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HOT TOPICS IN ECOLOGY

Broadcast Baiting May Ultimately Help Fire Ants Spread, Not Eradicate Them

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Broadcast baiting efforts are not eradicating fire ants in SE Queensland; targeted, species-specific strategies offer better control and community engagement.

Red Imported Fire Ant (*Solenopsis invicta*—RIFA; Figure 1 and Figure 2) is identified as a key threatening process in Australia under the Environment Protection and Biodiversity Conservation Act 1999 by reducing the biodiversity of Australian native fauna and flora (DCCEEW 2021). The control/suppression and eradication strategy of RIFA in South East Queensland (SEQ) (Scott-Orr et al. 2021) is the world's largest invasive ant removal effort, targeting infestations across 850,000 ha (Wylie et al. 2024). The strategy relies on biosecurity restrictions, broadcast baiting, and chemical direct nest injection. Broadcast baiting uses two Insect Growth Regulators (IGRs: Pyriproxyfen and S-methoprene) in eradication zones (Fire ant biosecurity zone 1) and suppression/control zones (Fire ant biosecurity zone 2) as well as direct nest injection with Fipronil. Eradication zones also include "prophylactic" applications of IGR 500 m beyond detected nests (Wylie et al. 2020).

Evidence is clear that pesticide broadcast baiting for RIFA is a successful eradication method for small-scale infestations: less than 10,000 ha in total (Hoffmann et al. 2016; McNaught et al. 2014; Wylie et al. 2020). However, when RIFA infestations are over 10,000 ha, successful eradication has not been achieved and evidence of successful, temporary eradications at smaller scales cannot be used to further justify the financial and ecological costs of imperfect control at larger scales. Complete pesticide treatment of large areas, multiple times, becomes untenable across urbanised and rural environments.

Incomplete removal of RIFA in suppression areas enables their reinvasion of pesticide-treated locations (Banks 1986; Banks et al. 1973; Drees et al. 2013; Stimac and Alves 1994). For example, across an 850,000 ha pesticide-treated area (using Mirex) in Savannah (GA, USA) and at 98%–100% mortality, RIFA still reinfested from adjacent non-treated areas (Banks et al. 1973; Williams et al. 2001). Flooding can also result in the rapid spread of whole colonies due to rafting even in the absence of queen dispersal (Wylie et al. 2024). RIFA reinvasion occurs faster and at higher densities post-pesticide treatment than native species, or other non-native/invasive species replace RIFA (Banks 1986; Morehart et al. 2022; Song et al. 2024). Pesticides—such as the IGRs used in SE QLD—are non-specific, causing significant ecological disruption by eliminating other arthropods that compete with or prey on RIFA (Banks 1986; Hoffmann et al. 2016; Siddall 1976). This creates ecological vacuums that favour RIFA resurgence (Calixto et al. 2007; King and Tschinkel 2008, 2016; Morehart et al. 2022).

"Prophylactic" baiting on the leading edge of the eradication zone is unlikely to kill off mated, winged queens. The IGRs that are released can remove non-target invertebrate species that may directly compete with or predate on RIFA (Morehart et al. 2022; Oi et al. 2025) at their most vulnerable stage of the invasion process—i.e., queens prior to colony establishment (Nickerson et al. 1975; Whitcomb et al. 1973). Increasing queen survival rates through the reduction of native ant abundance and diversity with broadcast baits has been shown to be a key process that increases successful establishment and survival of RIFA queens and newly founded colonies (Tschinkel and King 2017). It is not feasible to have prophylactic baiting perfectly timed or sustained

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Summary Points

- Widespread application of broadcast baits with insect growth regulators used to control and eradicate fire ants in southeast Queensland has not halted their dominance and spread.
- Eradication efforts for fire ants have failed when infestations exceed 10,000 ha or have been established for over a decade.
- Fire ants quickly re-establish in treated control areas and establish in areas 'prophylactically' baited at the leading eradication edge. Broadcast baits may exacerbate negative outcomes while continuing unnecessary financial costs.
- To avoid accelerating the spread of fire ants at the eradication edge and stop their dominance in the control zones, we need to shift to targeted, species-specific methods using integrated tactics, scientific testing, and community engagement.

for sufficiently long enough periods and over large enough spatial extents to guarantee that baits will be taken up during early foraging of newly founded colonies after the queen establishment phase. Thus, the most likely outcome is a reduction of the native ant community prior to the founding events, which will ultimately favour RIFA queen survival and the establishment and survival of colonies (King and Tschinkel 2016).

The current RIFA infestation area of 850,000 ha in SE Qld is 100 times larger than any successful eradication area to date. A reliance on pesticide control will not eradicate RIFA from SEQ unless there is full and consecutive pesticide coverage of the entire area multiple times. However, it is simply not possible to achieve full, consecutive coverage of 850,000 ha. Nor is it feasible to sustain such an effort for the extent of time needed to eliminate missed colonies and dispersing queens across the existing RIFA infestation. Re-establishment events will continue,



FIGURE 1 | *Solenopsis invicta*—fire ant worker. Brackenridge Field Laboratory, Texas, USA. Photographer—Alex Wild. Public domain image.



FIGURE 2 | *Solenopsis invicta* spring mating flight. Brackenridge Field Laboratory, Texas, USA. Photographer—Alex Wild. Commercial licence image.

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particularly at treatment edges. Of note, biosecurity measures have effectively only reduced the human spread outside the horizon perimeter to ~4 km/year with small infestations moving outside the perimeter and successfully controlled. The 2021 strategic review (Scott-Orr et al. 2021) noted that RIFA eradication was not possible without an increase in funding, resources and a new plan: none of which have been fully addressed. In sum, the current strategy of what is realistically only a "partial eradication" is not and cannot be considered an eradication strategy and ignores the cumulative scientific record of what is now known of factors favouring successful RIFA invasions at large temporal and spatial scales.

A strategic shift is needed and a reassessment of the program is now urgent (Scott-Orr et al. 2021). The RIFA management program needs to consider targeted, integrated management, focusing on known nests and infestations, using landscape features to guide control, and adopting species-specific methods (Chen and Oi 2020; Hoffmann et al. 2011; King 2024). This includes selective baiting to limit non-target impacts (Oi et al. 2025) and leveraging RIFA biology for precision control (Hoffmann et al. 2016; Liu et al. 2025).

Total eradication of RIFA in SE Qld is not currently scientifically feasible under the current management plan and costing arrangements. Moving away from a "one size fits all" broadcast baiting model toward adaptive, ecologically sensitive approaches will likely improve RIFA management effectiveness, reduce immediate and long-term financial and ecological costs, and build public trust (Hoffmann et al. 2016; Suckling et al. 2014).

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Nigel R. Andrew: conceptualization, investigation, writing – original draft, writing – review and editing, project administration, resources, data curation, formal analysis, methodology, validation.

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Disclosure

The authors have nothing to report.

Conflicts of Interest

Nigel R. Andrew is an Editor with *Austral Ecology*. However, he played no part in the editorial decision-making process for this manuscript.

Data Availability Statement

Supporting Evidence Spreadsheet attached as per Hot Topic Authorship guidelines in Supporting Information.

References

Also see supporting evidence spreadsheet for further details of cited papers in Supporting Information

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Supporting Information

Additional supporting information can be found online in the Supporting Information section. **Data S1:** aec70174-sup-0001-DataS1.xlsx.

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