Distribution of Psyllids in Citrus Groves

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Monitoring ACP is an essential component of IPM

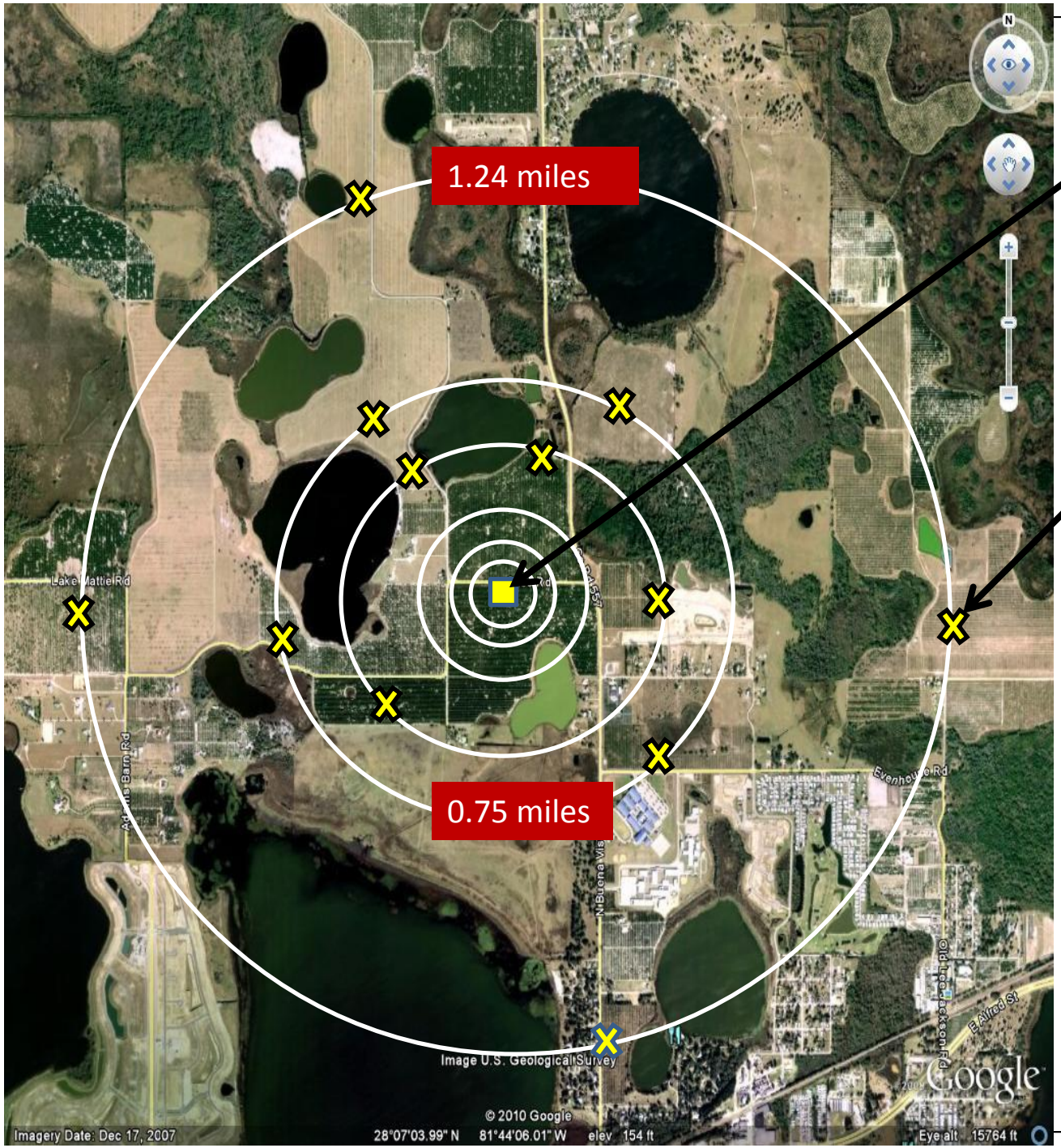
- ACP are not sessile; they move frequently and long distances by their own capability (up to 2 miles at a time) and beyond 400 miles with wind assistance
- ACP are able to use non-host plants to ‘refuel’ with resources needed for flight in cases when hosts (citrus) are not present

Asian citrus psyllid sampling

Flush examination. In addition to nymphs that are only found on new emerging leaves, adults are often present on flush, either because they just emerged, are laying eggs, or are looking for a mate. Flush examination is the fastest and easiest way to assess for the presence of Asian citrus psyllid.

Tapping: Tap a randomly selected branch three times with a stick (PVC pipe). Psyllid adults are counted as they fell on a white board placed below tapped branch. Ten tap samples should be made at ten locations per block (http://edis.ifas.ufl.edu/in1116).

Yellow **sticky traps** can also be used to monitor flying Asian citrus psyllid adults. One trap is recommended per 20 trees.

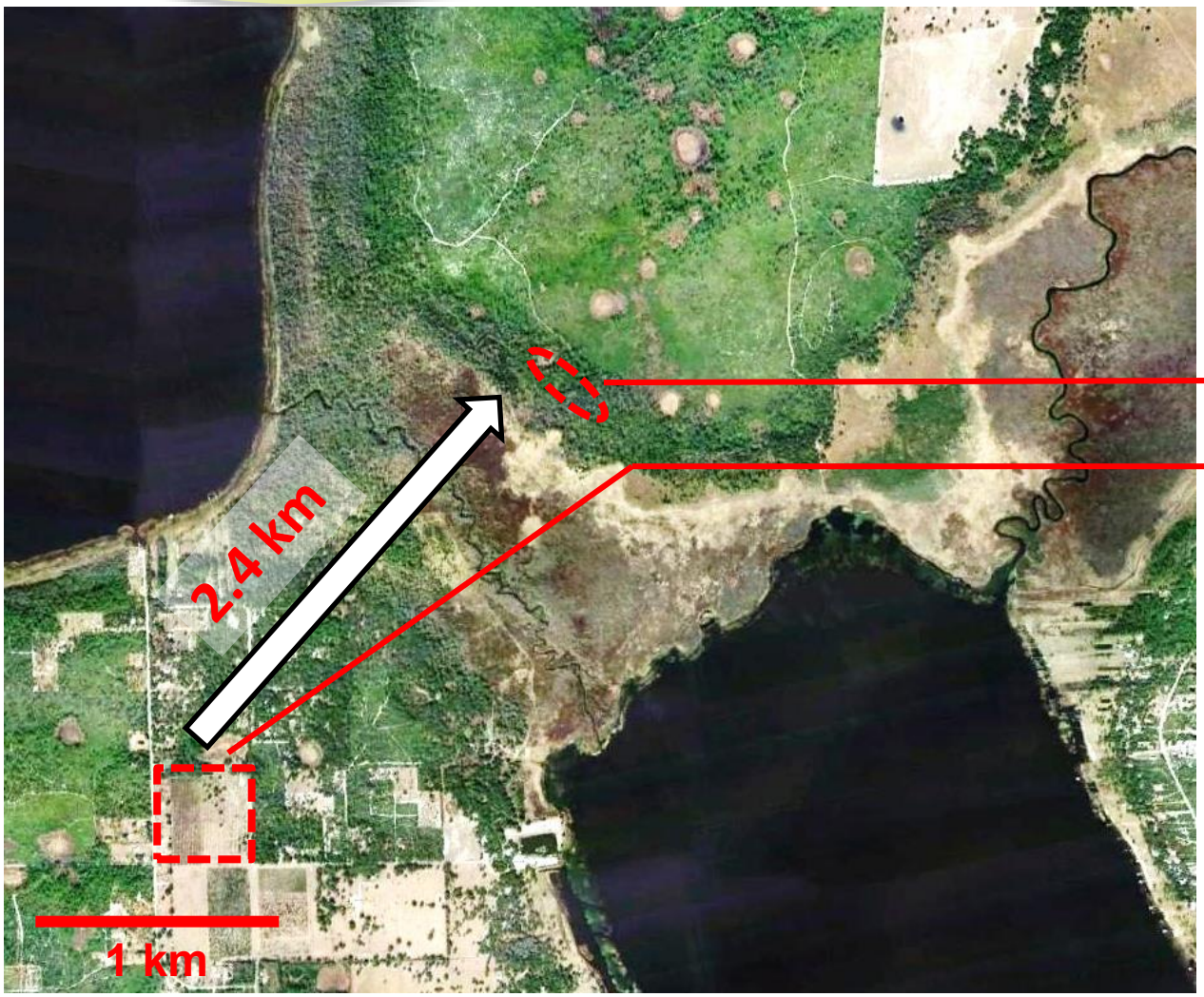


Block of 200 trees sprayed with protein mark

Traps placed in radial fashion at distances from 0.06 miles to 1.24 miles away from sprayed area

Traps were collected 12 days after spray application and psyllids were tested for the marker protein

Dispersal potential of *D. citri*

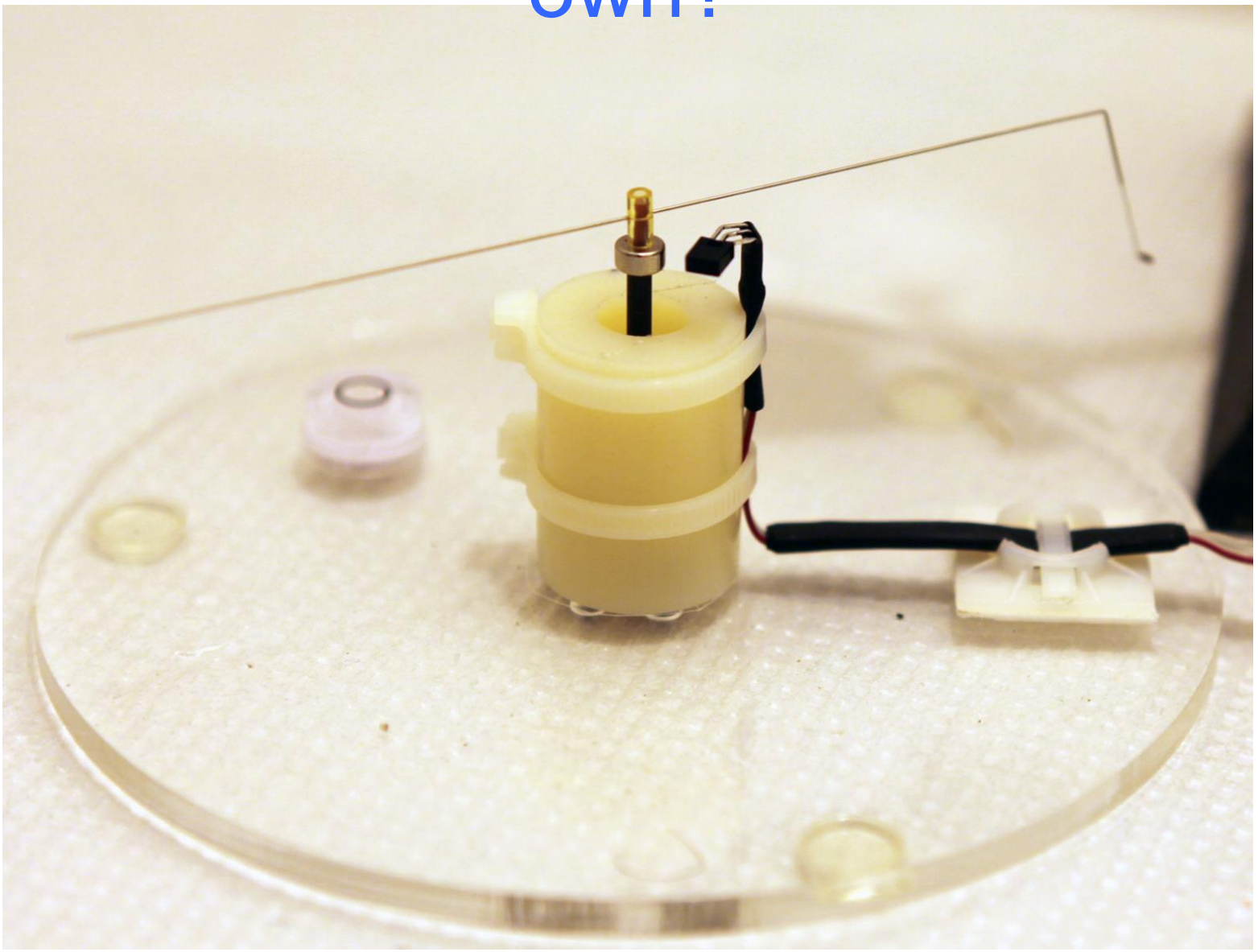


Collection site

Abandoned grove

Martini et al. 2013 *Florida Entomologist.* 96: 658-660.

How far can psyllids move on their own?



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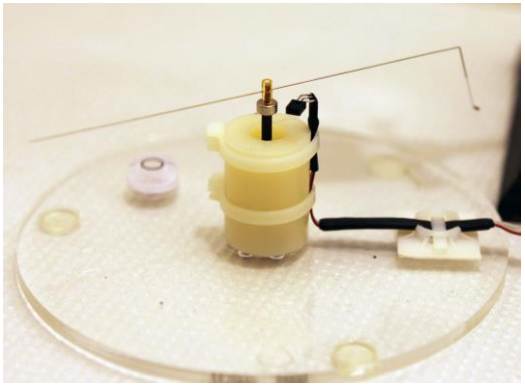


- Psyllids are capable of 3 hours of continuous flight.
- This translates to approximately four miles of continuous flight.

We likely underestimated the level of infection in psyllids and plants for a long time

- Coy et al. 2014 published a new method for detecting the CLas bacterium in Journal of Microbiological Methods.

- This was an update to the original method published in the same journal.

- We found that we were underestimating the level of infection by more than 50%.

LANDSCAPE ECOLOGY

Where are the psyllids?

Psyllid Density

High (> 10)

Medium (5-10)

Low (0-1)

Management varies widely

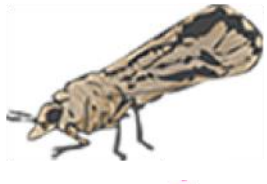
Organic

Conventional Management

Abandoned

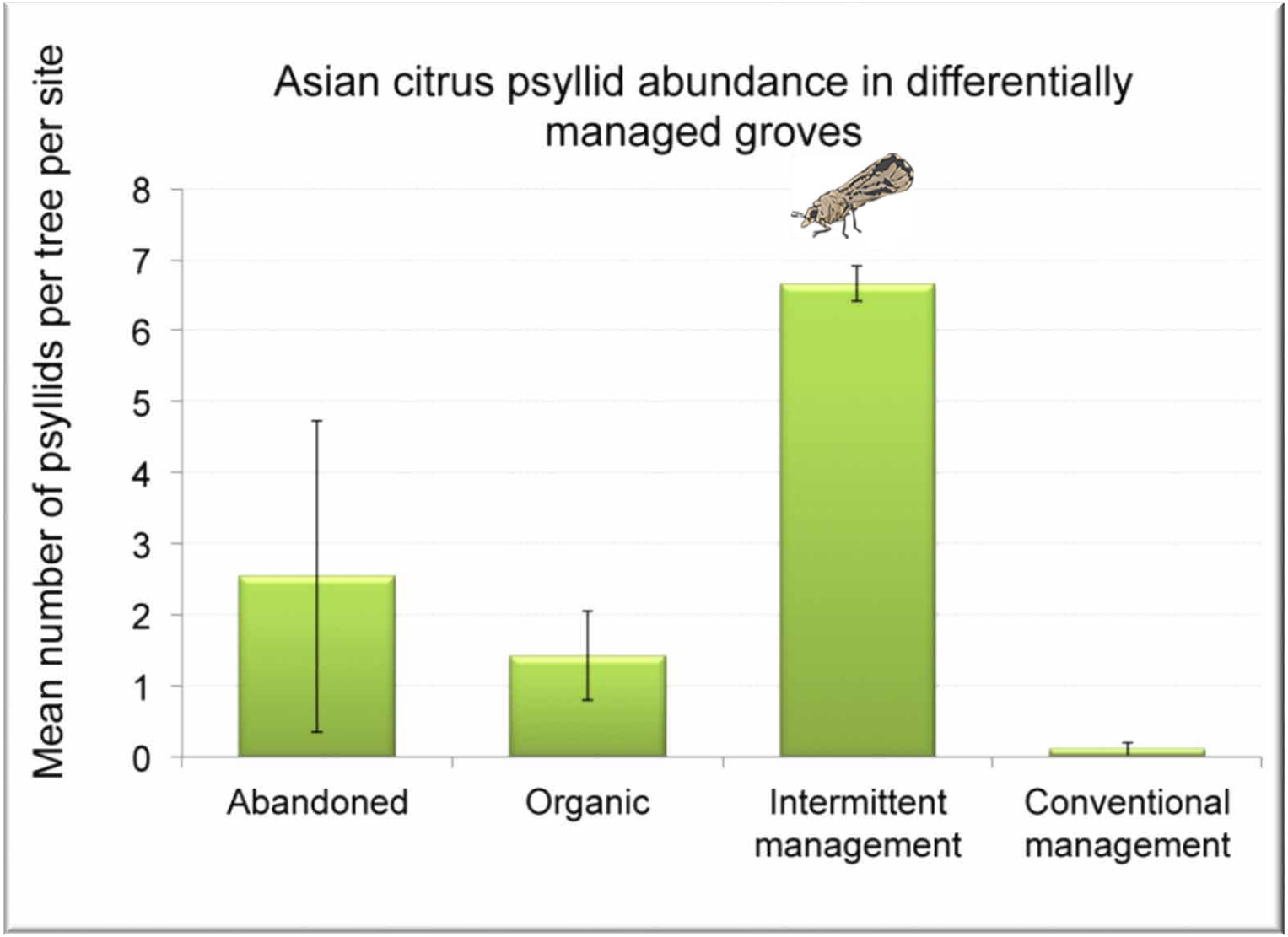
Intermittent Management

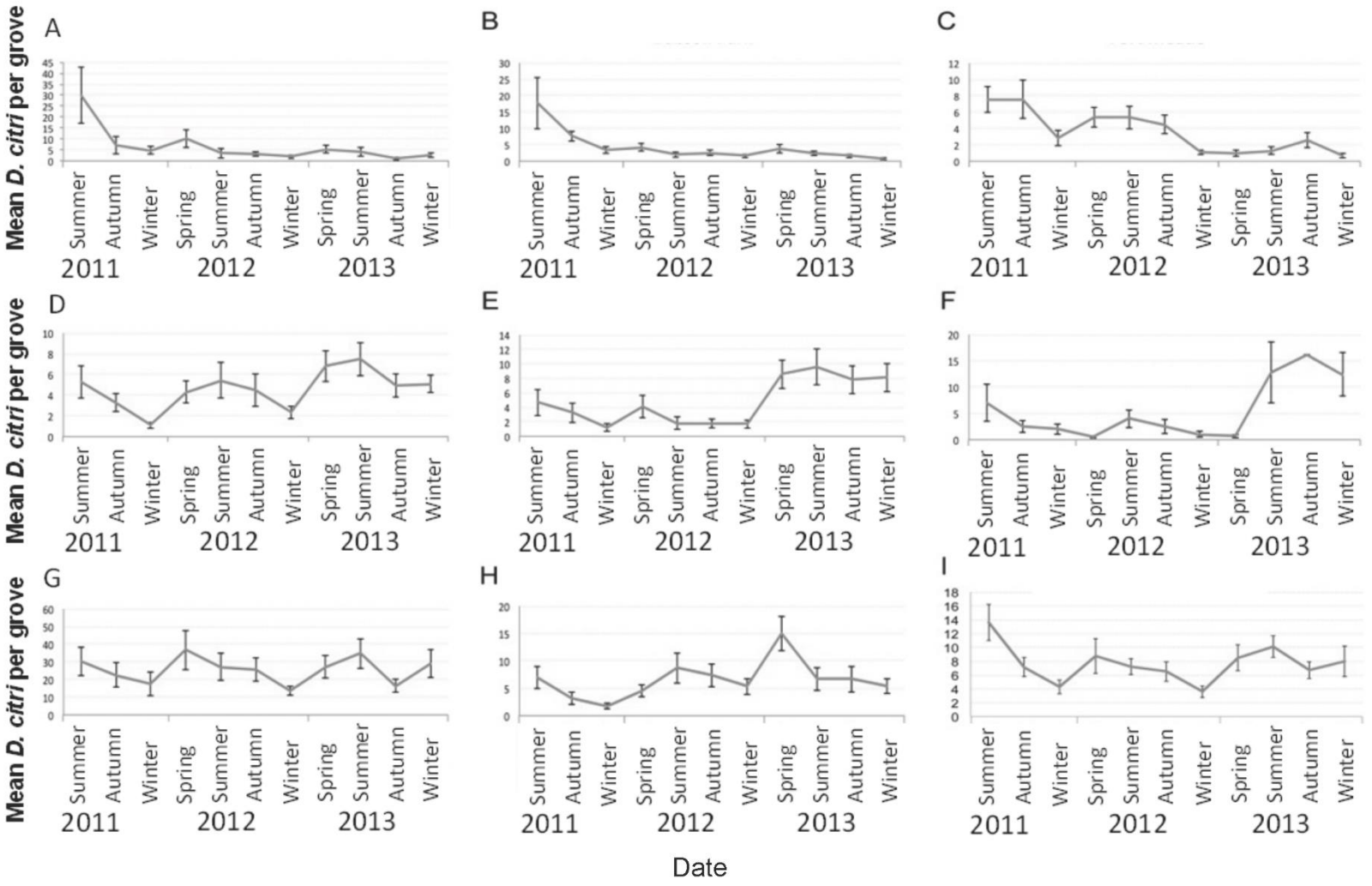
Grove Management



- Grove management had a significant impact on ACP populations
- Four management strategies: abandoned, organic, intermittent (5 or fewer insecticides treatments per year), conventional (12 annual insecticide treatments)

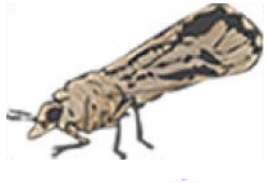
More psyllids found where management is intermittent





Reduced ACP populations between December and February, but varied significantly between locations

ACP Winter Populations



- Psyllid populations decline in Florida winter's, December to March, due to low minimum temperatures and reduced precipitation
- Reproduction is limited in winter months due to limited new flush; therefore, less oviposition and nymph development
- Psyllids can survive up to 48 hours of 32°F
- Winter temperatures are the "weakest link" in the annual life cycle of the psyllid

Grove Characteristics

- More psyllids were found on tree rows oriented East-West (exposed North South) and at southern latitudes versus other sampled locations
- Psyllid populations not impacted by overall shape of the grove, citrus cultivar, or the number of gaps between rows per acre

Presence of windbreaks

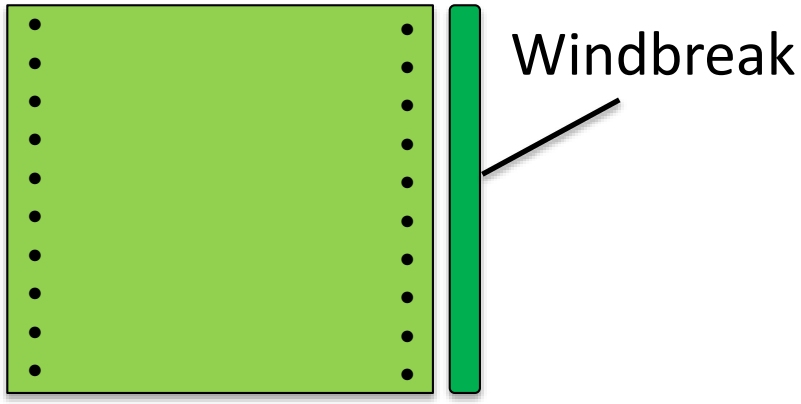
Windbreaks are erected to protect orchards from extreme weather to manage citrus canker

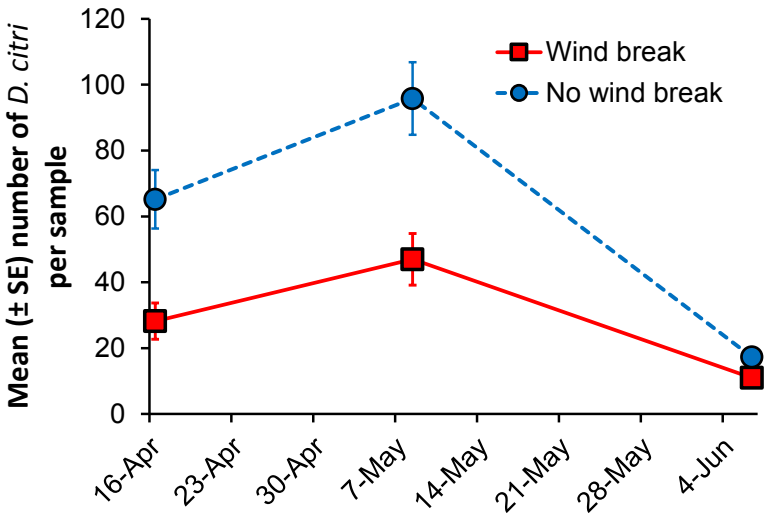
→ Effect on ACP populations?

→ Effect on natural enemies?

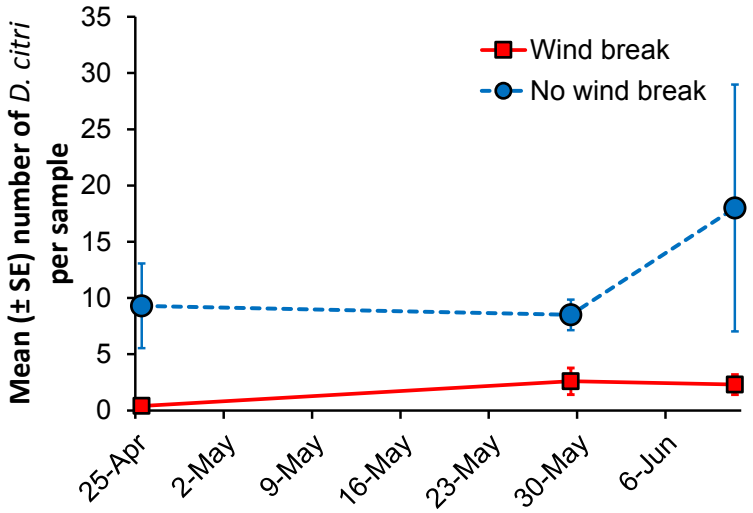
Presence of windbreak

5 Groves
2 months of sampling
Use a vacuum insect sampler





GLMM on pooled data:
$\chi = 1141.9$, $P < 0.001$



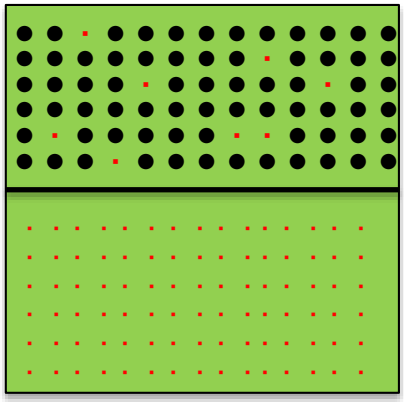
Martini X. et al. 2015. *Agriculture, Ecosystem, and the Environment*

Grove architecture

Resets in mature orchards

Solid set planting

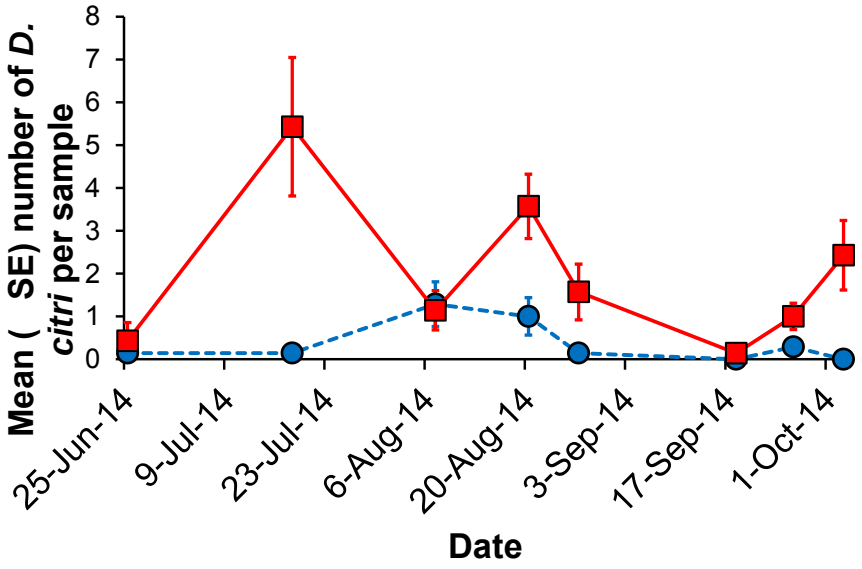
4 fields; 4 varieties
2 months of sampling
2 seasons
14 trees per field
Use a vacuum insect sampler

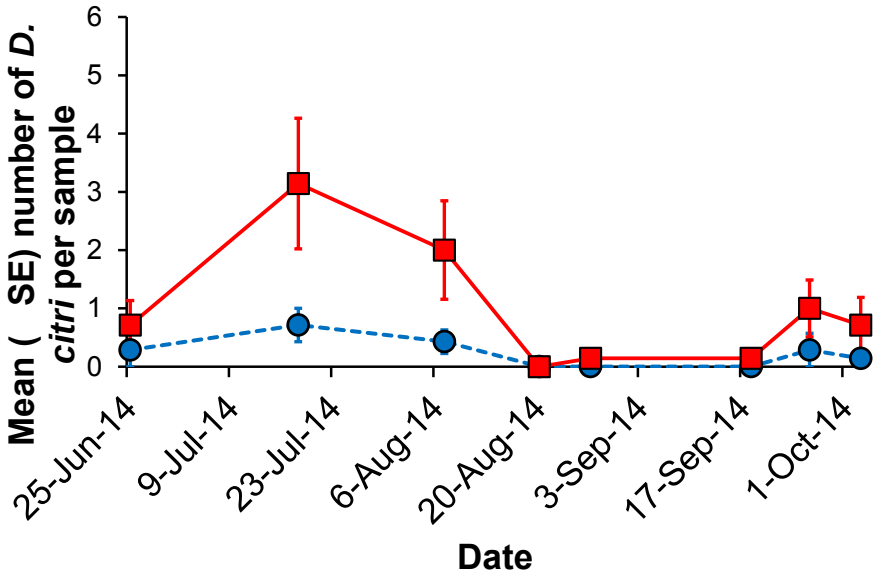


- Reset
- Mature trees

Martini X. et al. 2015. *Agriculture, Ecosystem, and the Environment*

Grove architecture





Resets

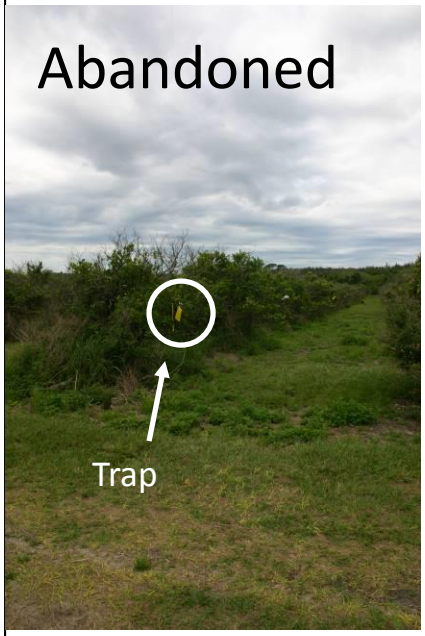
Solid set planting

GLMM on pooled data:
$\chi = 19.446$, $P < 0.001$

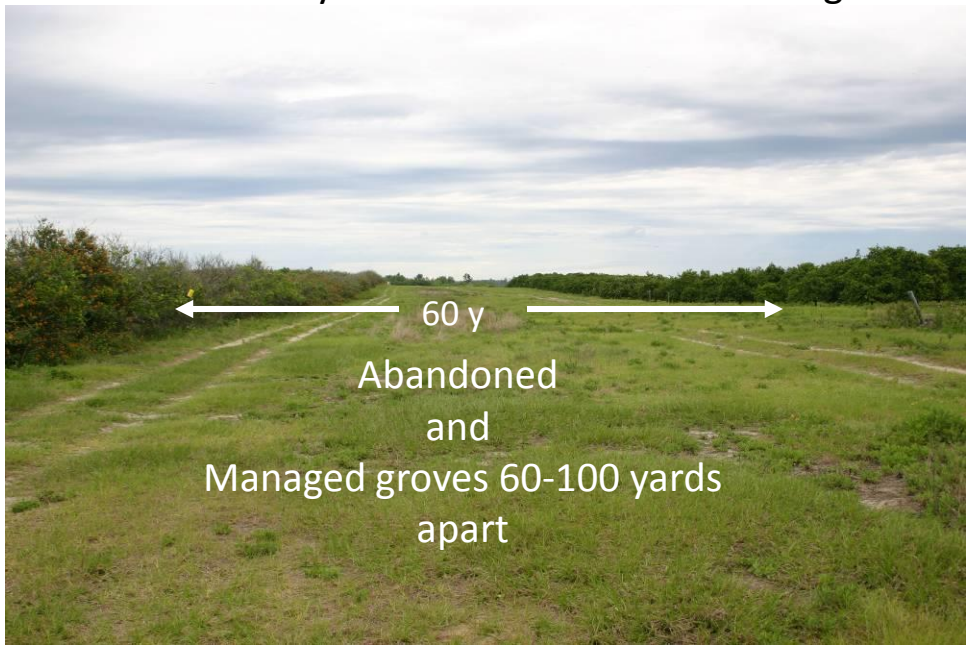
Martini X. et al. 2015. *Agriculture, Ecosystem, and the Environment*

Impact of abandoned groves on managed groves

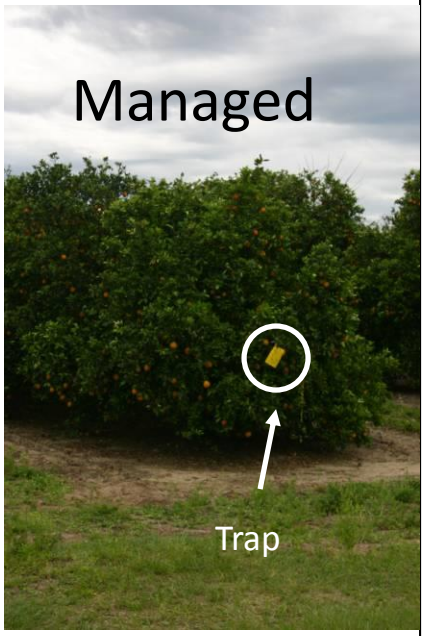
Abandoned Grove
marked with Protein 1



Psyllids recaptured on traps within each grove are tested by ELISA to determine their origin



Managed Grove
marked with Protein 2



Results suggest that direction of psyllid movement is from abandoned to nearby managed groves

The Border Effect

Average number of psyllids / sticky trap per week

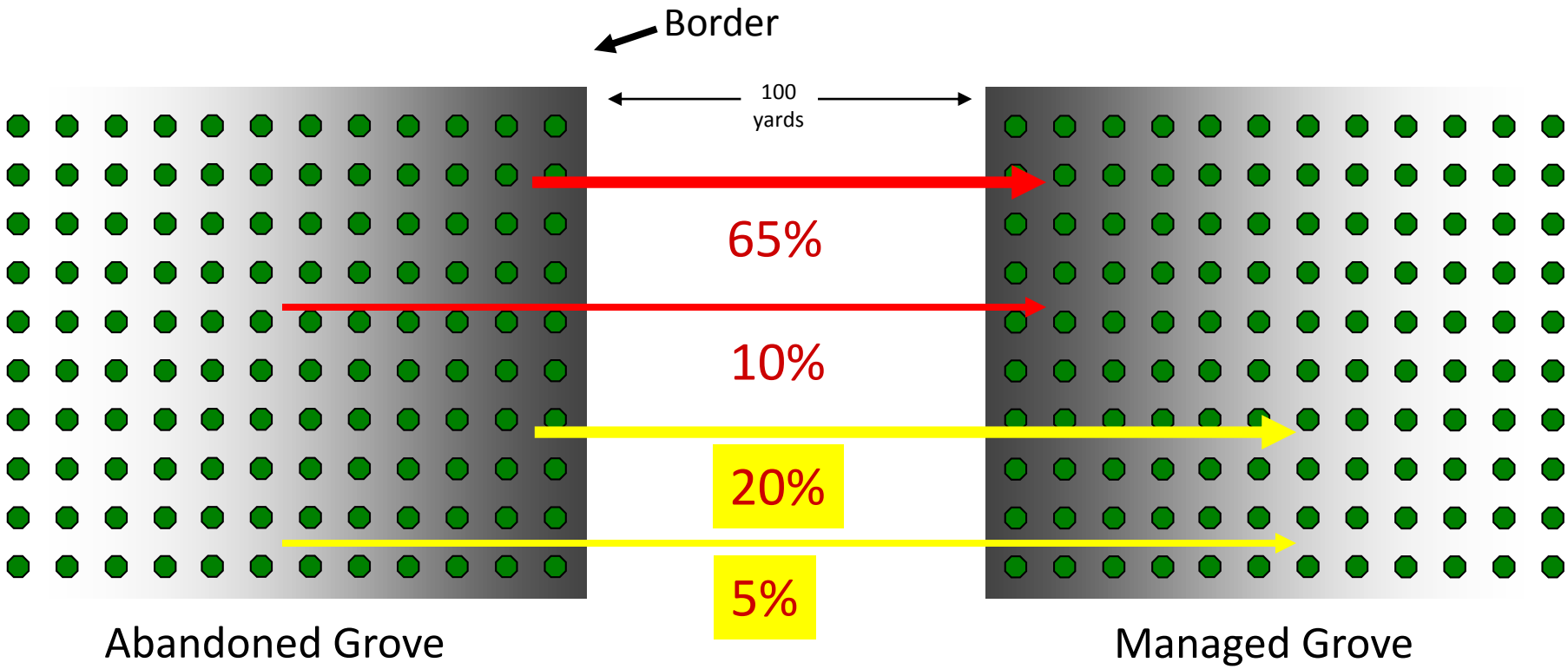
0-5/ trap | 5/ trap | 15/ trap | 30/ trap | Border | 100 yards | 30/ trap | 15/ trap | 1/ trap | 0/ trap

Majority of back and forth psyllid movement restricted to first 3-4 rows from grove borders

Abandoned Grove

Managed Grove

The Invasion Effect



65% females

35% males

Prevention

- Sample every week during spring and summer for Asian citrus psyllid, especially when young flush are abundant on citrus.
- Only buy citrus from registered nurseries. Always check citrus purchased for psyllids.
- When possible, grow windbreaks or hedgerows on citrus grove borders, as this can reduce densities of the pest on grove borders.

Windbreaks protect citrus groves from Asian citrus psyllid infestation.
More information on windbreaks in citrus groves can be found at:
http://www.crec.ifas.ufl.edu/extension/windbreaks/

Future Research and Applications

- Protecting grove borders is essential.
- ACP initially colonize and prefer borders.
- When populations build, ACP move inward to avoid competition.
- Effective traps will be useful in detecting ACP infestation.
- Intermittent ACP management appears insufficient; requires coordination and frequent input.
- Psyllid management with insecticides, cultural control (windbreaks), dormant sprays, and biological control, with focus on borders.

Thank You!

- Xavier Martini
- Angel Hoyte
- Wendy Meyer
- Heather Gibbard

2017 Florida Citrus Growers' Institute