4 Exposure characterisation: identification of the extent of the problem

4.1 Tropical fire ant habitat preferences and reasons for preference

The constantly changing and hostile landscape at Ashmore Reef is suited to *S. geminata* being a pioneer species or one that is a great coloniser of disturbed habitats. *S. geminata* nests have a broad tolerance for nesting sites and are usually found in the soil around bare ground, grasslands or in lawns. They also are common in orchards, woodlands and sandy areas., but are known to avoid shaded areas (Chin 2004, Yates 2005, Taber 2000).

S. geminata are known to harvest seed including *Amaranthus*, which were collected as seeds from nests in Hawaii (Taber 2000). *S. geminata* have previously been observed to tend aphids on *Amaranthus interruptus* found on the East and Middle Island at Ashmore Reef. The effect of tending aphids can cause decline with the *Amaranthus* from feeding pressure by the aphids, or through virus transmission.

The soil profile of the islands at Ashmore Reef is predominantly a coarse but uniform beach sand around the island perimeters with fine sands towards the interior. On West Island there are some small areas of extremely hard sandstone rock near the old well and old weather station site.

S. geminata have a large tolerance for temperature variation. A critical maximum temperature of 45°C has been observed to cause 50% mortality after 30 minutes with 25°C to 33°C optimal and a lower threshold for 2°C (Taber 2000). They also have a preference for low altitudes (Taber 2000). There are no continuous climate records from Ashmore Reef due to the vandalism to the weather station in the late 1960s. Estimates in the region from Kupang and Troughton Island have temperatures ranging from 22°C to 36.4°C and average humidity from 56% to 78% (Glenn 2004). The islands experience monsoonal activity during December to May (Pike & Leach 1997, Russel et al 2004).

S. geminata was reported by Brown to have been wide-spread on all three islands at Ashmore Reef (Russell et al 2004); however, no quantitative observations or collections of this ant species have occurred. Ashmore Reef provides abundant food, suitable climate and abundant nesting sites, and it is probable that *S. geminata* is now well and truly established on all the islands.

4.2 Current distribution and density of tropical fire ants on Ashmore Reef

4.2.1 Methods

The systematic sample grid, described in section 3.5.1, was used to map the distibution and abundance of tropical fire ants during the survey conducted in September 2004. The two centres of adjacent grids were placed approximately (±5–10 m) 50 m apart on Middle Island, 60 m on East Island, and 80m on West Island for a total sampling area for each grid of 0.25 ha at Middle Island and 0.36 ha at East Island, and 0.64 ha at West Island (Appendix 7).

Ants were surveyed using two methods:

- Pitfall traps
- Baits

Pitfall traps

A single pitfall trap was set at each way-point positioned at the center of each grid. The pitfall traps were 30 ml polycarbonate vials filled with 20 ml of 70% ethanol. The vials were pushed into the ground ensuring that the soil, dead grass or beach sand was flush with the mouth of the vial. To assist with recovering the pitfall traps, each one was marked with a wooden bbq skewer (30 cm) taped at the top with red electrical tape for flagging (Figure 30).

Figure 30 Pitfall trap in dead grass

Pitfall traps were set for nocturnal and then diurnal periods. For nocturnal periods the bait stations were set in the evening and collected the following morning (approximately 15 hours). While collecting the nocturnal pitfall traps the diurnal pitfall traps were then set. They were collected approximately 9 hours later in the afternoon. At each way-point, and the closest bird species and their direction to the waypoint, were recorded (Appendix 8). Ant collections were sorted and identified in the laboratory.

Baits

The bait-attractant trial was set after the completion of the pitfall trial. At each way-point in the grid, three baits were offered separately, one metre apart in a triangle formation. No pesticides were added to the baits.

The bait were as follows:

- Oil-based bait: Home Brand Smooth Peanut Butter. One heaped teaspoon per petri dish, approximately 15 g.
- Protein bait: Sealord chunky style tuna in springwater. Approximately 20 g per petri dish.
- Sweet bait: Beechworth honey (applied undiluted). 1 teaspoon approximately 2–3 ml.

Baits were placed into a 9 cm petri dish that had been modified to reduce interference by birds and hermit crabs (*Coenobita* sp.). Using a soldering iron, four holes were made around the walls of the lower petri dish to allow access for the ants. Single holes were also made through the lid and base so that the marker could secure the unit to the ground Figure 31).

Figure 31 Peanut paste bait station

The following system was used to rank the abundance of ant density in each of the bait stations:

0. 0 = nil (mid-point 0)
1. 1 = 1–5 ants (mid-point 3)
2. 6–20 ants (mid-point 13)
3. 21–100 ants (mid-point 60.5)
4. 100 plus ants (mid-point estimate 100)

Two additional classes were:

5. Abandoned: evidence of ants taking bait but no ants were remaining at time of rating
6. Destroyed: hermit crabs took the bait

Once ranked, any pitfall traps that contained ants were placed into a plastic ziplock bag. The ants were killed and preserved for later identification in the laboratory.

While ranking the bait abundance trial at Middle Island, *Solenopsis geminata* colony trails and the location of visible ant nests were all mapped in relation to the bait stations (Appendix 9).

Hand collections were usually made at the completion of the bait trials. These were to provide information pertaining to any further behavioural observations of *S. geminata*, interactions with the birds, collections of the other ant species and observations of their nests where possible, as well as general insect fauna collections.

4.2.2 Results

Middle Island

Middle Island was sampled from 14–17 September 2004. Four species of ants were collected from this island (*Solenopsis geminata*, *Tetramorium simillimum*, *Monomorium* sp. and *Tapinoma melanocephala*). *S. geminata* were spread across the entire island and were found in all vegetation types and baits. *T. simillimum* were attracted to tuna and honey and both shaded vegetation (*Tribulus* sp.) and open ground. *Monomorium* sp. was found at one location

near the eastern shoreline and was attracted to tuna. *T. melanocephala* was found at one location on the southern shoreline (near W46). They were attracted to some left over honey (not part of the bait trial) (see Appendix 8 for details of data) (Figures 32–34).

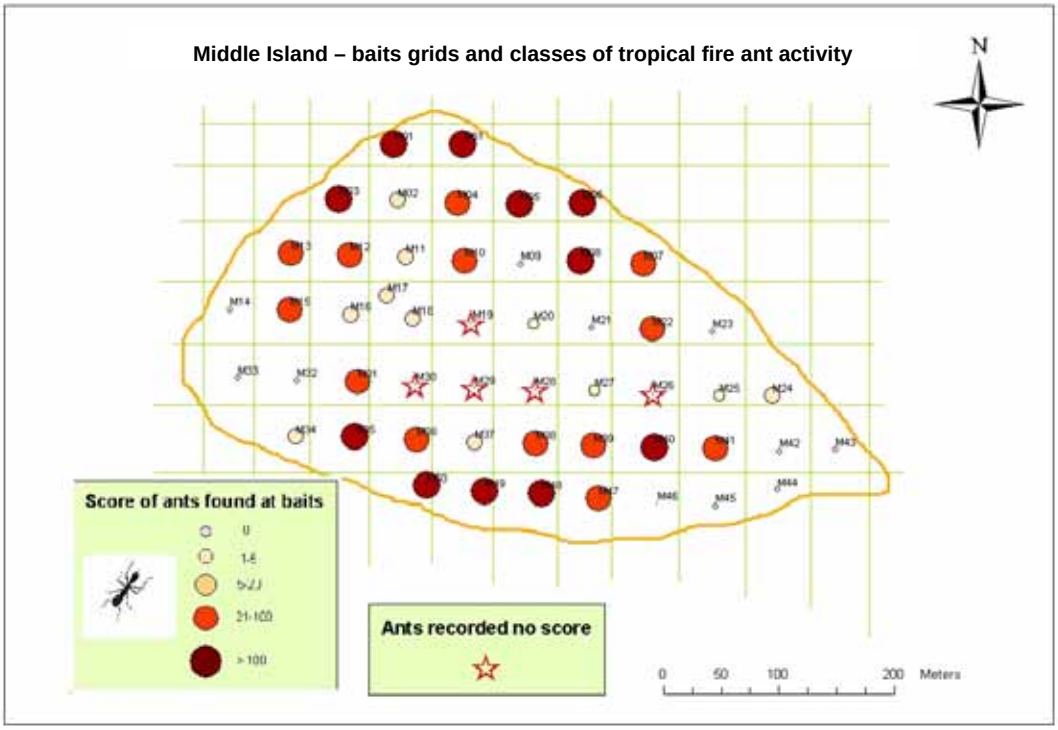

Figure 32 Middle Island. Distribution of the five abundance classes of tropical fire ants recorded visually at bait stations in the centre of each grid cell.

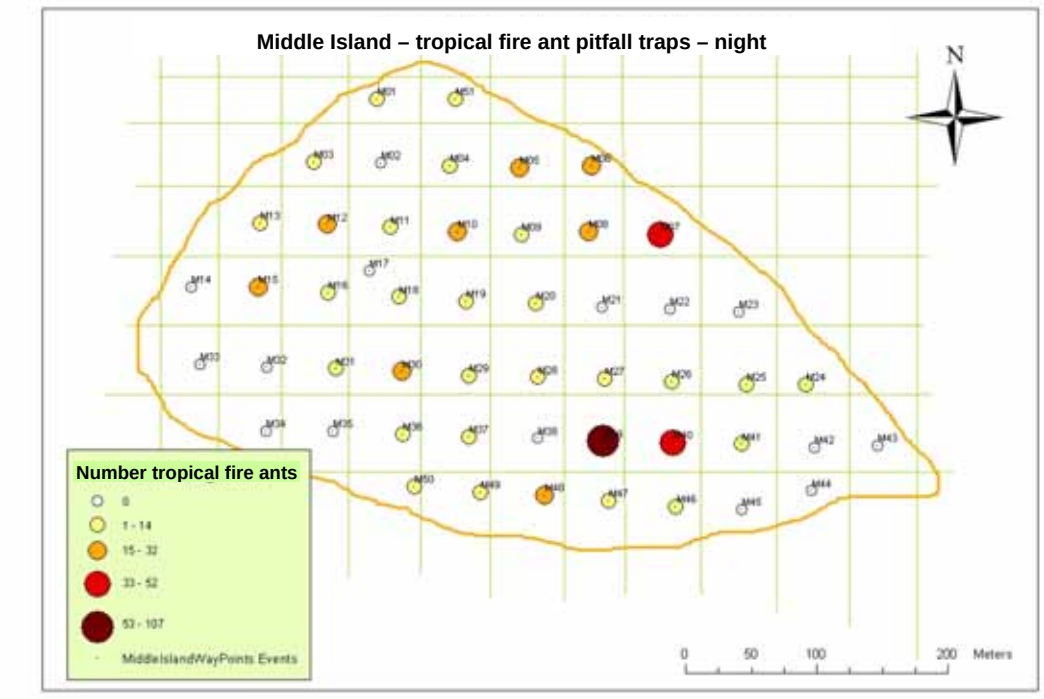

Figure 33 Middle Island. Distribution and abundance of tropical fire ants across the sample grid as ascertained by pitfall traps set at night.

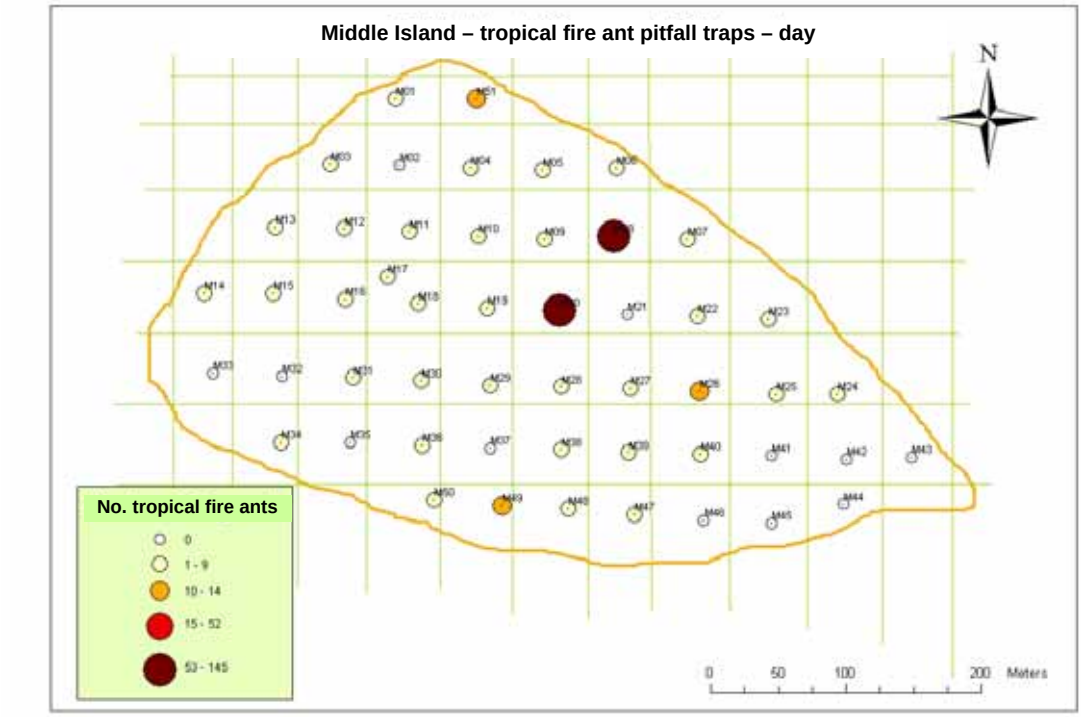

Figure 34 Middle Island. Distribution and abundance of tropical fire ants across the sample grid as ascertained by pitfall traps set during the day.

The tropical fire ant nests were usually found in proximity (0.5 m to 2.0 m) of the baits stations. Larger distances of 3.0 m to 4.0 m were less common, while one trail was recorded at 9.0 m (see Appendix 9 for details) (Figure 35).

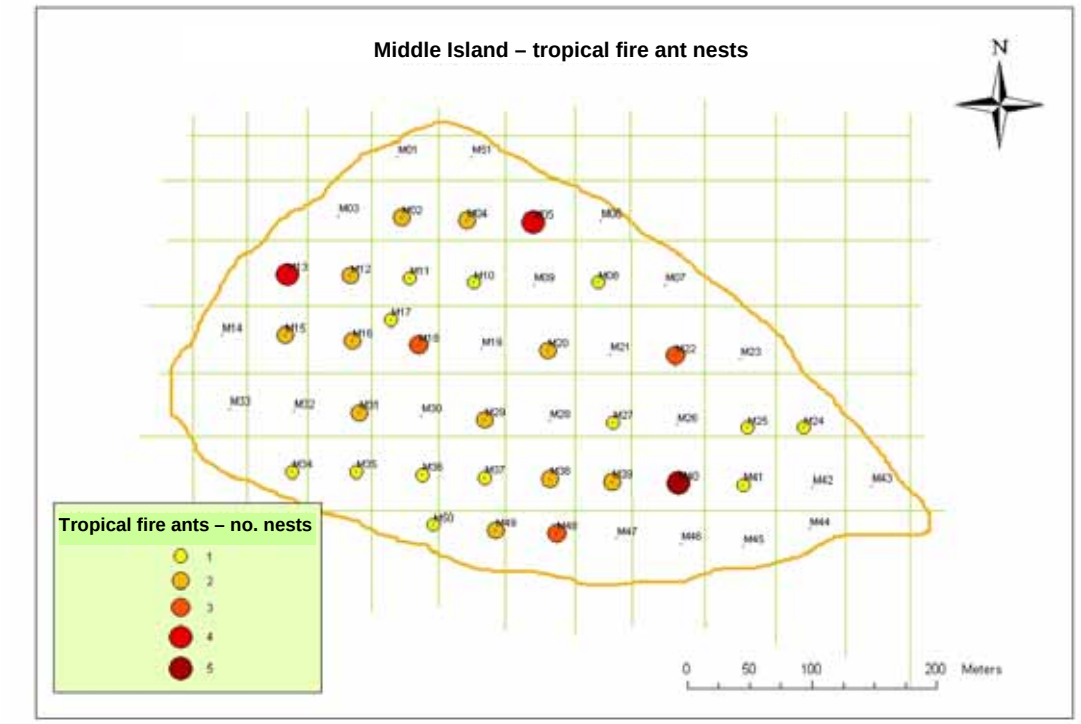

Figure 35 Middle Island. Distribution and abundance of tropical fire ant nests found across the sample grid.

West Island

West Island was sampled from 11–14 September 2004. Five species of ants were collected from this island (*Solenopsis geminata*, *Paratrechina longicornis*, *Tetramorium simillimum*, *Cardiocondyla* sp. and *Monomorium* sp). *S. geminata* were not as abundant on West Island. They had a scattered distribution and were found in all vegetation types and baits. *P. longicornis* were the second most abundant ant species. They were attracted to all bait types and were found mainly around the island's perimeter. *T. simillimum* were lowly abundant and favoured the long dry grass vegetation found in the islands interior. They went for all bait types. *Cardiocondyla* sp. were not collected from any of the baits. They were in low numbers and were collected from various vegetation types. *Monomorium* sp. were only found near the Indonesian graves and were attracted to honey and peanut butter (Appendix 8) (Figures 36–38).

East Island

East Island was sampled from 7–10 September 2004. Two ant species were collected from this island (*Solenopsis geminata*, and *Tetramorium simillimum*). *S. geminata* were spread across the entire island and were found in all vegetation types and baits. *T. simillimum* had low abundance and distribution. They were attracted to all baits and were found in shaded lush green vegetation (*Tribulus* sp.) and open ground (Appendix 8) (Figures 39–41).

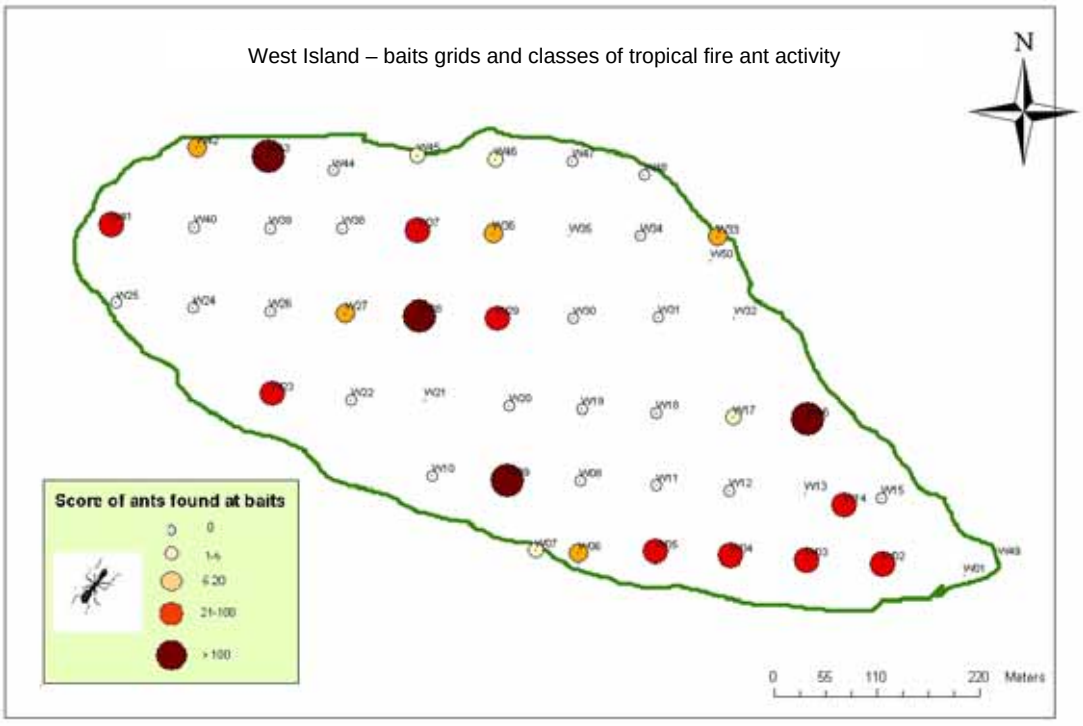

Figure 36 West Island. Distribution of the five classes of abundance of tropical fire ant activity visually recorded at bait stations in the centre of each grid cell.

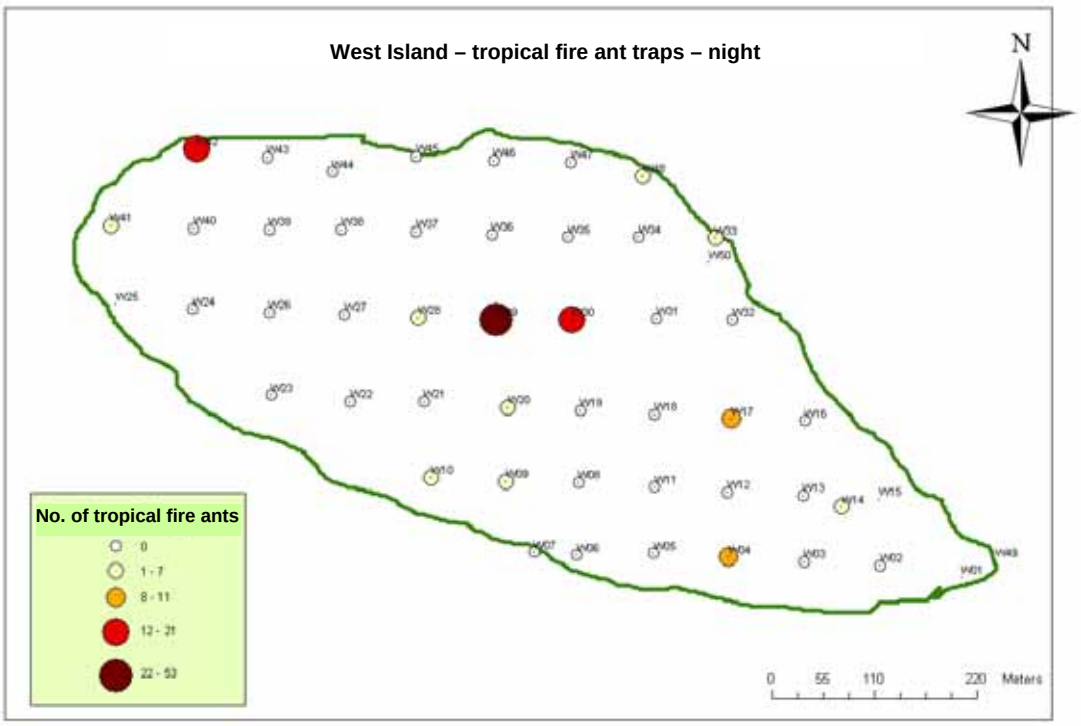

Figure 37 West Island. Distribution and abundance of tropical fire ants across the sample grid as ascertained by pitfall traps set at night.

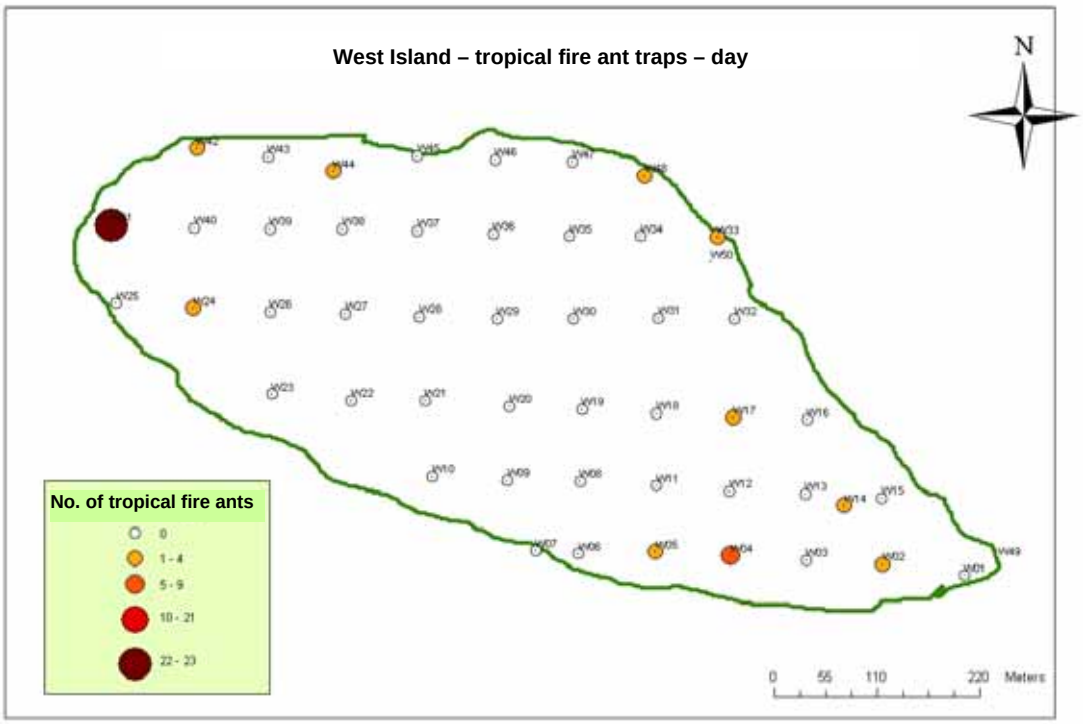

Figure 38 West Island. Distribution and abundance of tropical fire ants in each sample grid as ascertained by pitfall traps set during the day.

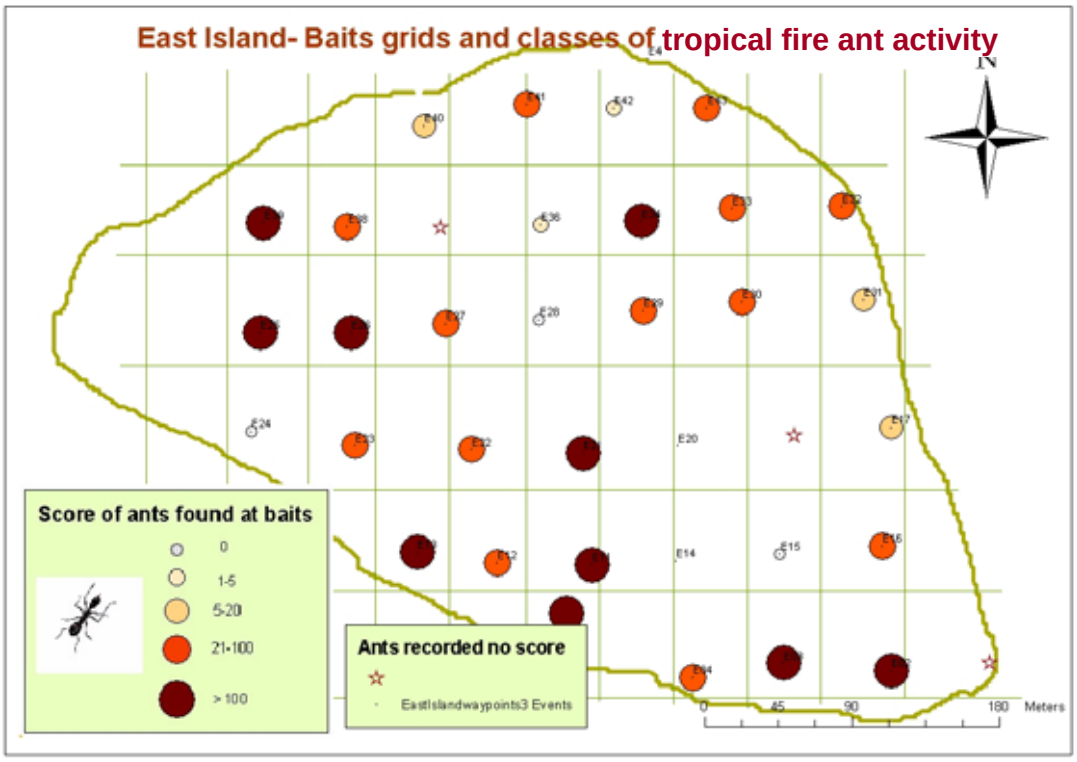

Figure 39 East Island. Distribution of the five classes of abundance of tropical fire ant activity visually recorded at each sample grid point.

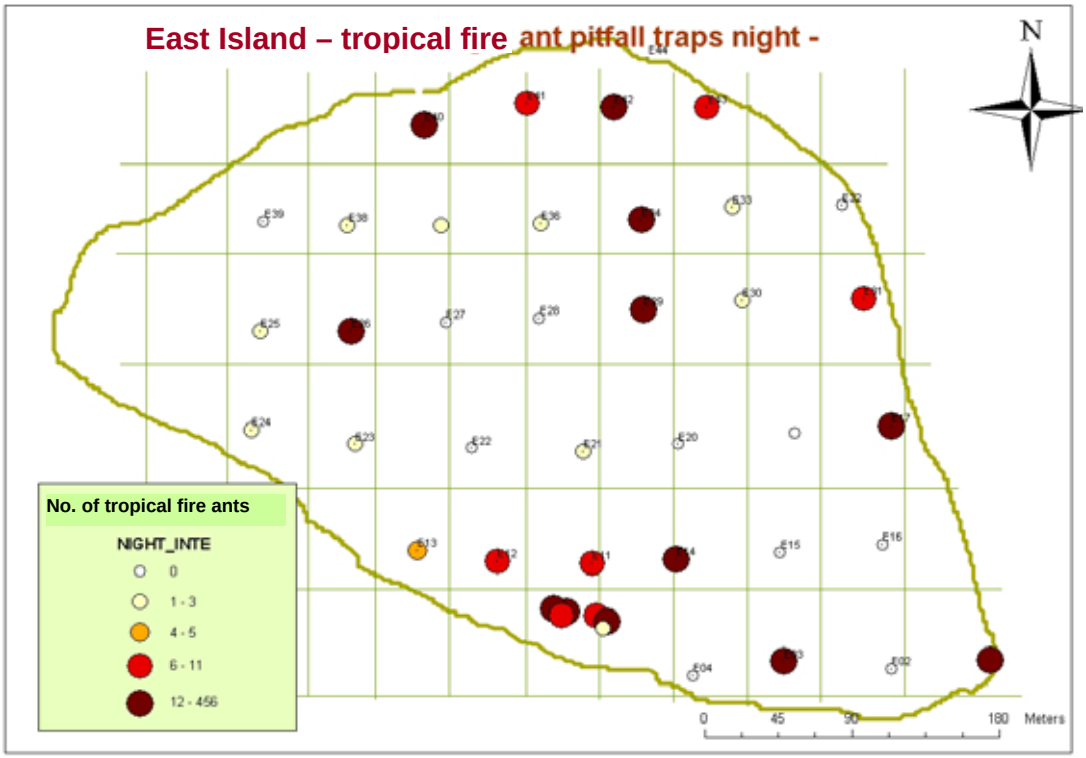

Figure 40 East Island. Distribution and abundance of tropical fire ants in each sample grid as ascertained by pitfall traps set during the night.

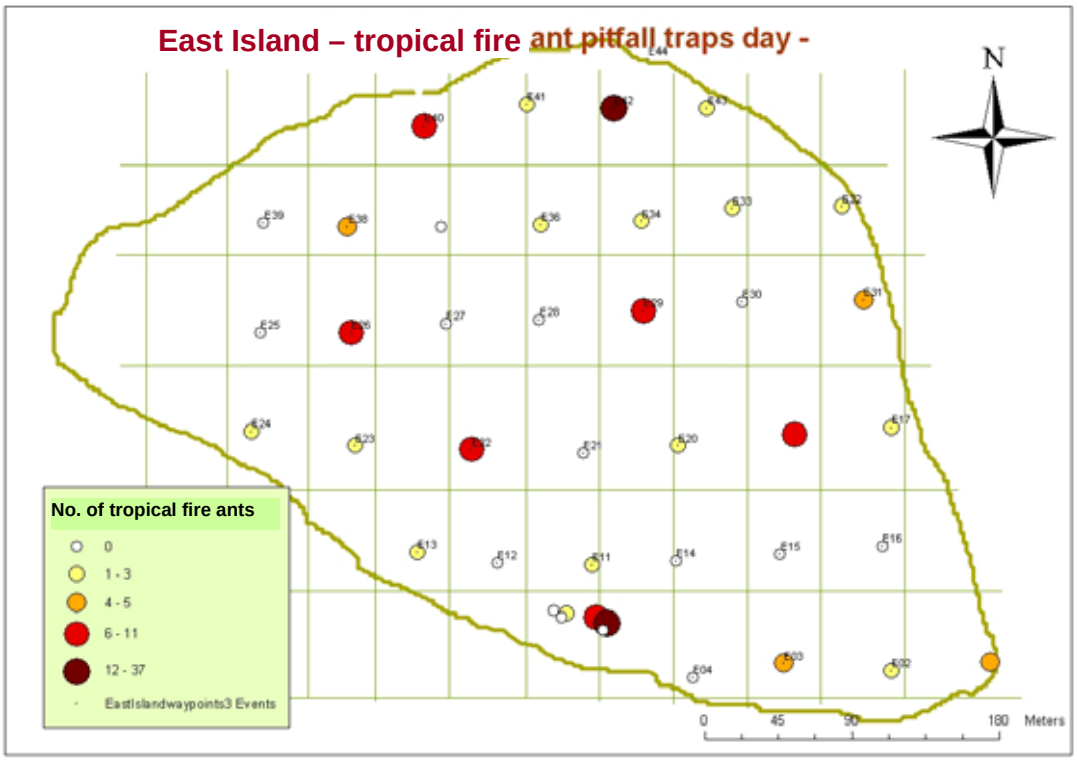

Figure 41 East Island. Distribution and abundance of tropical fire ants in each sample grid as ascertained by pitfall traps set during the day.