# Goanna News, September 2021- Lockdown mega-edition

It has been so long since the last Goanna News (in Nov 2020) that you might have thought the goanna project had ended.  Well no. It is still going.

## ***Hatchling Patrols***

The last Goanna News reported that 16 goanna nests had been found in *Nasutitermes exitiosus* termitaria. Later patrols found two more, a total of 18 goanna nests. Cameras on the nests recorded the comings and goings of hatchlings but also revealed repeated visits by adult goannas. None of these goannas dug into the mound and no predation of hatchlings was seen. (Nor was any bird predation recorded this year.)  Also, we captured hatchlings at some nests and took DNA samples for future study.

**Figure 1: Hatchling Rosenberg's Goanna (left) and adult visiting hatchling exit hole(right).**



## ***Trapping, and GPS tracking of adult goannas in 2020/21***

Having successfully tracked male goannas for several years with GPS, our highest priority now is to obtain adequate movement data on females. In the first two years, trapping, noosing and hand capture had produced only 2 females (and 39 individual males). In 2019/20 we managed to add six more females (and in the process, 32 additional males, giving us 71 in total). Eureka! We had found we can trap females by starting earlier in the goanna active season, ie in October up to the first half of November.

Unfortunately, that year my mini-male-style GPS harness proved unsuitable for girls. All GPS packs were quickly shed. With no further opportunity to capture females that year , the following goanna season, 2020/21 became our big year for females – our second attempt to track some females for most of the active season. It was vital to catch sufficient females and equally vital to successfully attach the GPS packs. So, how did we go?

Because the hatchling patrols had to be extended well into November (new hatchling exit holes kept appearing) there was an overlap with trapping. With the extra effort being put into trapping, some hasty work was required at times.

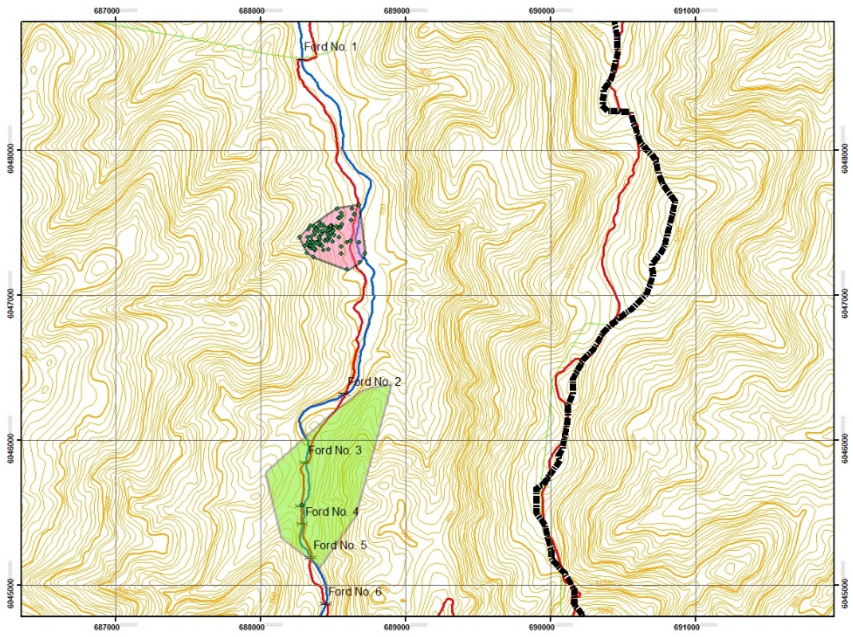
There were 91 goanna captures, involving 55 goannas, of which 35 were cleanskins and 20 had been recorded in previous years. Seven of the cleanskins and one of the recaps, were females, eight in all. Wahoo! We had the number we needed! And all six female-sized GPS packs were successful - at first.

But now over the ensuing weeks, our third female challenge revealed itself. Goannas shed patches of scales unpredictably, so weekly radio tracking visits enable us to check each of them every few weeks to check them for signs of shedding in the area around the backpack. Then, as necessary, we hand noose them to reglue their backpack. That system has worked well enough with males which rely on their camouflage to avoid detection. When we are following their radio signal, that reliance on camouflage makes them easier to inspect and to recapture. However, when we are in the general area, females seem to enter burrows. We successfully tracked females many times to burrows but no inspections reported shedding, because on most occasions their backpacks were not actually seen. All but one GPS pack were shed prematurely, a disappointing outcome.

**Figure 2: The underside of a shed female backpack, covered in old scales.**

On a brighter note, we did record some movement data from the shed backpacks. The numbers of GPS fixes were insufficient to meet accepted scientific standards for calculation of home range but the pattern recorded is still helpful. The data suggest females were faithful to home ranges much smaller than the male home ranges, which is the usual case among vertebrates. Figure 3 is a map illustrating that typical pattern.

**Figure 3: The home range of male Goanna H in 20/21 (57 ha) (green shading); and the partial home range of female Goanna E3 (13 ha) (pink shading). Goanna H has been tracked for three full seasons and has never migrated. Unfortunately the female data do not cover the time of year when some goannas migrate. Thus we cannot yet say with certainty whether this female migrates.**




One of the most interesting findings in the four years of this study came from the only female backpack that was re-glued before it was shed. That female exhibited a contrary pattern. Goanna M7 is the smallest goanna in the study. Home range generally scales with size, so we would predict a home range of around 10 ha for M7, which is a tiny area, equivalent to a square 316 m wide.

In reality M7 ranged repeatedly around an area more than one thousand times bigger than the largest male home range - about 110,000 ha, which is equivalent to a square 3,300 m wide. Her movements stretched from near the Murrumbidgee River in NSW, across the Clear Range and the Naas River to near the top of the Booth Range, and back again.

We must resist the temptation to speculate that this exceptional behaviour is explained by M7 being the only GPS-carrying female located outside of the area where *Nasutitermes* termite mounds occur. There are alternative possibilities. For example, what now appears to be a large home range could actually be migratory movements of an unexpected type, or M7 may prove to be 'different' - the only goanna who does such large, and apparently undirected, movements.

It is a high priority to track M7 in 2021/22, and other females outside the *Nasutitermes* area, as well as ones within the area. Hopefully, M7 is still carrying her GPS. (Road closures and Covid closures in Namadgi have prevented us from checking on her.) There is more comment about M7 under 'Plans for this 2021/22 season'.

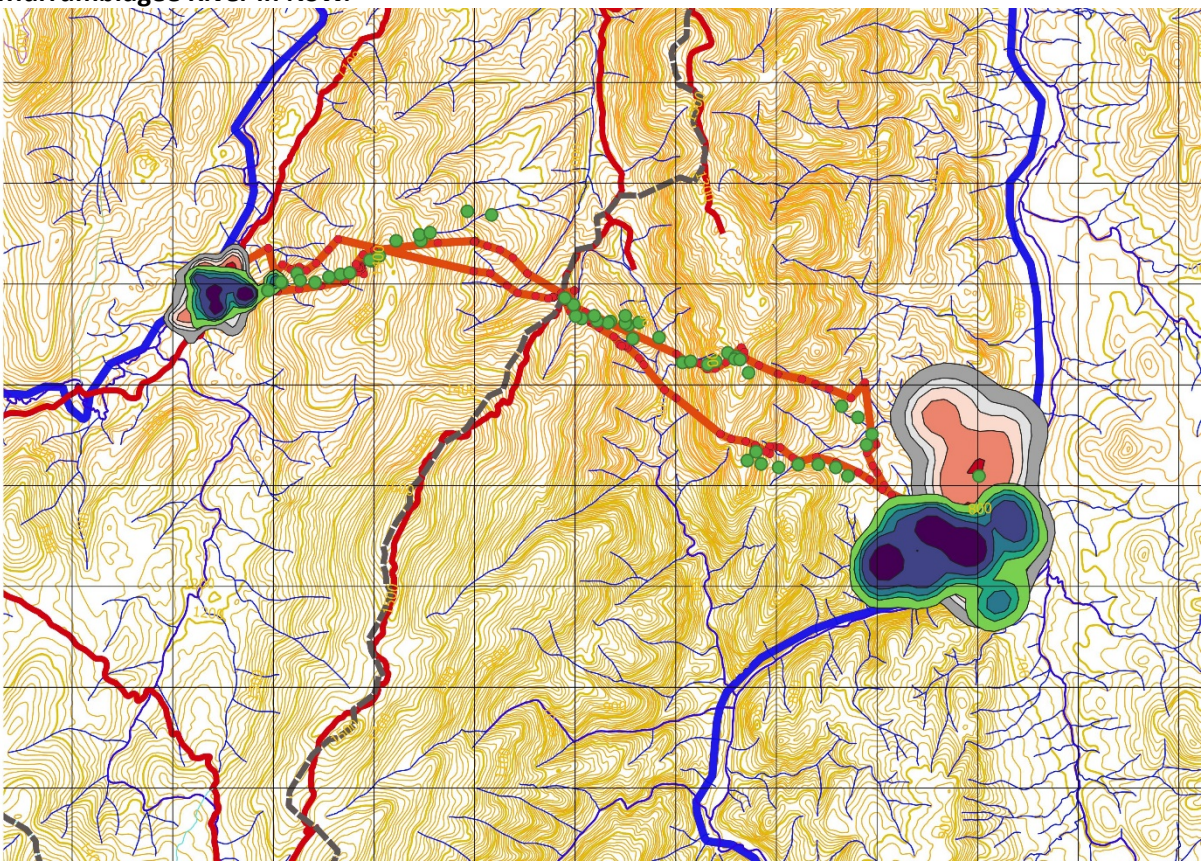
Male goannas tracked in 2020/21 provided a more satisfying story.

Goanna 35 was only the second male we have tracked which was captured in the *Nasutitermes* area. Like Goanna H living nearby, for which we now have three full seasons of data, 35 did not migrate. This adds weight to the suspicion that the migrations are undertaken to bring males to areas where *Nasutitermes* occurs, presumably because receptive females are found there. Goannas H and 35 live in the *Nasutitermes* area all year.

Goanna 35 has half his home range outside Namadgi. On Chris Rowley's grazing lease, Goanna 35 moved from tree clump to tree clump. Contrary to my expectation, he spent relatively little time in the grassy parts of the grazing lease although the cattle had been sold two years previously and the grass was long enough to afford cover to goannas.

As well as adding 35 to the tracking project, we also tracked male goannas 3, 5, 14 and 18 for an additional year. Goanna 3 had migrated every year for 4 years and 5 had migrated in both previous years to points up to 12 km away. However neither migrated this year. This is the proof that annual migration is not obligatory. Meanwhile, Goanna 18 again migrated to the Bumbalong rural residential area in NSW (Figure 4).

**Figure 4: Movements of a male Rosenberg's Goanna (18) living in the upper Naas Valley of Namadgi National Park, during two active seasons: Red lines and red-grey probability contours (50%, 70%, 80% 90% and 95% kernel density) show the 2019/20 primary home range (small polygon on left beside Naas River) and breeding range (larger polygon on right). Green dots and green-blue contours show the corresponding features in 2020/21. The dashed grey line is the ACT/ NSW border and the boundary of Namadgi National Park. The primary ranges are in the ACT national park but both breeding ranges are located in a rural-residential area beside the Murrumbidgee River in NSW.**



Including Goanna 18 (Figure 4), three of our goannas that apparently live in the Naas Valley, and are apparently protected within Namadgi National Park, have been revealed by our GPS tracking to be visiting hobby farm areas along the Murrumbidgee River in NSW in late December and early January. In such places they could potentially consume pest species like grasshoppers, or eat rats and mice made moribund by slow-acting anti-coagulant toxins. We have learned that Bogong Moths transport a toxin, Arsenic, into protected areas of Kosciuszko National Park. Is it possible for goannas to be doing something similar, bringing insecticides or anti-coagulants from NSW farms into Namadgi?

***Toxic goannas?***

With those movements in mind, I submitted Namadgi goanna livers to Mel Snape's (Conservation Research) national anti-coagulants survey. I have not heard about the goanna samples in particular, but an amazing 80% of wildlife samples (from all species) contained concerning levels of 2nd generation anticoagulant pesticides. One compound, Brodifacoum (the main rat and mouse poison sold in my local supermarket and probably elsewhere in Australia), was responsible for 70%. So-called 'first generation' anti-coagulants like Warfarin are probably safer because they do not persist as long in living animals.

***Parallels and comparisons with other movements studies***

At the link here is an interesting article about the study of animal movements, based on research just published in the Journal of Ornithology on Black-crowned Night Herons.

100 years ago biologists at the Smithsonian Zoo in Washington DC wanted to know why their Night Herons were declining. They did not know where the herons went in winter and suspected the answer lay there. So they started the scientific study of bird movements in the USA. *'Knowing where birds go and what threats they may encounter throughout the year can help us learn about causes of declines for certain breeding populations'. 'For example, in the 1990s, scientists observed an alarming decline of Swainson's hawks in the U.S. They decided to follow the birds to their wintering grounds in Argentina. They discovered farmers were using a pesticide for insect control on their fields that had been banned in the U.S., but not in Argentina. The birds were eating the poisoned grasshoppers and dying in large numbers. Because scientists tracked the birds to their wintering locations, they were able to figure out why the birds were declining and ban the use of the pesticide. Today, Swainson's hawk numbers are stable.'* This comment about Swainson's Hawks reminded me of Rosenberg's Goannas visiting farms in NSW – see Figure 4 and 'Toxic Goannas?'

The Smithsonian biologists started fitting conventional numbered leg rings (aka bird bands) to their Night Herons, 100 years ago. But rings were only ever recovered from the summer range, i.e. that technology did not answer the question. So …. *In 2013, 'Smithsonian researchers began tracking the birds* [using GPS] *in order to unravel the mystery of where these birds spend the winter. In the last five years, we've attached transmitters to 18 adults (12 satellite transmitters and six cell phone transmitters).* And the Smithsonian biologists also collaborated with researchers from Ohio, another place where Night herons spend the summer. Their joint conclusion was published three months ago in the *Journal of Ornithology,* then in the popular article at the link given above.

It took five years to get GPS data from just 18 birds. Note that the birds were captured in the National Zoo, using standard avian methods, to attach a standard design falconry harness, by scientists employed in the highly regarded and well funded Smithsonian Institution. It took a further three years before the results were published (eight years in all). The comparison to our Rosenberg's Goanna Project reminded me about a harsh comment made earlier this month, that our four-year Rosenberg's Goanna project had 'made no progress'. Beauty is in the eye of the beholder I suppose. It depends what perspective you take to examples like the Smithsonian Institution's study of Night Herons and our study of Rosenberg's Goannas, whether you just see wasted money and unnecessary delay, whether you recognise any science progress before publications appear, and (importantly) whether you recognise gains made other than the number of publications. I totally reject the 'no progress' assessment! But to anyone who judges us only by the number of papers published (none so far), I say, there is light at the end of the tunnel. See 'Project Outline'.

***Mt Ainslie survey in February***

In February I undertook a paid project with Parks and Conservation to conduct a survey for Rosenberg's Goanna at Mt Ainslie. I hired Lisa Jokinen to do most of the work. She is one of the

undergraduate students who joined the project in 2019 (see previous Goanna News editions). But don't expect to often see Lisa at Naas valley in 2022 as she will be doing her Honours year on Jacky Dragons.

Our report is the property of Parks and Conservation but they have allowed me to distribute copies so just ask me if you want it. Lisa and I will be presenting a talk about the survey to the ACT Herpetological Society in December. Part of our payment for the survey is being used to obtain equipment that will be helpful for the project in Naas Valley.

Figures 5 and 6 hint at aspects of the survey. A large number of enthusiastic volunteers were involved, in rebaiting cameras and replacing memory cards and batteries. Unleashed dogs were recorded at a high proportion of goanna baits. Three goannas were recorded, and only once each, too few to enable the type of mark -resight analysis we had hoped to do. One was a goanna christened 'Rex' by Matthew Higgins in 2015. The others were new.

**Figure 5: Volunteers maintaining a camera trap (left)and unleashed dogs visiting a goanna bait.**


Three other goannas, recognisable from photos of their faces, have been recorded on Mt Ainslie in previous years, but were not detected in our survey (Figure 6). Thanks to the previous photographic efforts of Matthew Higgins, Luke Dunn and others, we now have good face photos of six individual goannas at Mt Ainslie, including the two new individuals first recorded in the February survey.

Please, if you ever get the chance to photograph a goanna at Ainslie Majura, try to get a clear image of its head, preferably from both sides, and provide the images to me and someone at PCS for our shared database. Currently, that someone should be Hannah Matthews or Maree Gilbert.

**Figure 6: Male Goanna 'Rex' (left column), photographed by Matthew Higgins in 2015 (top row) was detected in the February 2021 camera survey (lower row) but 'Rosie' (right, top row), 'Luke Dunn's Goanna' (right, lower row) and 'Roxy' (not shown) were not detected in the February 2021 survey.**

***Winter 2021***

We generally remove GPS packs in the last part of the active season before goannas enter brumation in their long winter burrows. During winter the GPS equipment is returned to Telemetry Solutions in the USA to be refurbished with new batteries, ready for the next goanna active season. Usually some of the radio aerials from the male goannas also need replacement. When we remove the GPS pack, we replace it with a small VHF radio transmitter if that goanna is wanted for GPS tracking again the next season. Trialling a new approach this year, the GPS packs were left on three goannas M7, 18 and 5. One of our first actions in the coming 2021/22 season will be to retrieve those GPS packs and in some cases, replace them with new.

Unlike previous years we did not have a regular radio tracking program in winter 2021. Partly because the road mostly remained closed by flood damage, only a little maintenance type work was done. See Figure 7.

**Figure 7: Project stalwarts, Kevin, Sonja, Isobel and their leader John, drove and mainly walked to retrieve the eight traps we had placed to the west of Boboyan Rd, higher up the Naas Valley than ever before.**

Meanwhile, I snuck away with Kerry, and joined many others who escaped to northern Australia between lockdowns. Figure 8 shows Mertens Water Monitors (*Varanus mertensii*) in the Top End at one of the pools where we had a swim. Most Top End goanna species are relatively inactive in the dry season but Water Monitors are the exception - active all year - so we met them in various places.

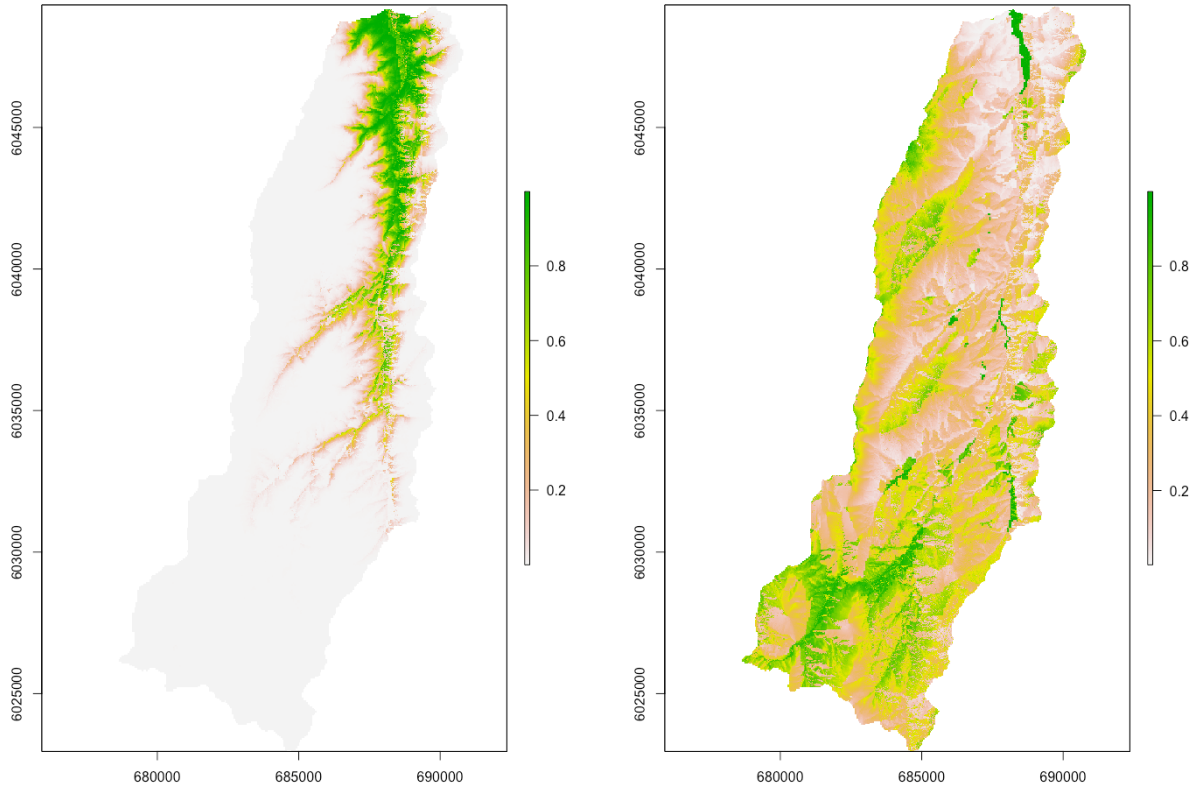
**Figure 8: Merten's Water Monitors (*Varanus mertensii*) Their tails are flattened to aid in swimming.**

***Termite distribution model***

Ewen, another of the students who joined the project in 2019 has been working in his spare time toward a model of termite mound distribution in Naas Valley. This is intended to be an ingredient in

our analysis of goanna movements, but expert opinion from a termite researcher tells us that it is publishable in its own right in a good entomology journal. Ewen's earliest maps are in Figure 9. More convincing models have been developed since.

**Figure 9: First draft modelled distributions of *Nasutitermes exitiosus* (left) and *Coptotermes lacteus* (right) in Naas Valley. Both over-predict the distribution.**




Once we have a statistically satisfactory model for both species, we will want to field-test the *Nasutitermes* predictions in the valley of Gudgenby Creek, which is immediately northwest of our site. So that means more sweep counts! This summer we hope.

***New harness design***

In making up the saddlebag harnesses for 2021/22, I suddenly realised that I can achieve a better contact between the glued surface and the skin of the goanna AND make the sewing much easier. See Figures 10 and 11. The hi-tek fabric is donated by Mont Adventure Equipment. It is super strong and lightweight, does not hold water, and is UV resistant. The side that we glue is cotton faced.

**Figure 10: Male and female-sized GPS packs of the new design under construction. They have a larger and smoother contact with the goanna's skin and are easier to sew than any of the previous designs.**

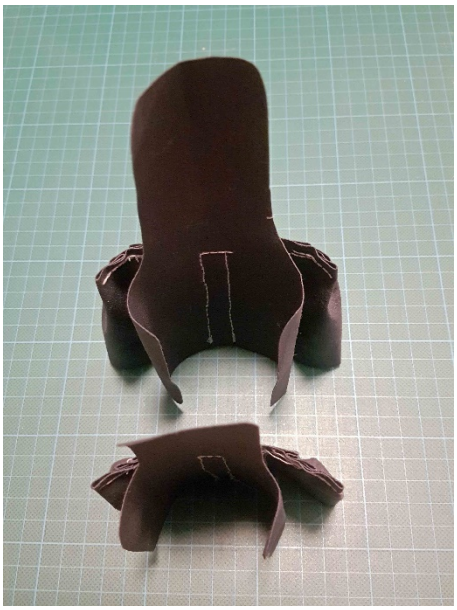


**Figure 11: Eleven GPS packs in production for use in the 2021/22 goanna season. This year we have four sizes: male, female, long female and nano. The protruding wire aerials are part the VHF radio beacons used for manual tracking. Red tapes hold magnets in place which keep the radios turned off. These GPS packs will be ready to use after new software has been installed in the GPS devices (not shown), which will then be sewn into the saddlebags on the opposite side to the radios.**

***Tarweed***

Isobel discovered the invasive Tarweed (*Madia sativa*) for the first time in the ACT a few years ago at Gudgenby and notified authorities. This year we discovered it is spreading down Nass Valley Fire Trail (presumably spread by vehicles). An effort was made to remove these plants (Figure 12), as with other localised weeds we have encountered during the project (e.g. the only Willow in the Reedy Creek catchment, and see previous editions of Goanna News).

**Figure 12: Tarweed being hand pulled by Debbie and John; Inset, its flowers**


***Updated project outline***

Numerous forms and documents have to be updated annually before each goanna season, including our licence under the ACT Nature Conservation Act, and our Animal Ethics papers. One of these is the Protect Outline. It states three areas of endeavour for the project, Science, Involvement and Extension, lists many of our achievements in the project, and defines aims and expectations for the coming year. A notional list of intended publications is included in the 2021/22 edition. Let me know if you need a copy.

***Plans for this 2021/22 season***

As previously mentioned, our highest research priority in regard to the study of goanna movements is to get good data from some females. However, due to Covid, it is unclear whether we will be allowed in to Namadgi this year in time to capture female goannas. (They can be trapped in October and to some degree in early November.) In any case, providing we are able to get access before mid-December, it is worth tracking some more males so that the number of males for which we have three seasons of data is increased from seven to ten. If you would like to help with trapping for female or male goannas, let me know please.

***Any volunteers for monitoring the 18 nest mounds?***

Brian pointed out to me the interest in determining the extent of re-use of the 18 termite mounds we found last spring which had goanna nests in them. The 18 mounds can be checked in a day by two to six people. Let me know if that could be you, in case we get access into the area in time. Also we can again use cameras to help monitor mounds, so if you are willing to do camera installations (after a brief introduction from me) please get in contact.