The University of Texas at Austin
Environmental Science Institute

Hot Science - Cool Talk # 115

Fire Ants, Crazy Ants & Zombie Ants

Dr. Rob Plowes
October 26, 2018

Fire Ants, Crazy Ants and Zombie Ants

Rob Plowes

Photo Credit: A Wild

Image Credit: Zazzle.com

Fire Ants, Crazy Ants and Zombie Ants

Rob Plowes

Zombie invasions from Old to New World

N. Webinger

Ants are Superorganisms

- Advanced social organization
- Colonies have Queens and sterile workers
- Communicate – by pheromones, sounds, touch, odors
- Fire ant larvae serve as the centralized digestive system.

Photo Credit: L Gilbert

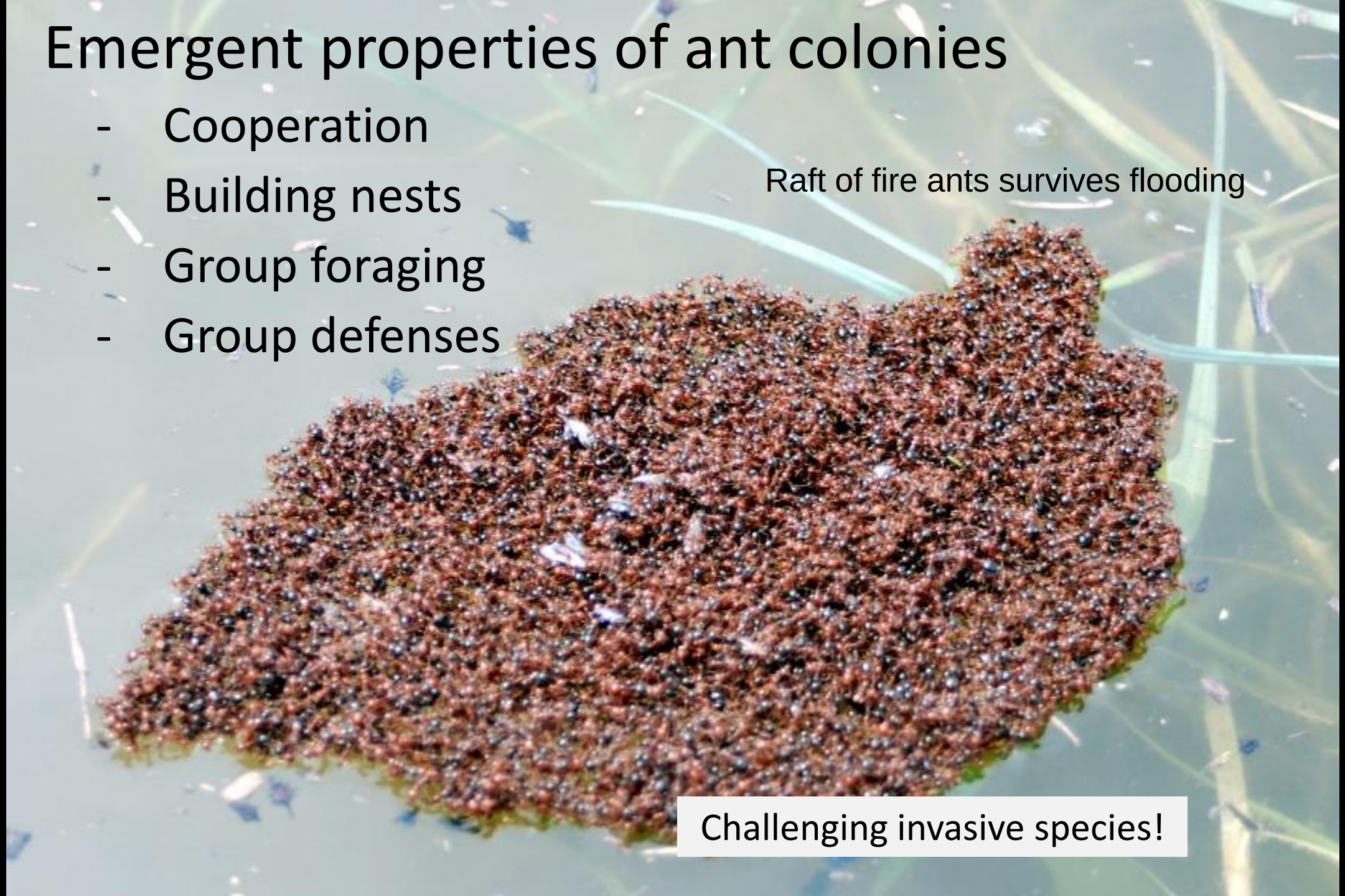
Fire ant larvae are the centralized digestive system

Source: Lekhnath Kafle

Queen with larvae attended by workers

Emergent properties of ant colonies

- Cooperation
- Building nests
- Group foraging
- Group defenses



Raft of fire ants survives flooding

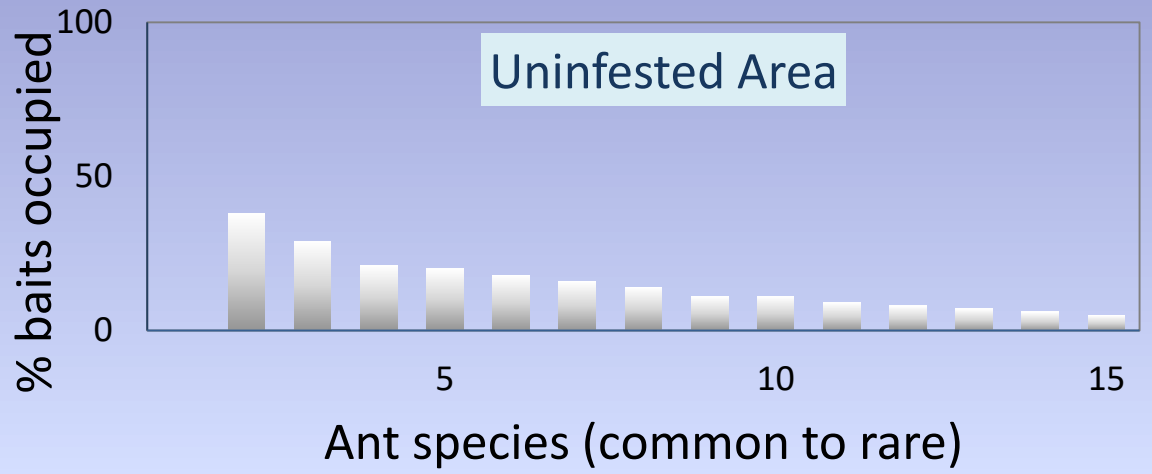
Challenging invasive species!

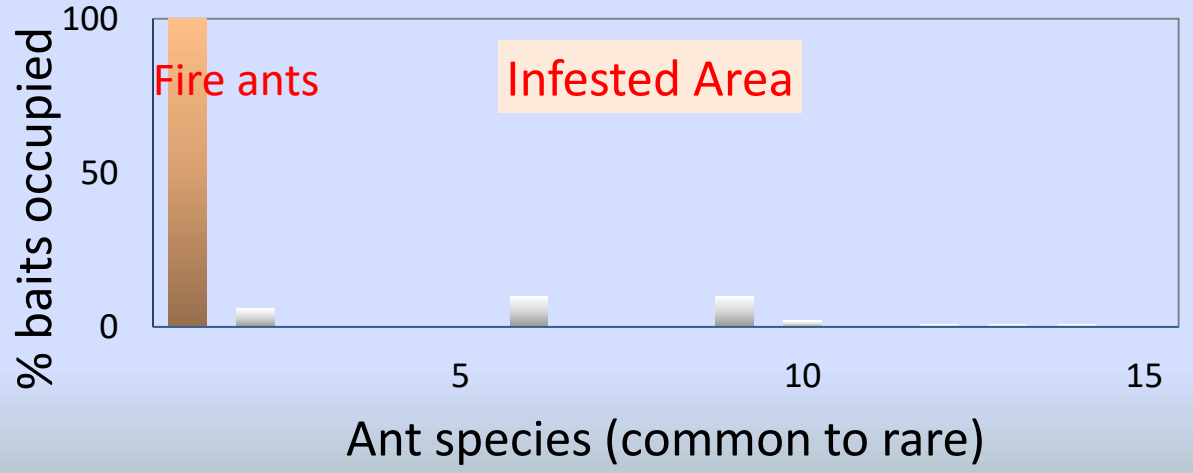
Data

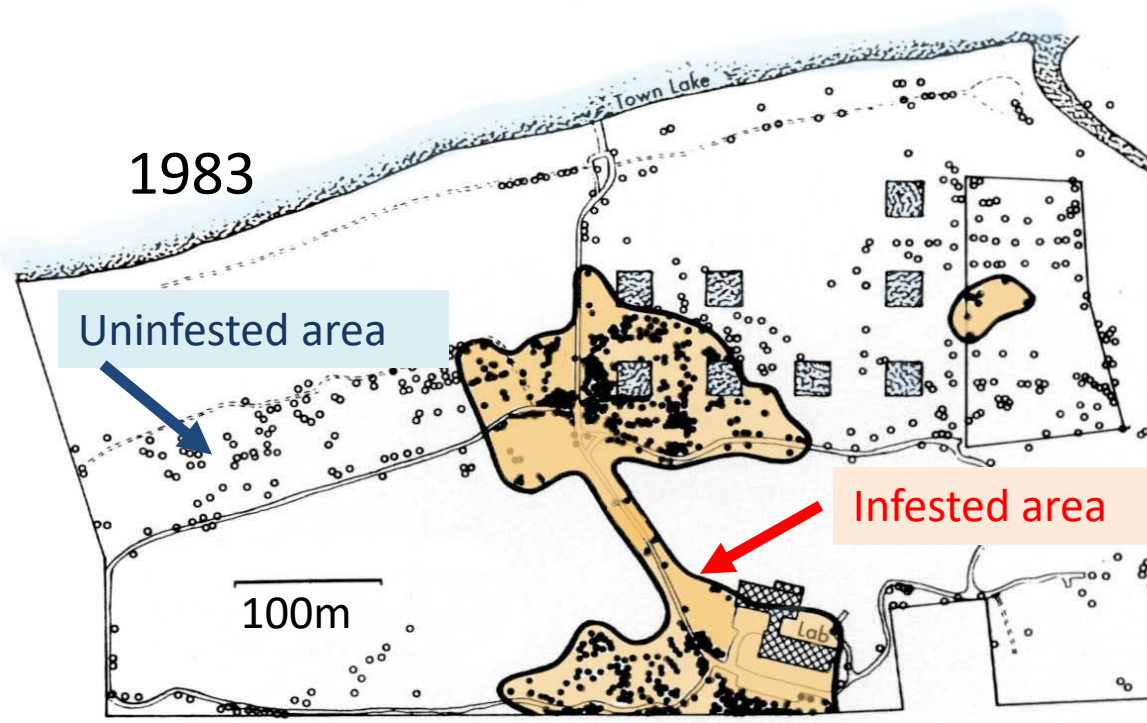
The University of Texas at Austin
Brackenridge Field Laboratory
College of Natural Sciences

Long-term studies in 82 acres of grassland, woodland and lakeshore

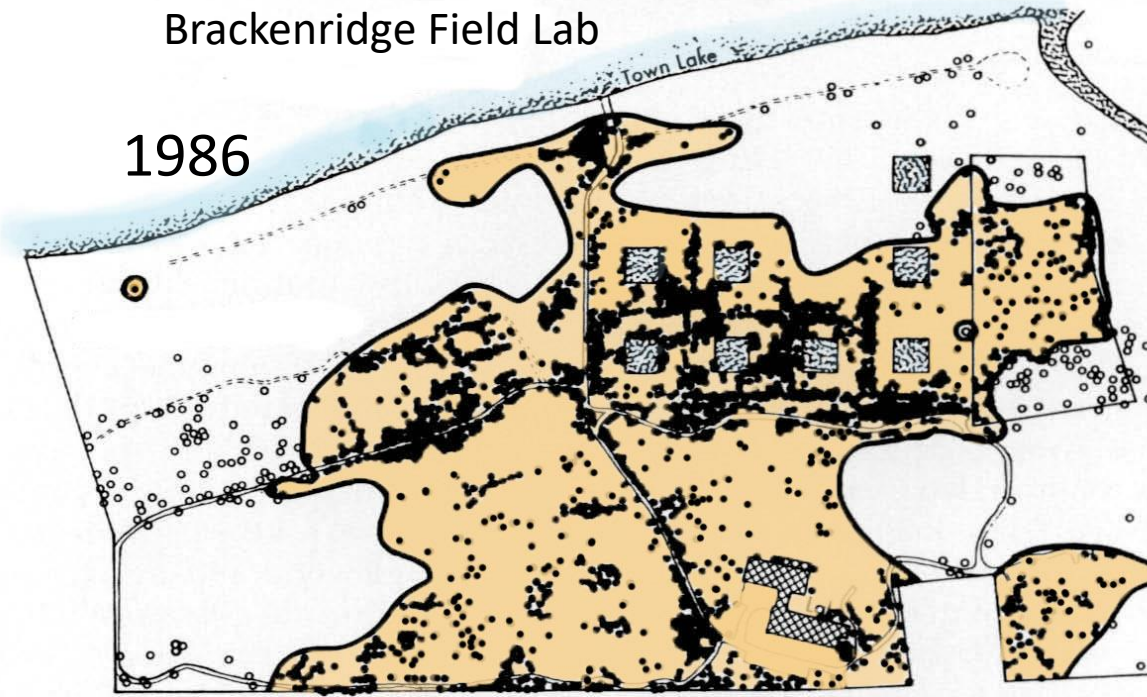
1980's - Fire ants invade the field station







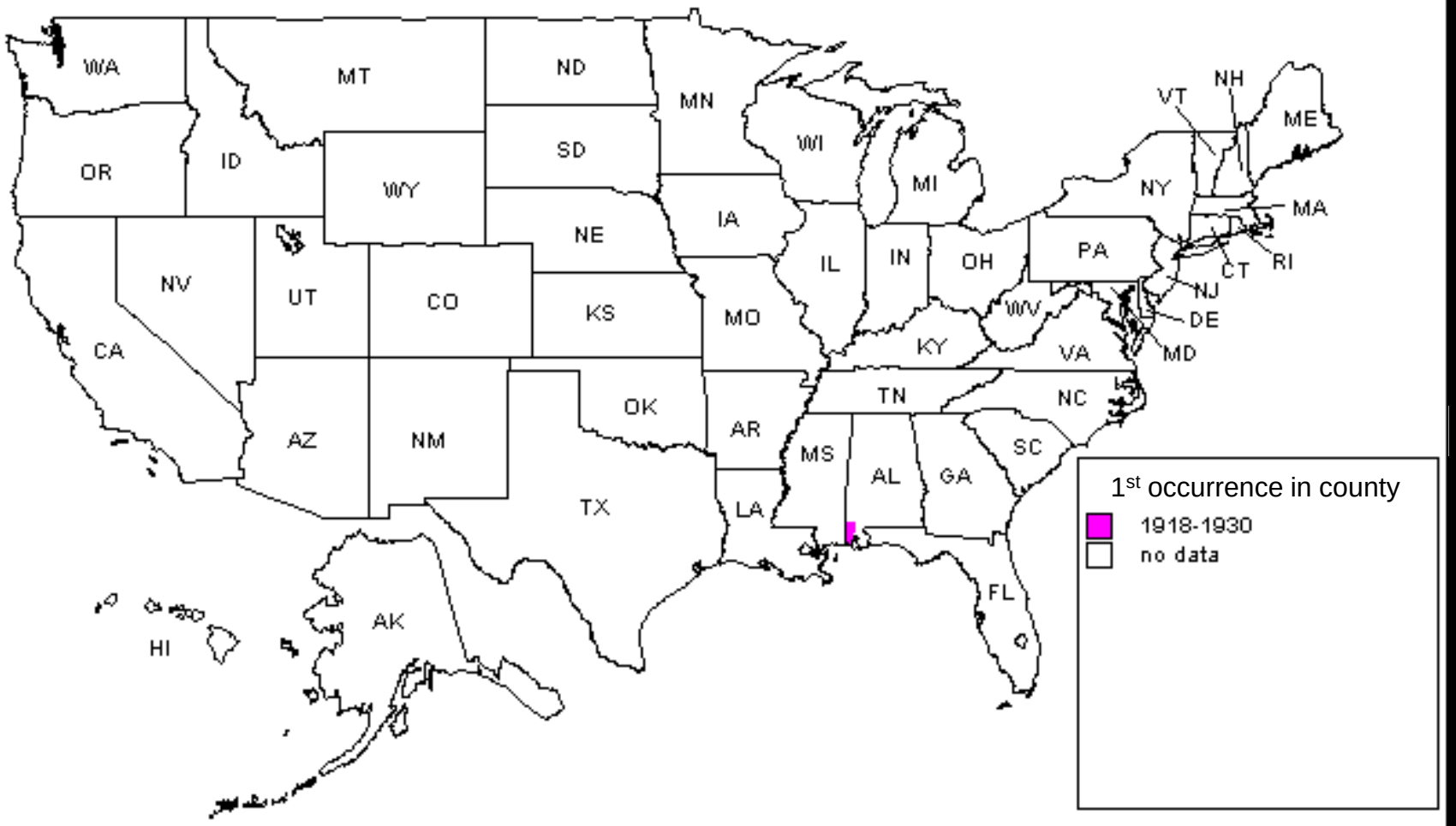
Brackenridge Field Lab



Fire ants invasions

First Reported Occurrence of Red Imported Fire Ant; Solenopsis invicta

2000-04-21 Data retrieved from National Agriculture Pest Information System



Center for Environmental Regulatory Information Systems does not certify to the accuracy or completeness of this map.

Schmidt Pain Index of Insect Stings

Bullet ant (4+)

Like fire-walking over flaming charcoal with a 3-inch rusty nail grinding into your heel.

Photo Credit: Hillewaert

Schmidt Pain Index of Insect Stings

Tarantula hawk wasp (4)

Blinding, shockingly electric. A running hair drier has been dropped into your bubble bath.

Photo Credit: NPS/Robb Hannawacker

Schmidt Pain Index of Insect Stings

Harvester Ant (3)

Bold and unrelenting. Somebody is using a drill to excavate your ingrown toenail.

Photo Credit: D Ward

Schmidt Pain Index of Insect Stings

Acacia ant (1.8)

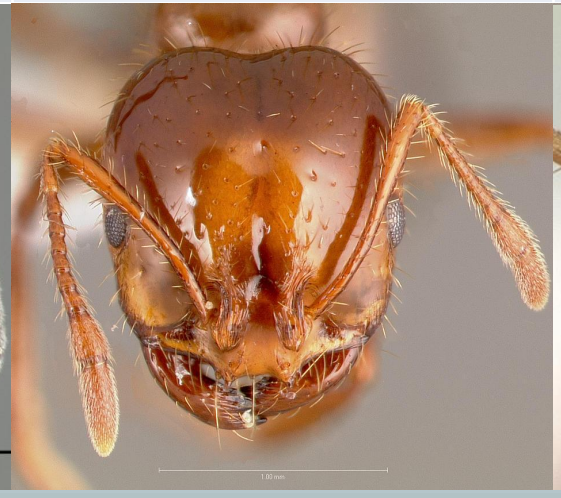
A rare, piercing, elevated sort of pain. Someone has fired a staple into your cheek.

Schmidt Pain Index of Insect Stings

Fire ant (1.2)
Sharp, mildly alarming.
Like walking across a shag carpet and reaching for the light switch.

Photo Credit: L Gilbert

Problem ants in Texas

Argentine Ant *Linepithema humile*	**Red Imported Fire Ant** *Solenopsis invicta*	**Tawny Crazy Ant** *Nylanderia fulva*
1890	1950	2002
No stinger	Stinger	No stinger
 *Photo Credit: AntWeb*		

Red imported fire ants – *Solenopsis invicta*

- $ 1.2 billion/year economic damage in Texas
- 80 million acres of rangeland infested

Red imported fire ants – *Solenopsis invicta*

- Impact on ground nesting birds and animals
- Disruption of food web: loss of species, pollinators

Tawny Crazy Ants – *Nylanderia fulva*

Source: Joe McGowan

Tawny Crazy Ants – *Nylanderia fulva*

- Major invader of urban areas along Gulf Coast
- Spread by human transport
- Extremely high densities
- Knock out native fauna
- Displace fire ants

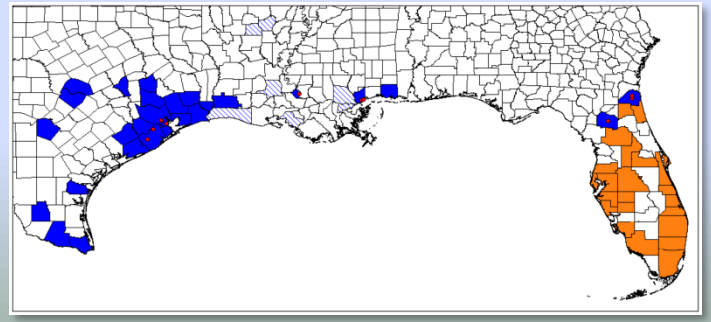
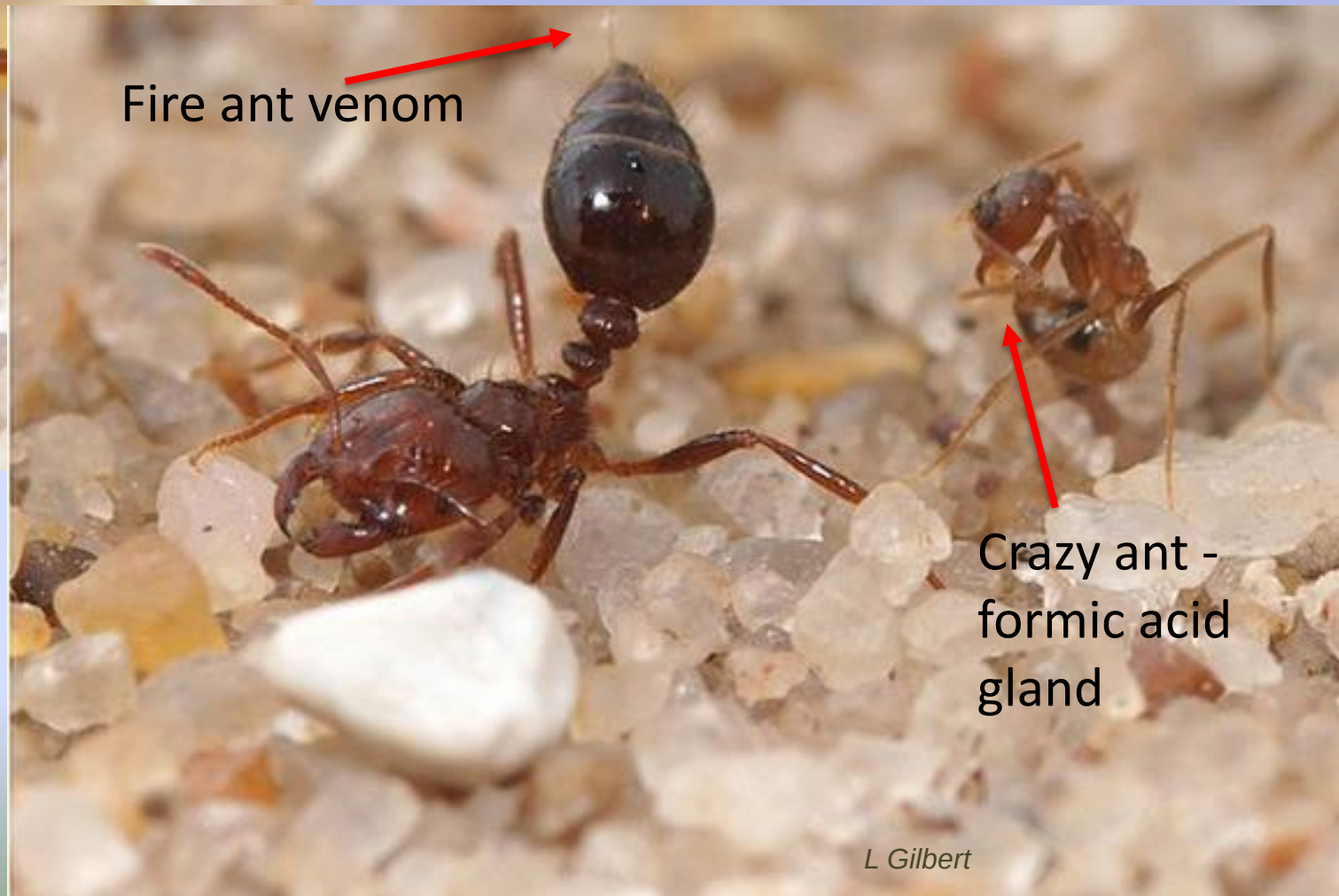


Photo Credit: L Gilbert

Chemical Warfare - Crazy Ants vs Fire Ants



Sciencexpress

Chemical Warfare Among Invaders: A Detoxification Interaction Facilitates an Ant Invasion

Edward G. LeBrun,* Nathan T. Jones, Lawrence E. Gilbert

Why do some species become invasive?

- Enemy escape hypothesis (competitors, parasites, pathogens)
- Fast growth & reproduction
- Good at dispersal
- Associated with disturbance

Red imported fire ant

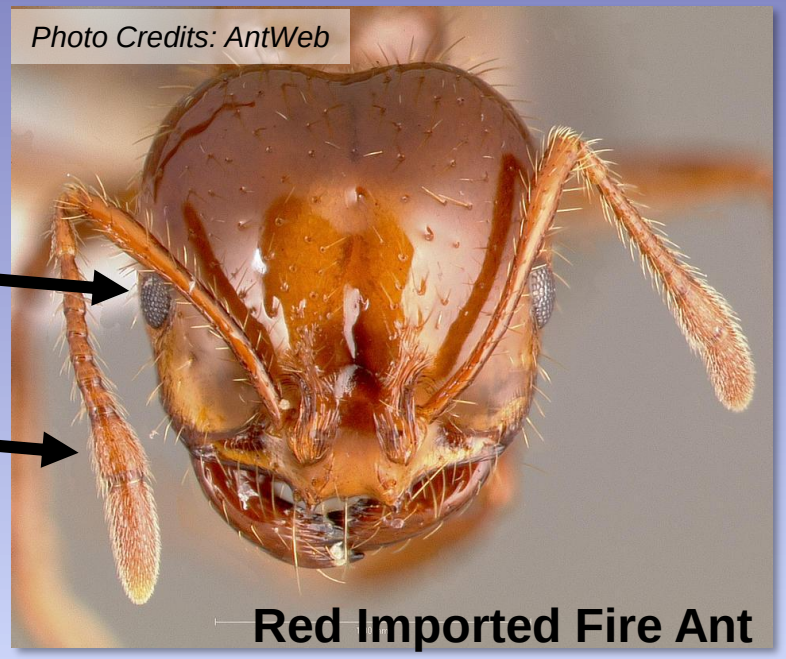
Brown tree snake

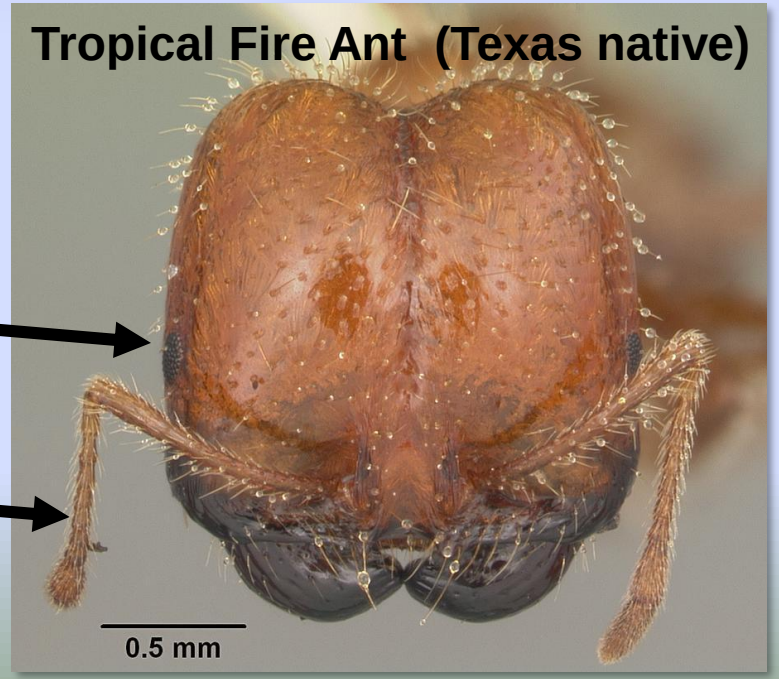
Zebra mussels

Kudzu vines

Traits of invasive ant species

- Multiple queens -“polygyne”
- Clonal spread
- Low aggression between nests
- High densities of colonies
- Dominant competitors – “top dogs”

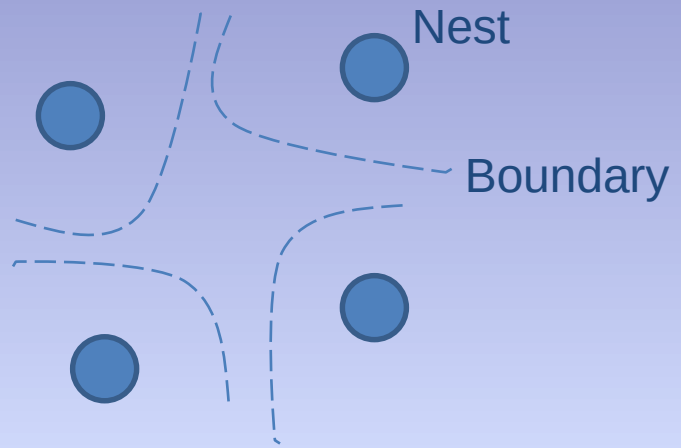




Social forms of fire ants

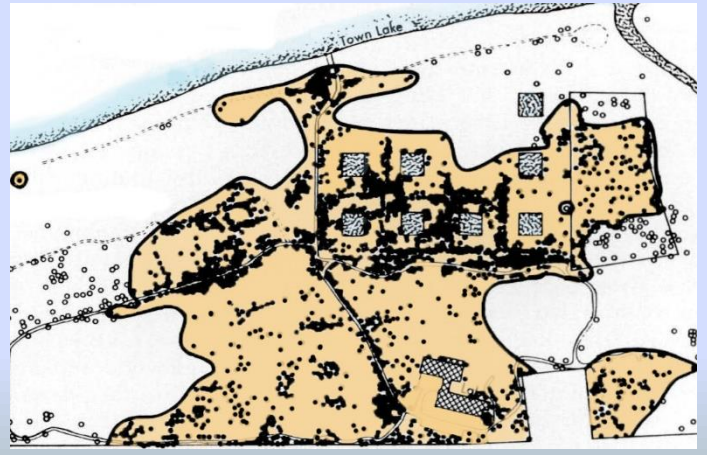
Monogyne

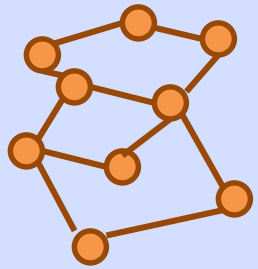
- Single queen colony
- Large, isolated nests
- Territorial
- 120 mounds/acre
- Isolation creates a “social immune” defense against diseases



Polygyne

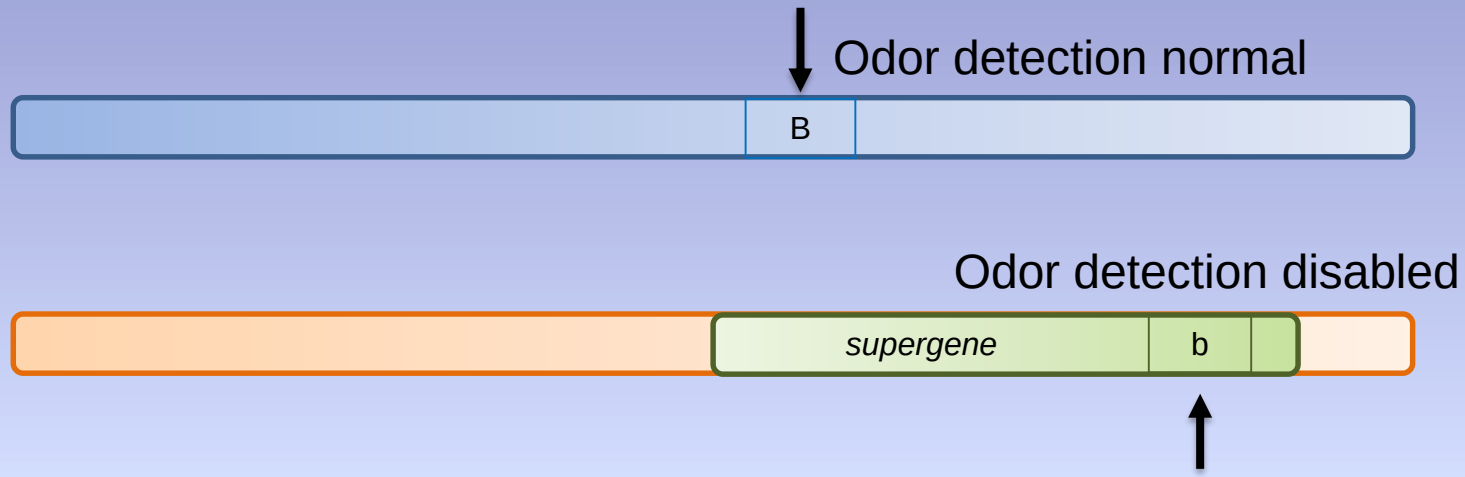
- Multiple queens per colony
- Small nests
- Interconnected network
- Up to 800 mounds/acre
- Disease risk from foreign workers





Supercolonies of connected nests

It’s a Supergene!



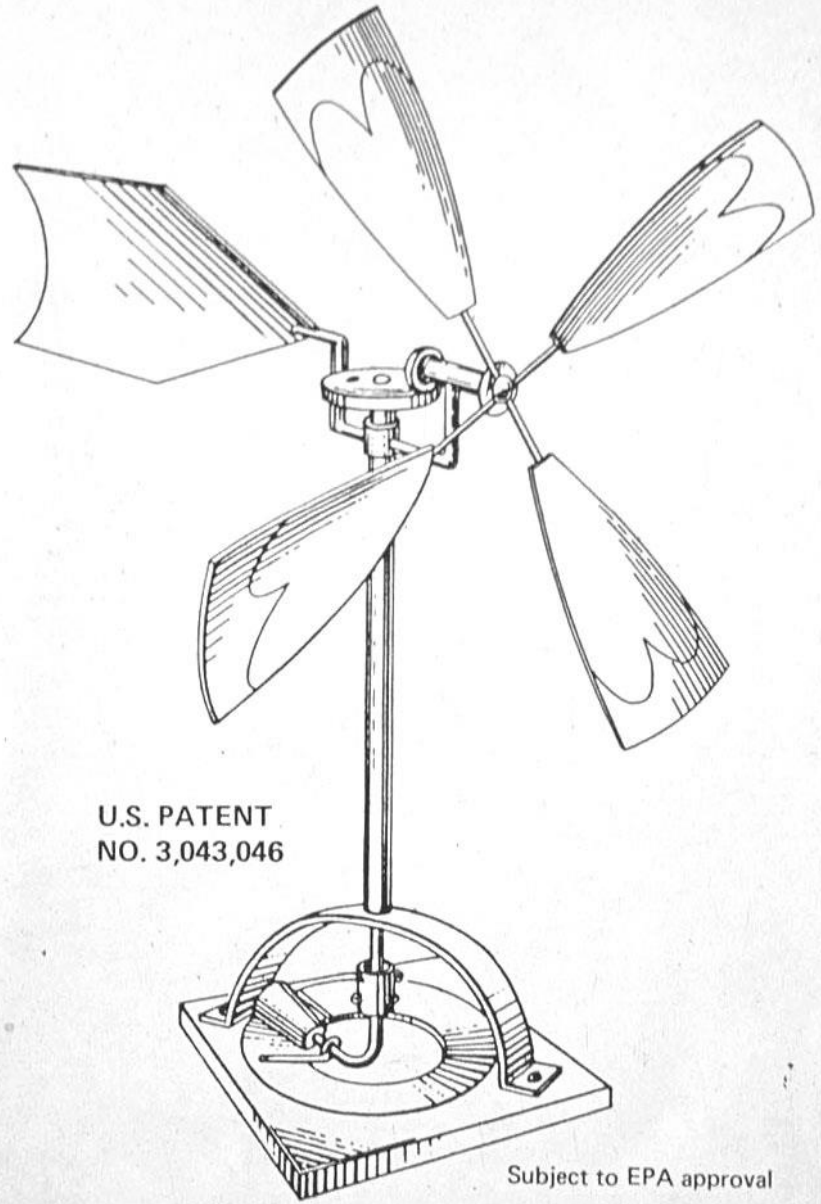
Monogyne BB

- workers recognize nest mates
- single queen

Polygyne Bb

- workers can’t distinguish nest mates
- multiple queens

GET RID OF THESE PESTS WITH THE



U.S. PATENT
NO. 3,043,046

Subject to EPA approval

McCOY ANT STOMPER

The McCoy Ant Stomper kills emerging fire ants quickly, safely and economically!

*Durable, heavy metal construction
*Easily portable
*No chemicals
*Environmentally safe for people, pets, cattle, land--everything except fire ants!

The McCoy Ant Stomper can be used again and again. It's a practical investment in fire ant control!

Only $98.50

*Wind-driven
*Price includes freight and handling
*Six to eight weeks delivery

NOW BEING DEVELOPED...

*Total electric battery-driven model
*Price slightly higher than wind-driven model
*12 to 14 weeks delivery

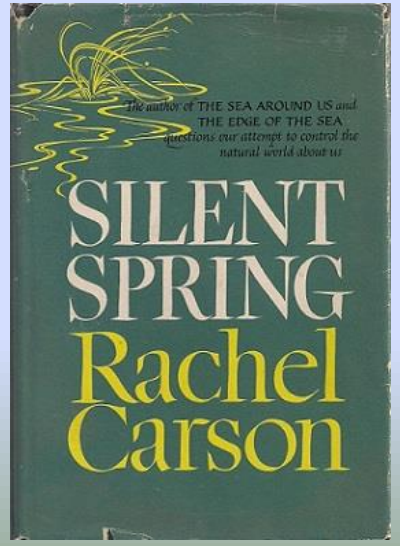
Post WWII – The Power of Science

Nuclear energy, penicillin and DDT

Comments about the 1957 Federal campaign to eradicate fire ants from 20 million acres using dieldrin and heptachlor ….

> "It is an outstanding example of an ill-conceived, badly executed and thoroughly detrimental experiment in the mass control of insects, an experiment so expensive in dollars, in destruction of animal life, and in loss of public confidence in the Agriculture Department that it is incomprehensible that any funds should still be devoted to it."

Silent Spring
Rachel Carson, 1962



Biological control

Opportunities to use natural enemies

- should be host specific
- self-sustaining after release
- low future costs

Concerns

- unforeseen collateral damage
- host-shifting after introduction
- may only have low impacts

Natural enemies of ants

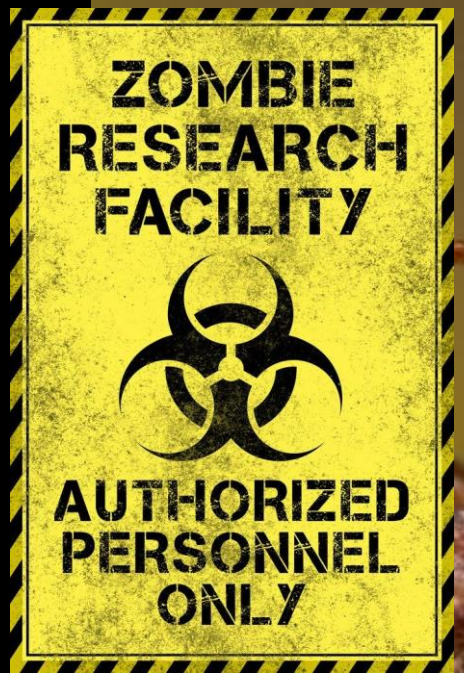
Carpenter ants

- Live in trees, forage on the ground
- Become infected with fungal spores
- Develops seizures and begins a zombie walk
- Descends to ground, climbs a plant
- Bites down and dies

Ophiocordyceps fungus turns carpenter ants into zombies

D. Newman

Pseudacteon phorid flies: Parasites of fire ants



J. Abbott


BBC

Source: National Geographic

Ant neck

Phorid fly larva

Ant jaws

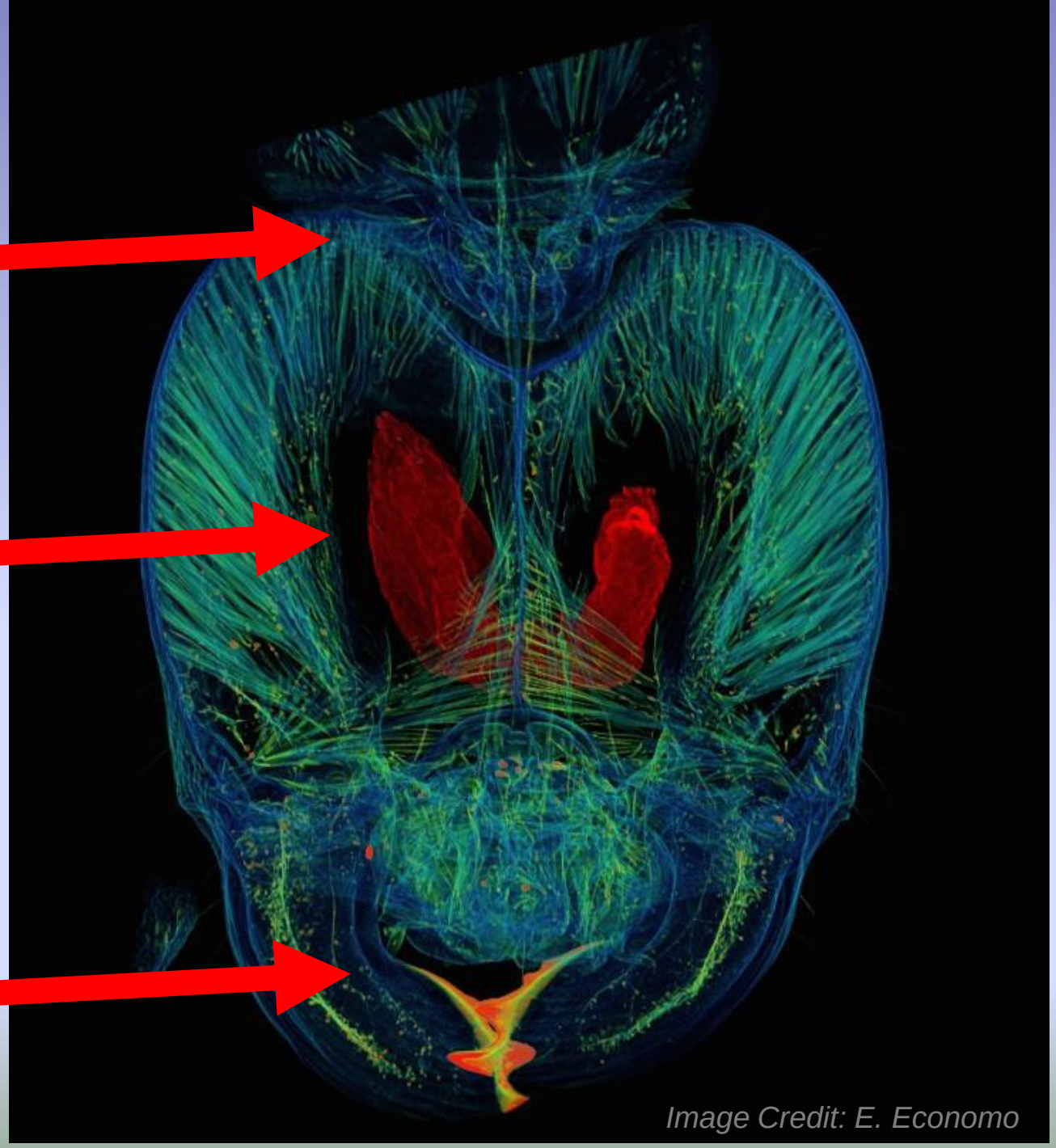
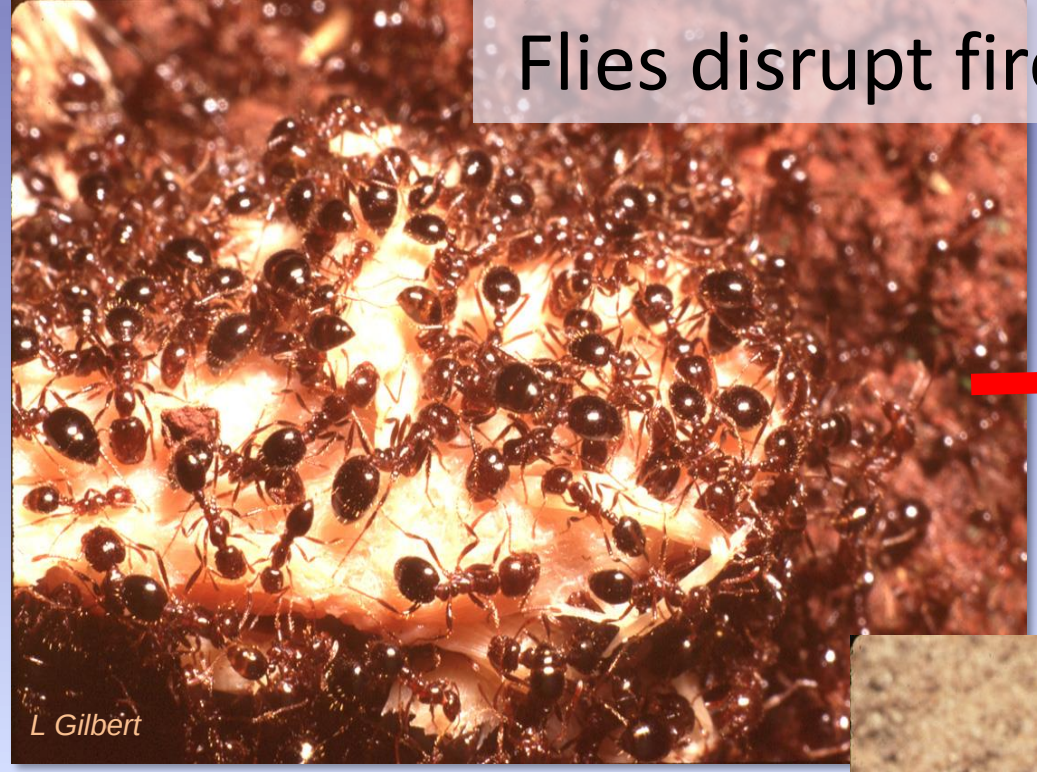
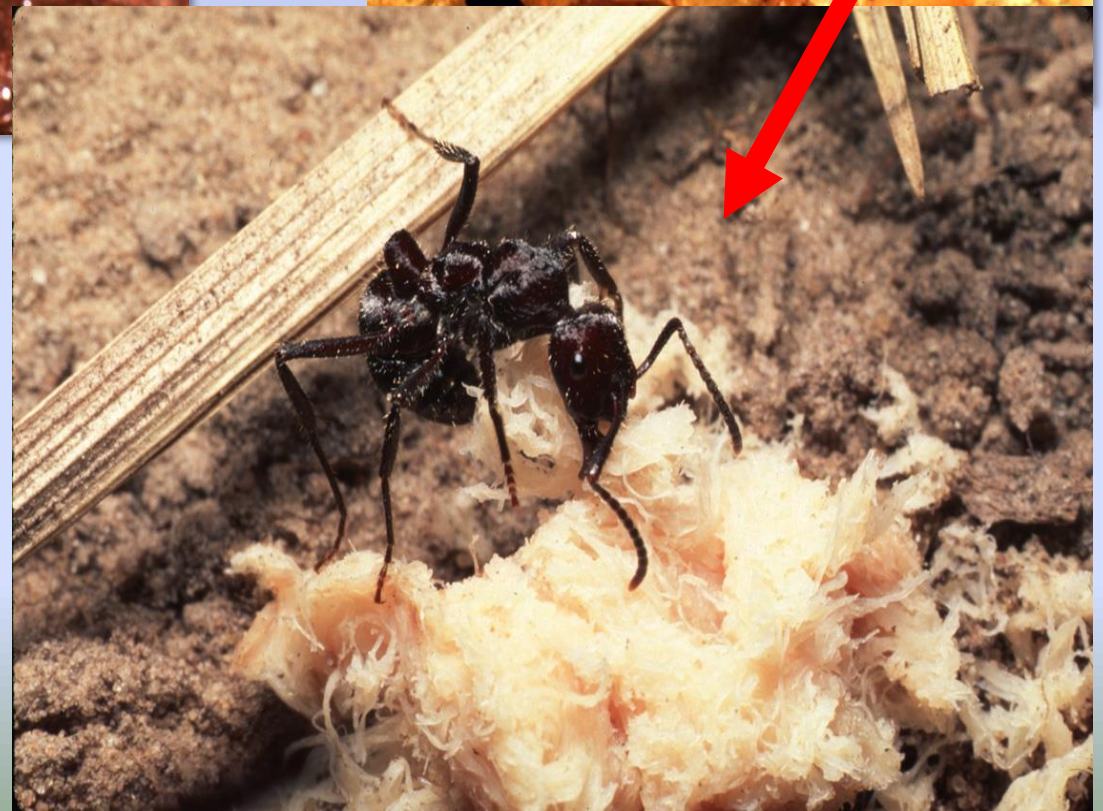


Image Credit: E. Economo

Flies disrupt fireant feeding





- Ants feed in high numbers, emit a foraging pheromone.
- Phorid flies detect and attack.
- Ants go into alarm mode, go home
- Native ants gain food,
  fire ants lose out!

Zombie defenses

Flies disrupt mound defenses

Loss of young reduces colony growth rate

Potential for biocontrol with phorid flies

- Direct effects - may kill up to 3% of workers
- Indirect effects – up to 50% reduction in gathering food
- Decreased nest defenses – loss of workers and brood
- Possible vectoring of pathogens by flies

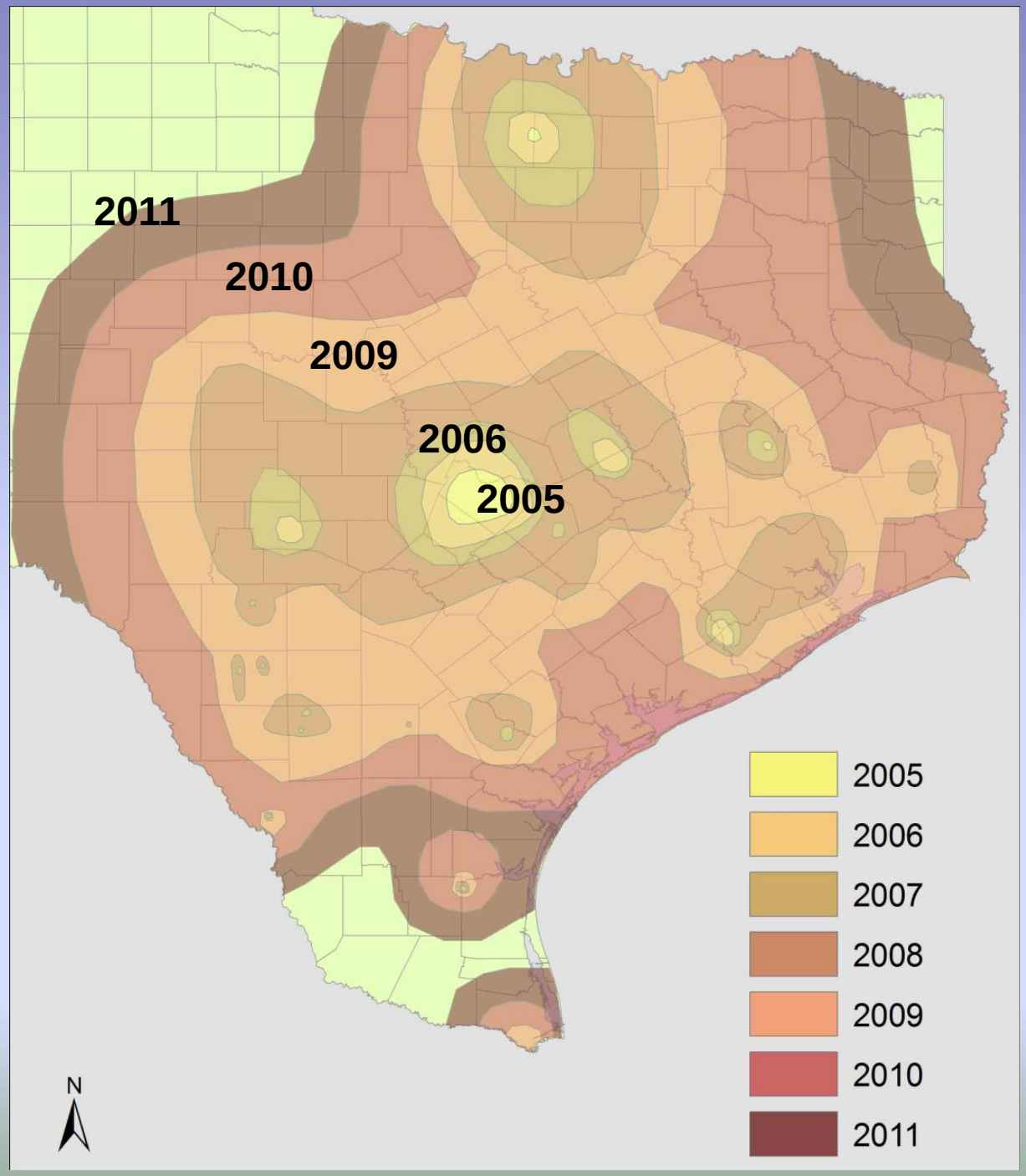
⇨ Slower colony growth, stronger native ant community


WARNING
ZOMBIE OUTBREAK
THIS AREA UNDER STRICT
QUARANTINE
AUTHORIZED PERSONNEL ONLY

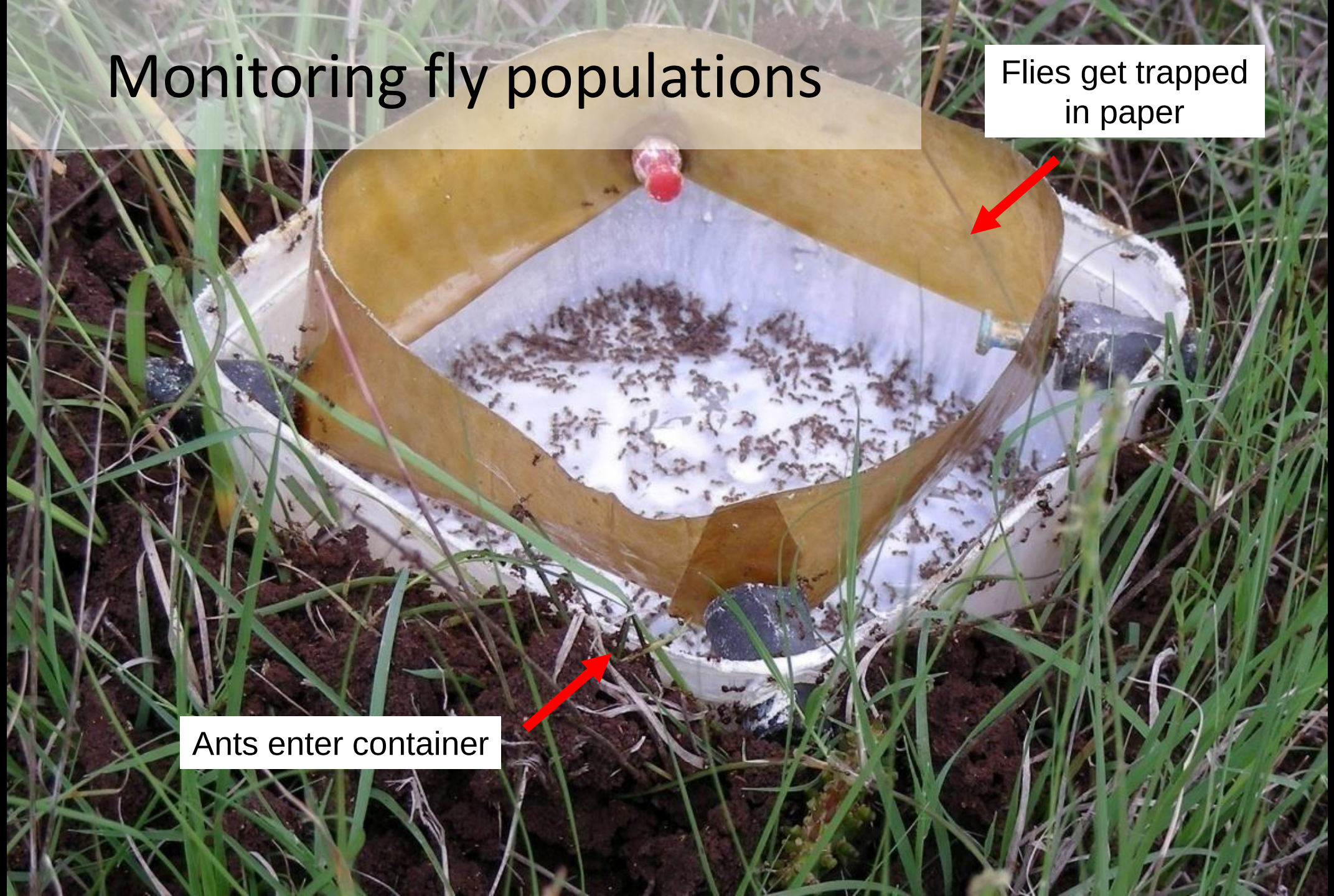
Release and dispersal of phorid flies

Pseudacteon obtusus

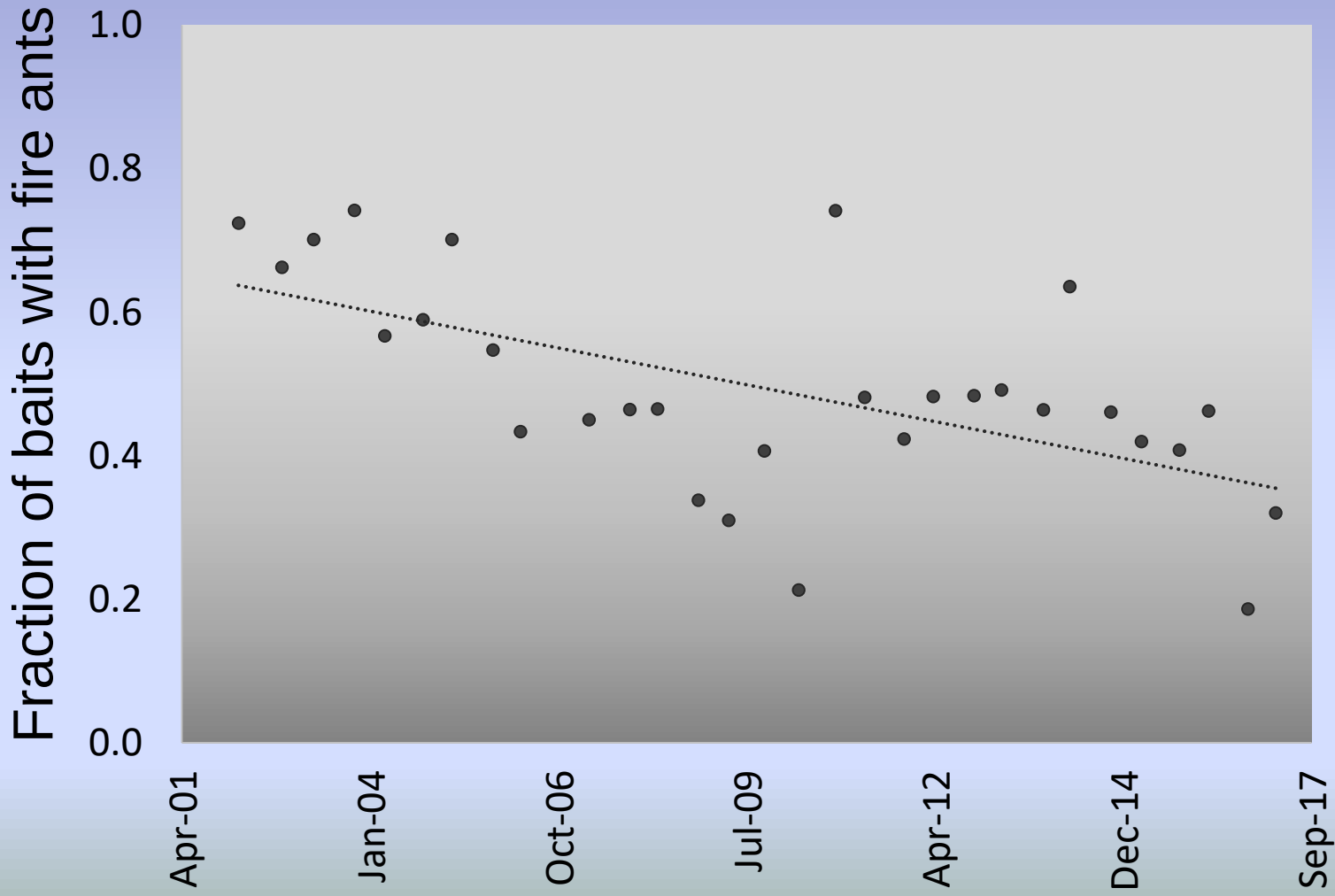
- Many release sites
- Rapid spread
- Self-sustaining populations

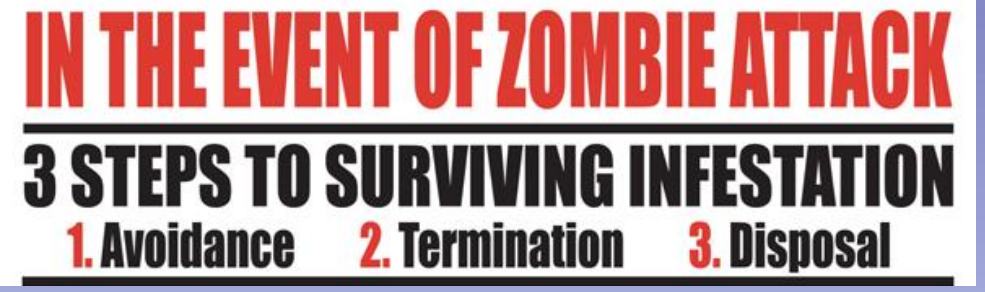


Monitoring fly populations



Potential biocontrol success?
Brackenridge Field Station





Summary

- Zombie ants are real
- Invasive ants pose a complex challenge for biocontrol

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