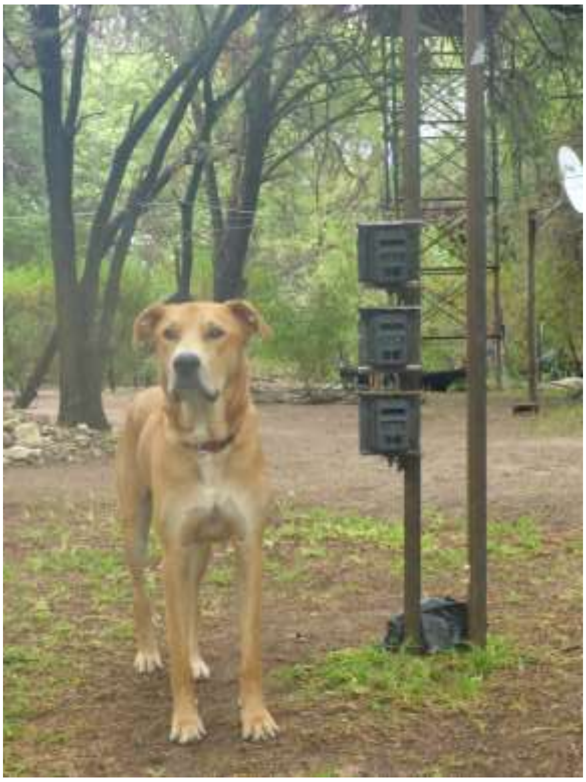

Figure 1. Three Reconyx Ultrafires mounted at different heights with zero dip and zero tilt.

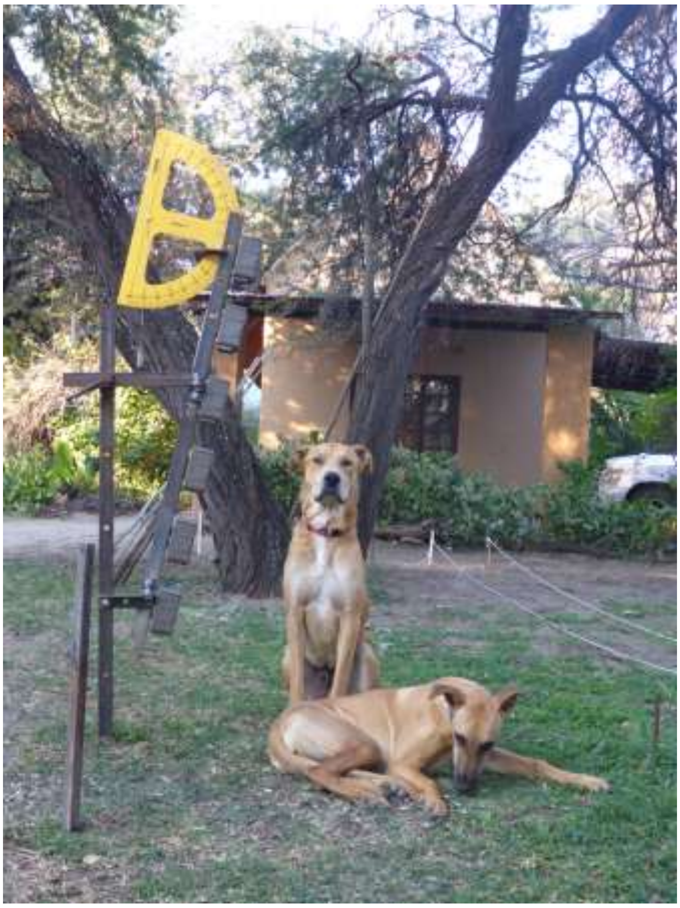

Figure 2. Cuddeback C1s at different heights, all with 10 degrees of dip.

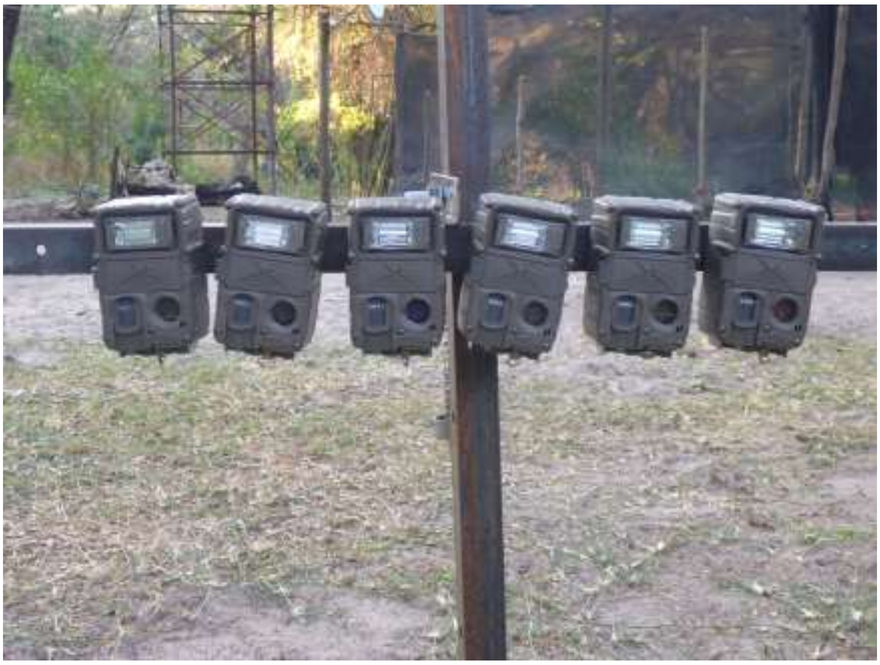

Figure 3 Cuddeback C1s mounted at the optimum height with, left to right, 2, 8, 0, 10, 6 and 4 degrees of tilt.

The target dogs walked across the field of view at right angles to its midline along tracks 50cm wide marked with thin rod about 20cm off the ground. For the Reconyx tests the tracks were 5, 5.5, 6, 7.5, 10, 12.5 and 15 m in front of the camera, for the Cuddeback tests they were 2.5, 5, 7.5, 10, 12.5 and 15 m from the camera.

For the Cuddeback tests the target dog wore a vest with a large black spot on it that could be located by automated image processing of whole sets of images using ImageJ. This was a huge improvement in both speed and precision over locating the dog manually on individual images. Strongly directional light causes problems, but that may be soluble by using colour processing.

Figure 4. Toffee the target dog with tacking spot walks across 5m in front of the camera.

RESULTS

This is just a very brief summary of the main results. I have submitted the Reconyx results for publication and a still need to write up the Cuddeback tests.

Reconyx

When the Ultrafires were mounted with their lenses 54 cm, 74 cm and 94 cm off the ground, height did not affect range, but mounting them lower increased penetration into the FOV before an image was captured.

The maximum range of the Ultrafires were very sensitive to dip, and much more sensitive if they were mounted lower; 5 degrees of dip reduced the bottom camera's maximum range to less than 5m (Table 1).

TABLE 1. The range of distances in front of the Reconyx cameras from which images were captured with combinations of height and dip. Green cells are combinations of height and dip where gave image captures over the full range. Minimum ranges of 2.5m are from a separate set of tests.

	DIP					
HEIGHT	0^{O}	1^{O}	2^{O}	3^{O}	4^{O}	5^{O}
54 cm	2.5-15	5-15	5-10	5-6	5-5.5	<5
74 cm	2.5-15	5-15	5-15	5-12.5	5-6	5-6
94 cm	2.5-15	5-15	5-15	5-15	5-12.5	5-7.5

Tilts of 5 and 10 degrees to the left did not affect range, but did increase penetration into the FOV before image capture.

Cuddeback

Cuddebacks were mounted with their sensors and lenses at 36, 56,76, 96 and 116 cm off the ground. Height did not affect maximum range but it did increase miniumum range. Cameras at 76 cm, 2cm below the target's shoulder height did not capture him at 2.5 m.

Dips up to 4 degrees had no effect on maximum range except for the bottom camera. Dips of 6 – 10 degrees reduced maximum range sharply at all heights. There were image captures over the full range of distances in front of the camera only with a limited subset of height and dip combinations (Table 2), and it looks as if the bottom edge of the PIR sensor zone is above the bottom edge of the field of view. The optimum height was 20 cm below the target's shoulder height.

TABLE 2. The range of distances in front of the Cuddeback cameras from which images were captured for combinations of height and dip. Green cells are combinations of height and dip that gave image captures over the full range.

	DIP					
HEIGHT	0^{O}	2^{O}	4^{O}	6^{O}	8^{O}	10^{O}
36 cm	2.5 - 15	2.5 - 15	2.5 - 12.5	2.5 - 2.5		
56 cm	2.5 - 15	2.5 - 15	2.5 - 15	2.5 - 10	2.5 - 2.5	2.5 - 2.5
76 cm	5 - 15	5 - 15	2.5 - 15	2.5 - 10	2.5 - 5	2.5 - 2.5
96 cm	7.5 - 15	5 - 15	5 - 15	2.5 - 12.5	2.5 - 7.5	2.5 - 5
116 cm	10 - 15	7.5 - 15	5 - 15	5 - 12.5	5 - 10	5 - 7.5

Tilt had surprisingly little effect on the Cuddebacks. Penetration into the FOV was increased on the side opposite to the tilt for cameras mounted higher than the optimum.

SUMMARY

The take-home message is that to get rigorously comparable data from camera traps you have to mount all the camera the same relative to local topography.

NEXT

I plan a shootout for trigger speed between Cuddeback C1s, Reconyx HC500s and Panthercams with running dogs as targets, and to repeat the height, dip and tilt tests with the HC500s and Pantheracams.