

A close-up photograph of a tomato plant showing symptoms of Tomato Yellow Leaf Curl Virus (TYLCV). The leaves are yellowed and curled, and a small yellow flower is visible. A wooden stake is visible in the background.

# **Environmental and Geographical Variables Associated with TYLCV Epidemics in Southwest Florida**

Bill Turechek, USDA-ARS, Fort Pierce, FL

# TYLCV/Whitefly Biology

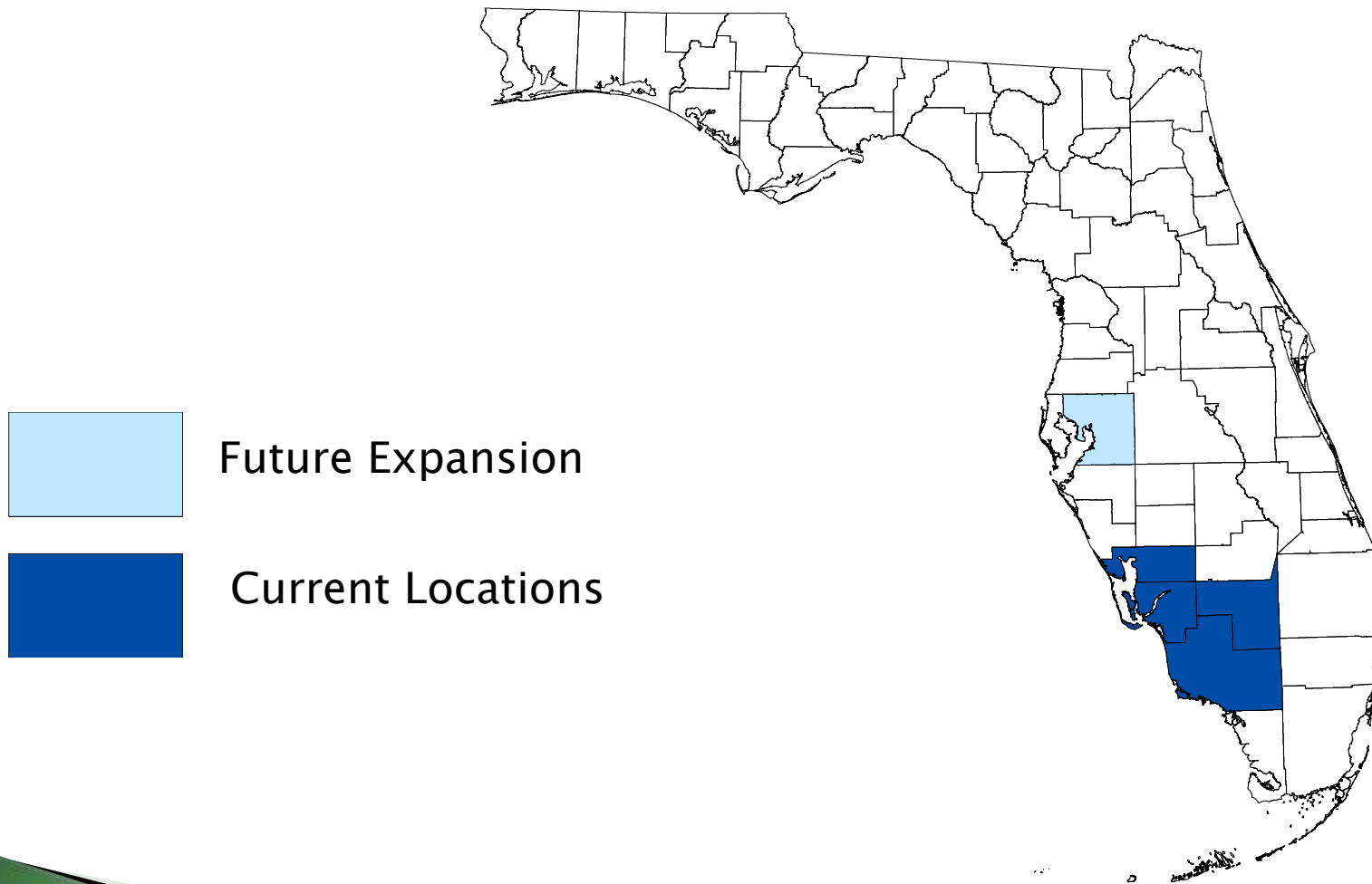
- ▶ Project began in summer of 2007
  - After a meeting w/ grower groups, industry reps, and University personnel in the wake of the 2006 epidemic
- ▶ We suggested conducting a regional survey of growers fields to gather info. on TYLCV/WF
  - Goal is to improve management of TYLCV and whiteflies
- ▶ Greatly facilitated when “we” received funding for 3 years through NIFA’s Specialty Crops Research Initiative (SCRI) program
  - The SCRI project focuses on managing whitefly-transmitted viruses of vegetables
    - Project team: Scott Adkins, Shaker Kousik, Susan Webb, Pam Roberts, Phil Stansly, Charlie Mellinger



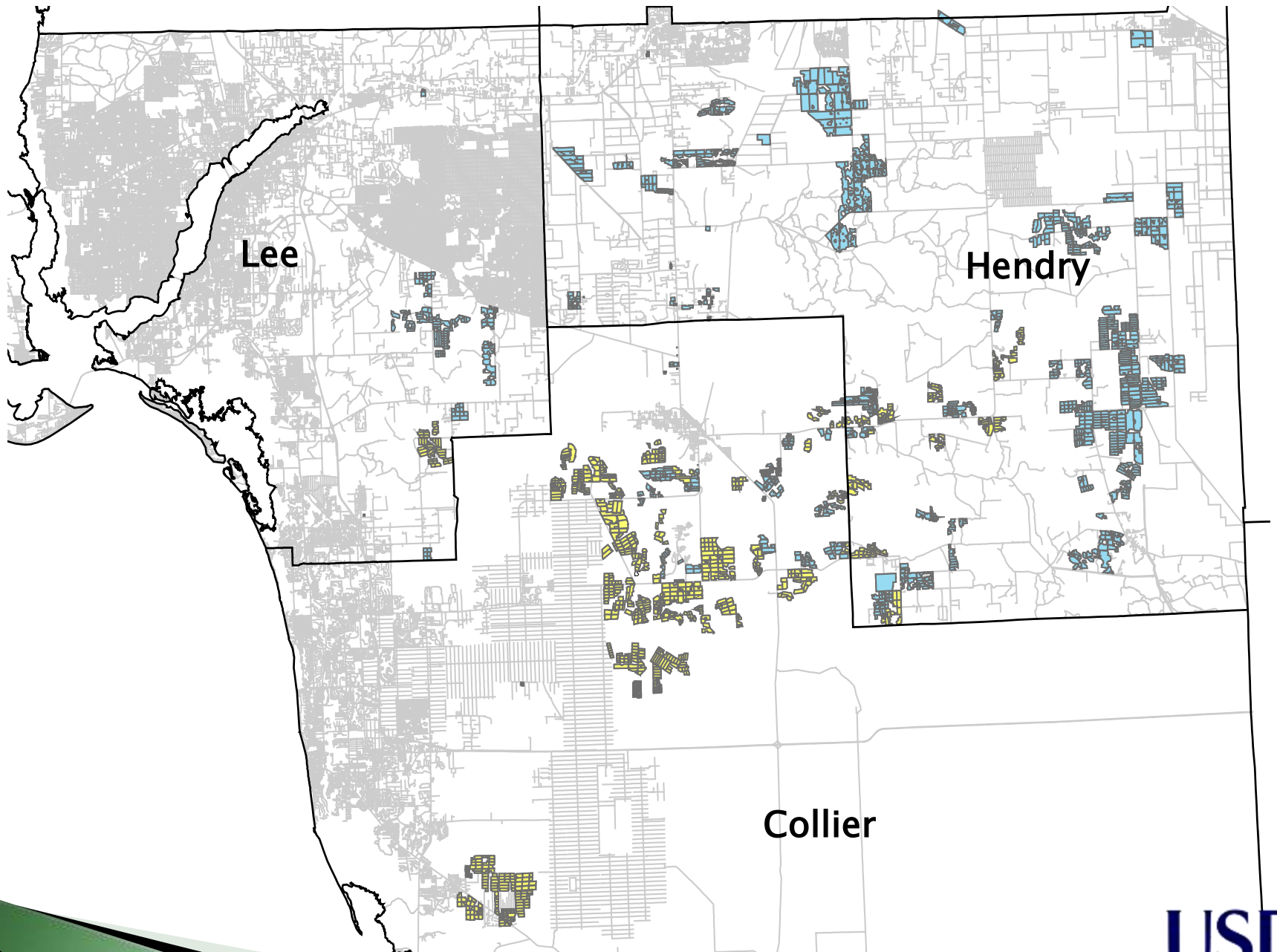
# Regional Survey

- ▶ An understanding of which factors contribute to “local” outbreaks of whiteflies & the viruses they transmit
  - Identify climatic variables and common features associated with problem locations (e.g., influence of location, production practices)
  - Develop a strategy to reduce epidemics
- ▶ ***Decision Support System***
  - GPS/GIS, internet, and smart phone-based technology
  - Develop a information collection, processing and delivery system
  - In cooperation with ZedX Inc.

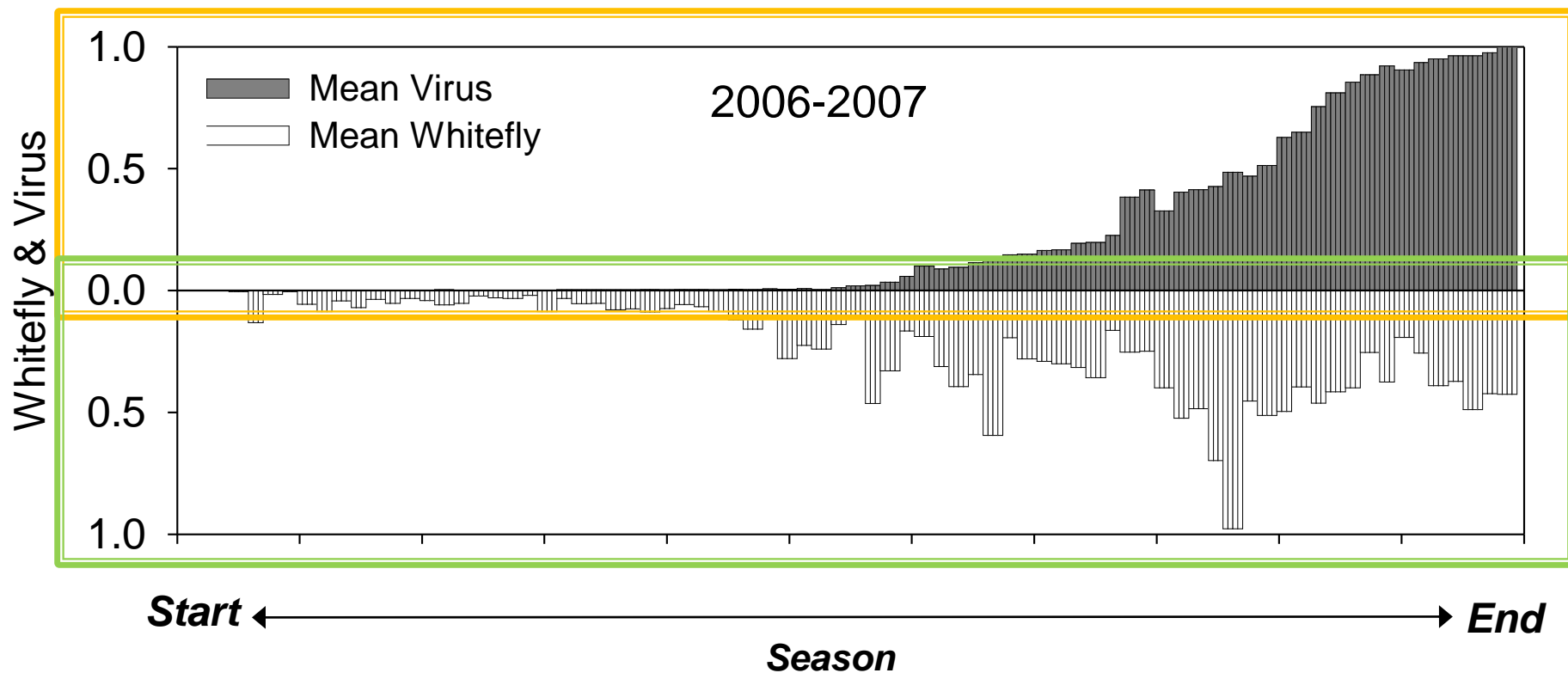
# Survey Location



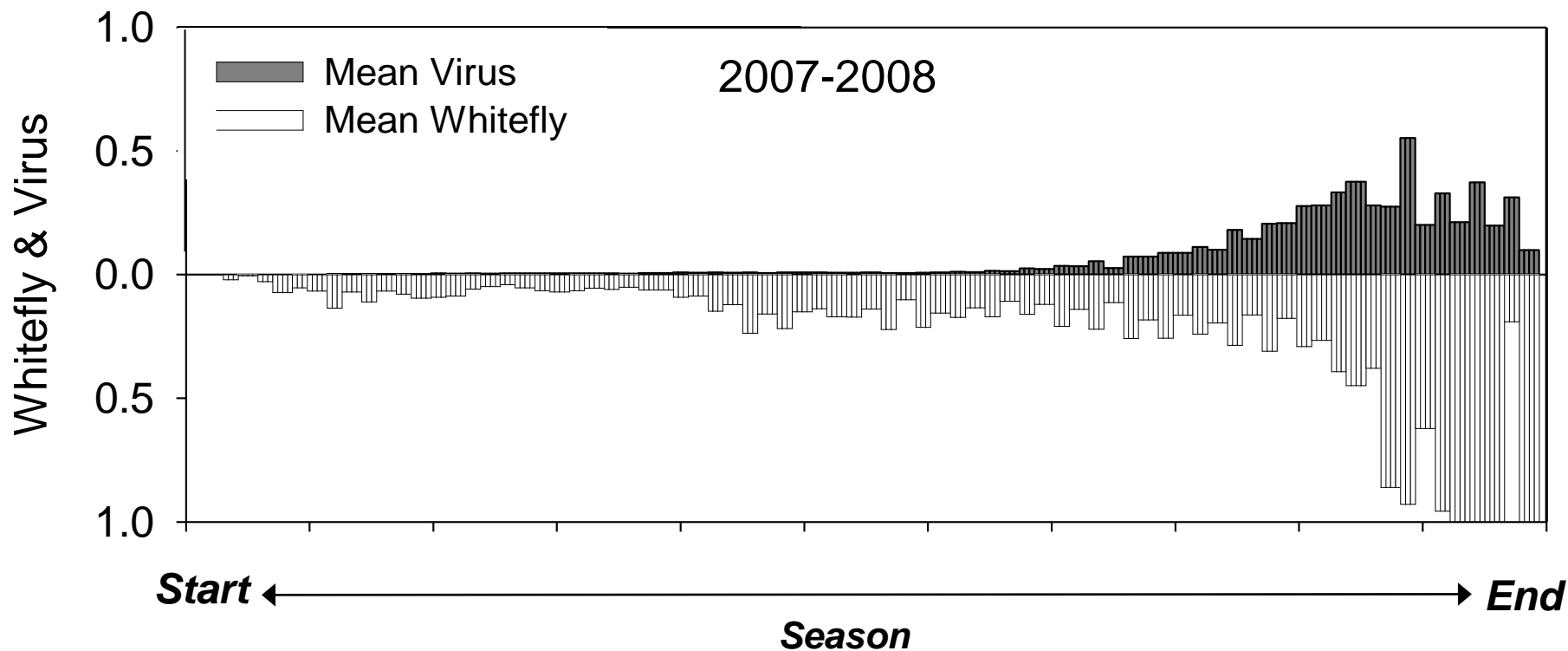




# 2006/2007 Season

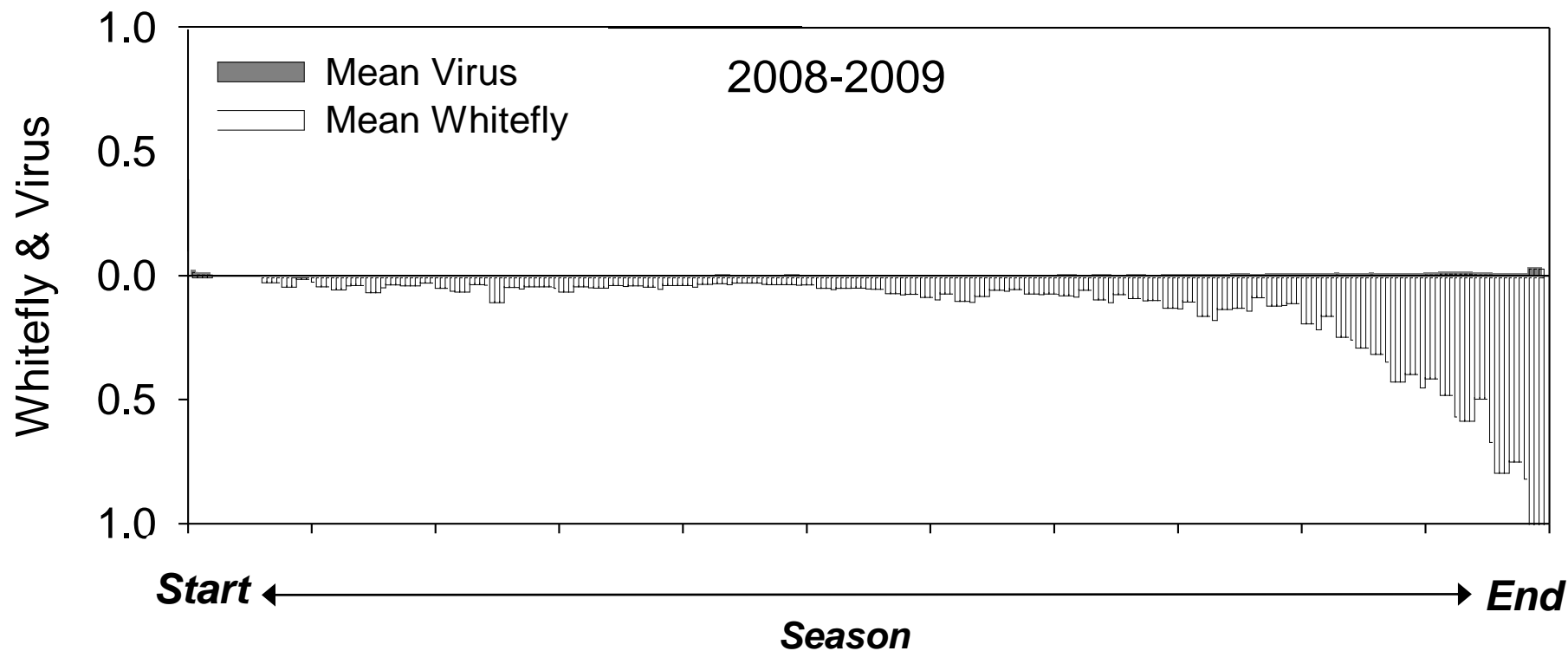


# 2007/2008 Season

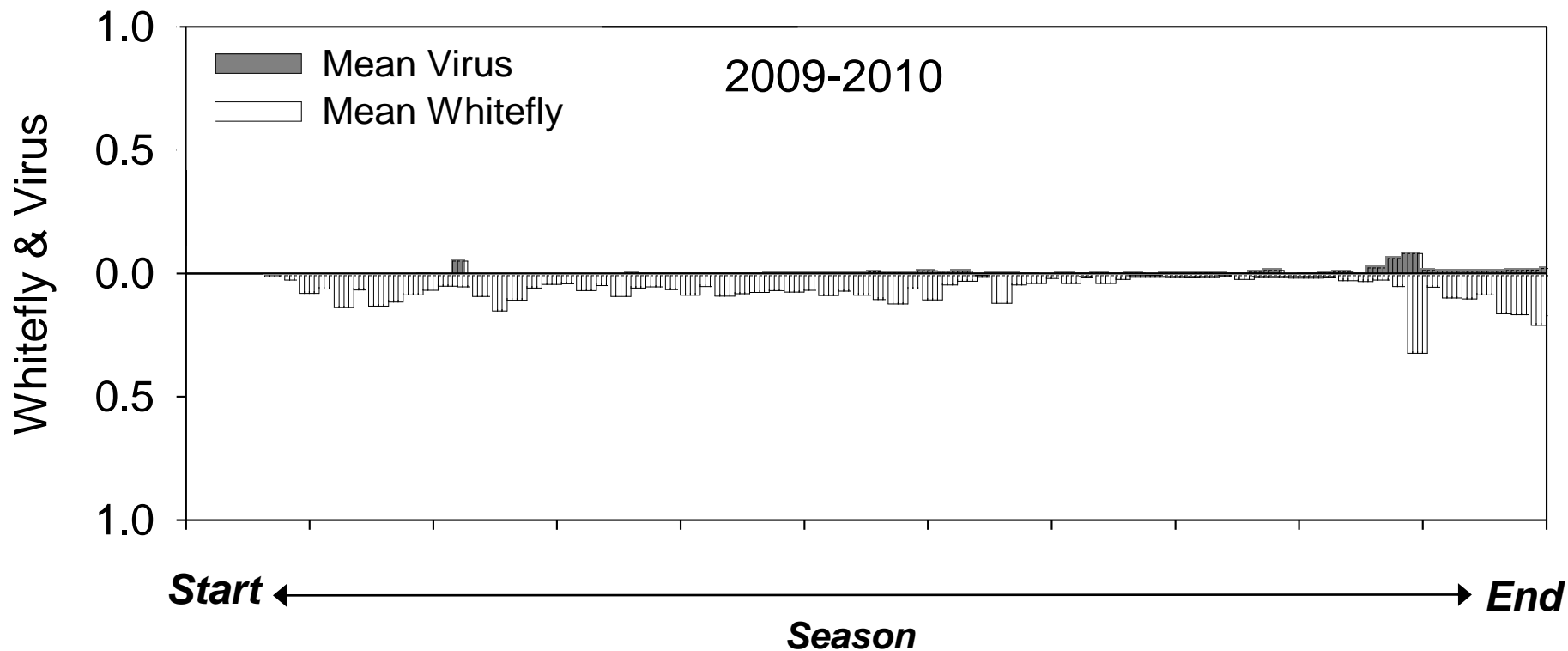




# 2008/2009 Season



# 2009/2010 Season



# Two Questions

- ▶ Can we rely on weather conditions to predict whitefly and/or virus outbreaks?
  - ...Yes and No
- ▶ Can we rely on geographical attributes or simply location to predict whitefly and/or TYCLV outbreaks?



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# Important Weather Variables

- ▶ Windowpane or Moving-Window Analysis
  - Variables
    - Temperature (max, min, avg.)
    - Wind speed, gusts, direction (max, min, avg.)
    - Dewpoint & Relative humidity (max, min, avg.)
    - Precipitation (max, min, avg.)
    - Visibility
  - Window sizes
    - 5, 10, 15, 30, 60, 90 and 120 days
- ▶ Determine the correlation between TYLCV severity or whitefly density and associated weather variables

# Important (?) Weather Variables

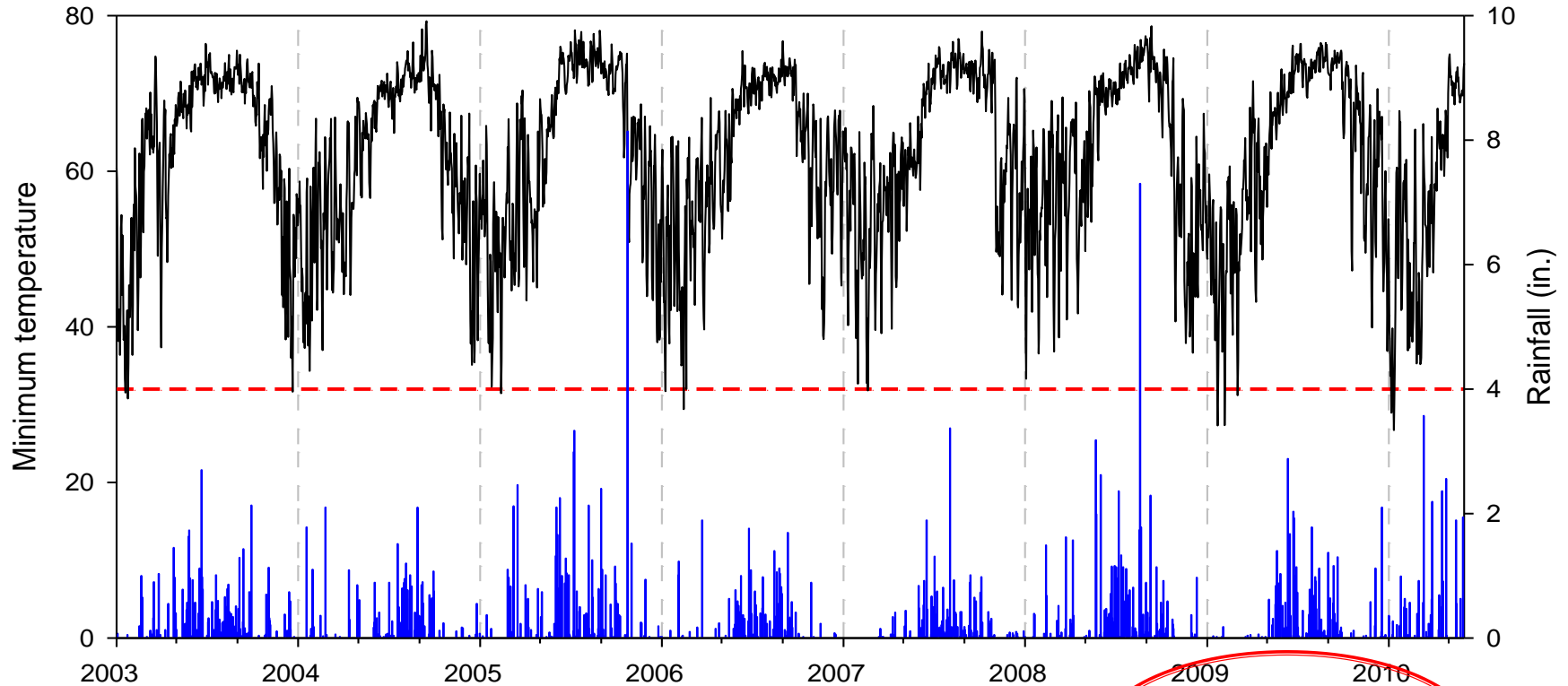
Variable	Whitefly	TYLCV
Wind Speed	+	+
Wind Direction	$\pm$ (30 day)	$\pm$ (30 day)
Precipitation	—	—
Minimum Temperature	$\pm$	—
Average Temperature	$\pm$	—
Maximum Temperature	$\pm$	—

- ▶ Pest management practices considerably alter counts
  - ▶ Averaging over the region helps to mediate this effect
- ▶ Varietal differences alter epidemic development
- ▶ Data is still sparse to fully overcome limitations



# Mother Nature's Role

Minimum temperature and total daily rainfall recorded in Immokalee



# Some Natural Questions

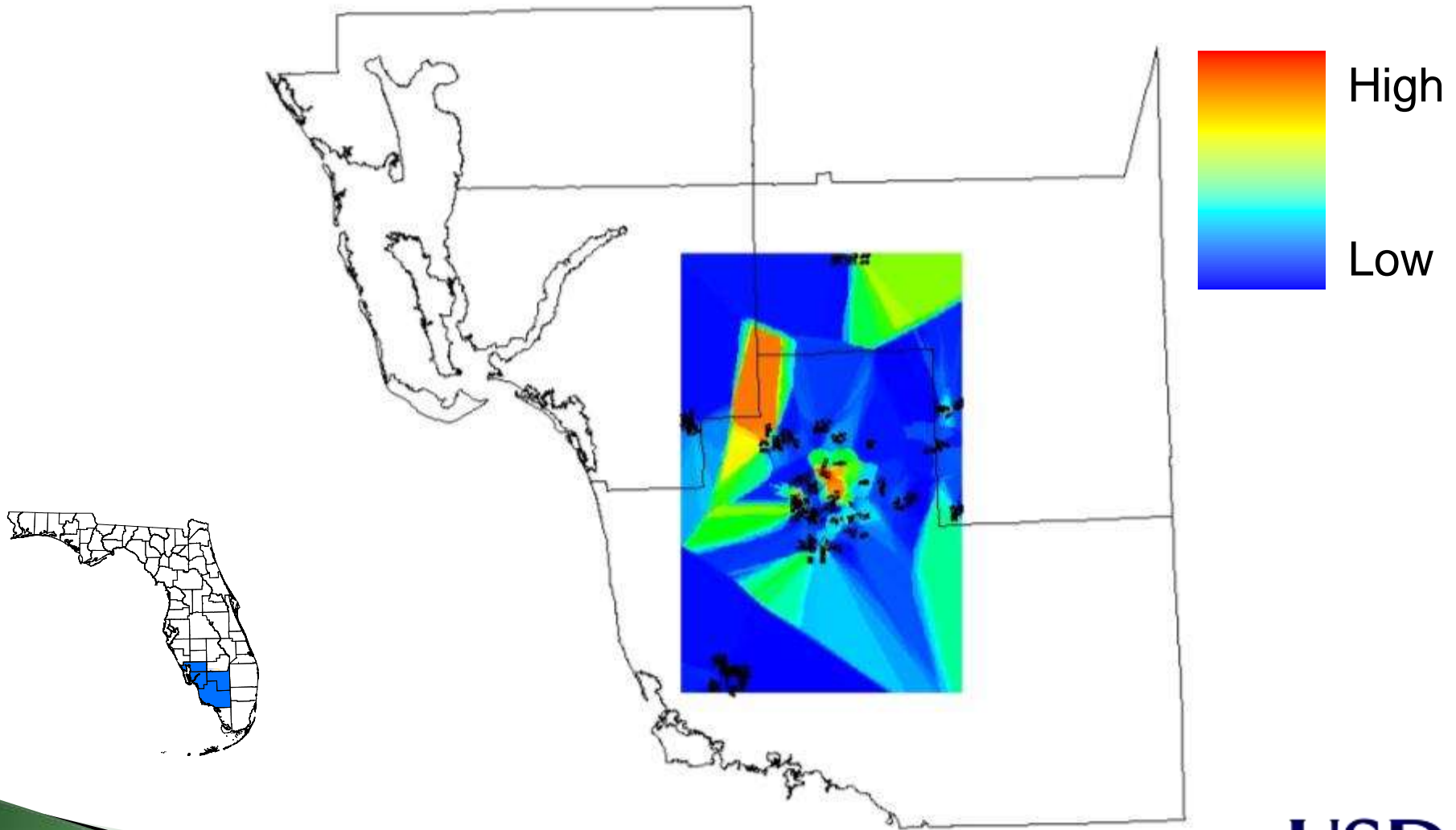
- ▶ Can we rely on weather conditions to predict whitefly and/or virus outbreaks?
  - ...Yes and No
- ▶ Can we rely on geographical attributes or simply location to predict whitefly and/or TYCLV outbreaks?

# Field Attributes

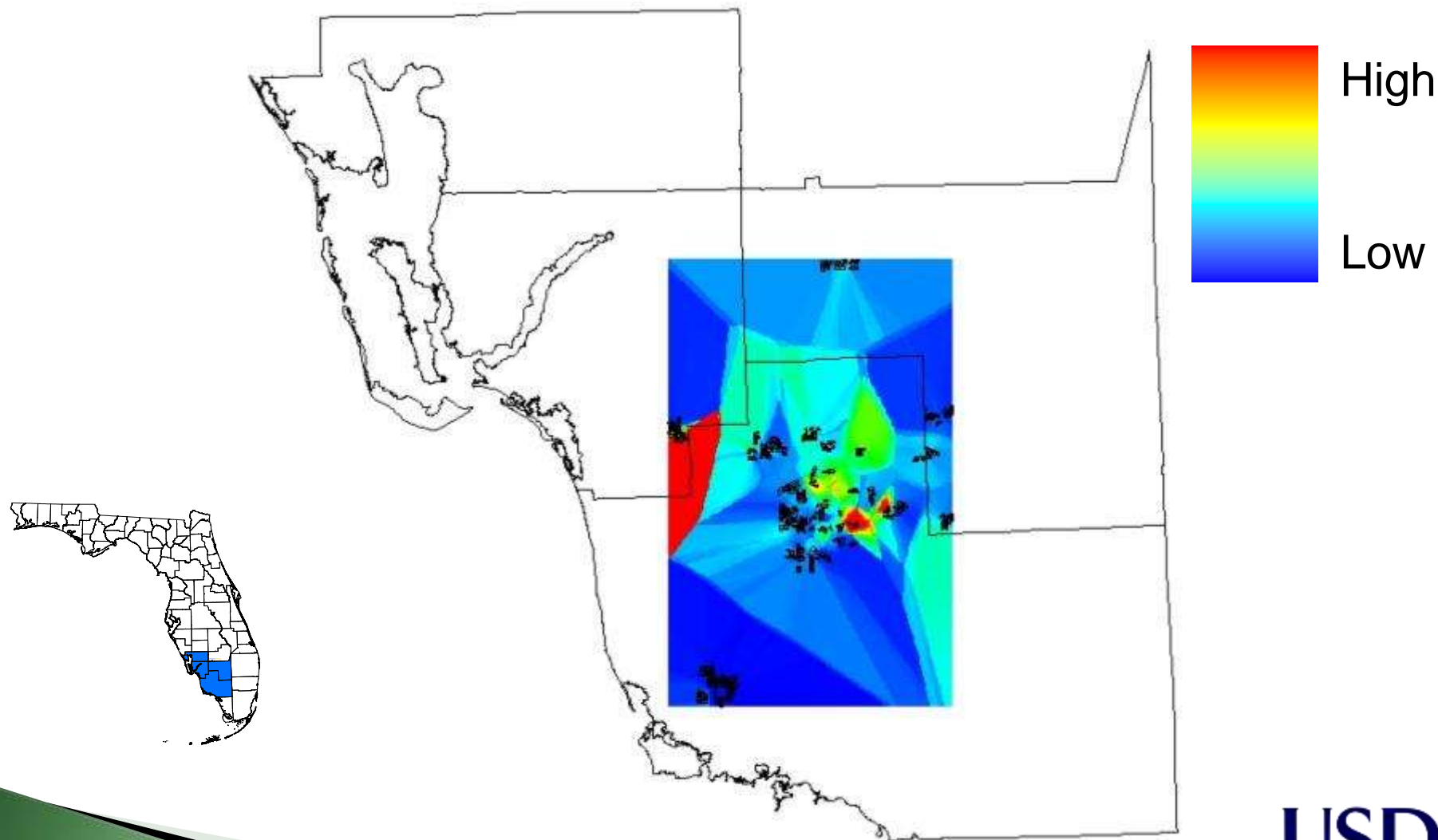
Variable	Mean Whitefly			Maximum Virus		
	06/07	07/08	08/09	06/07	07/08	08/09
East-West Direction	<u>0.35</u>	<u>0.31</u>	<u>0.39</u>	<u>0.39</u>	<u>0.21</u>	<u>0.21</u>
North-South Direction	0.02	<u>0.49</u>	<u>0.40</u>	<u>0.16</u>	<u>0.29</u>	<u>0.35</u>
Perimeter	<u>-0.28</u>	-0.05	-0.05	<u>-0.18</u>	<u>-0.19</u>	-0.07
Area	<u>-0.32</u>	-0.06	-0.06	<u>-0.23</u>	<u>-0.23</u>	-0.09
Date Planted	<u>0.74</u>	<u>0.23</u>	<u>0.21</u>	<u>0.74</u>	<u>0.36</u>	-0.12



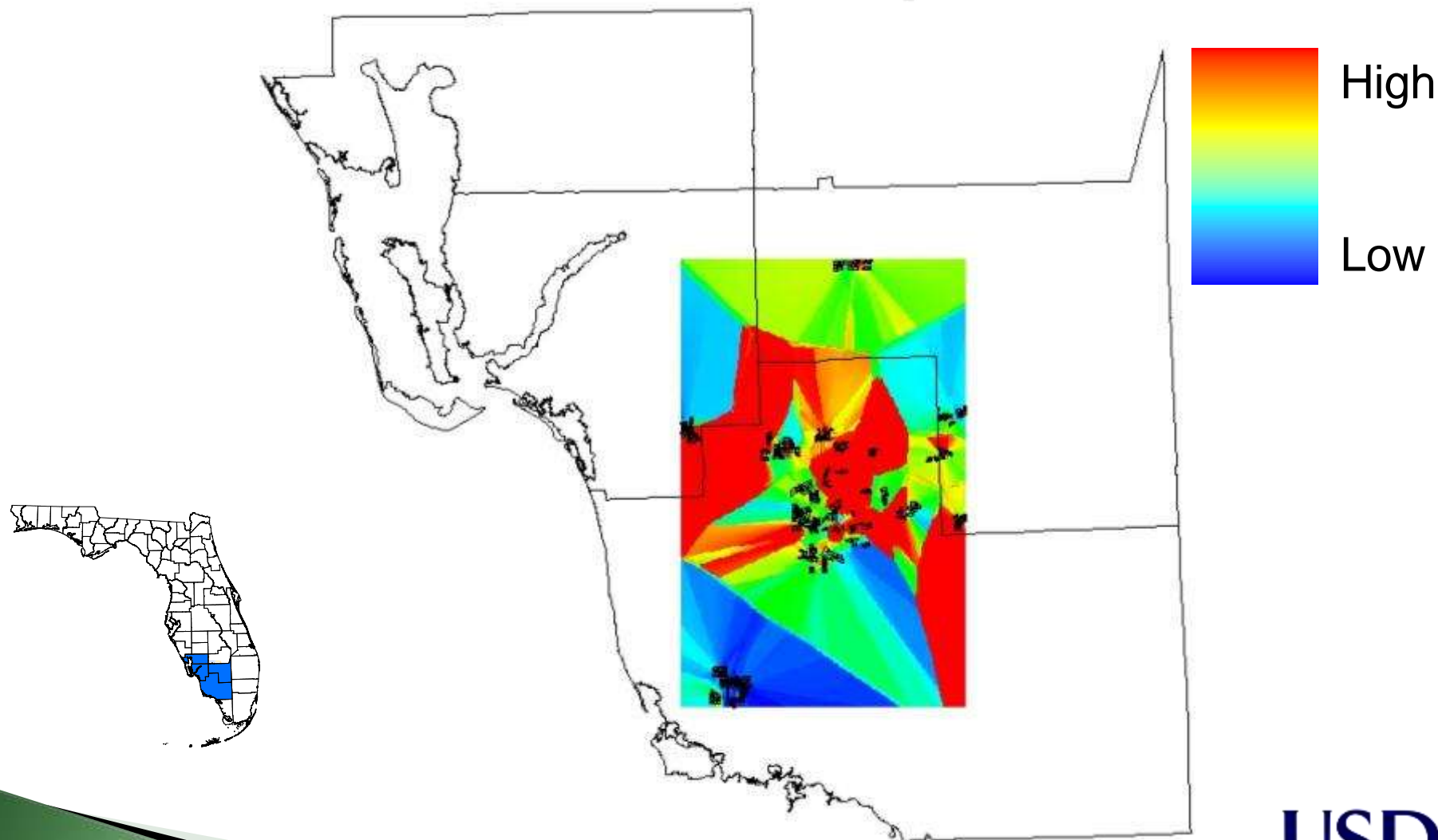
# Maximum Virus (2007–2008)



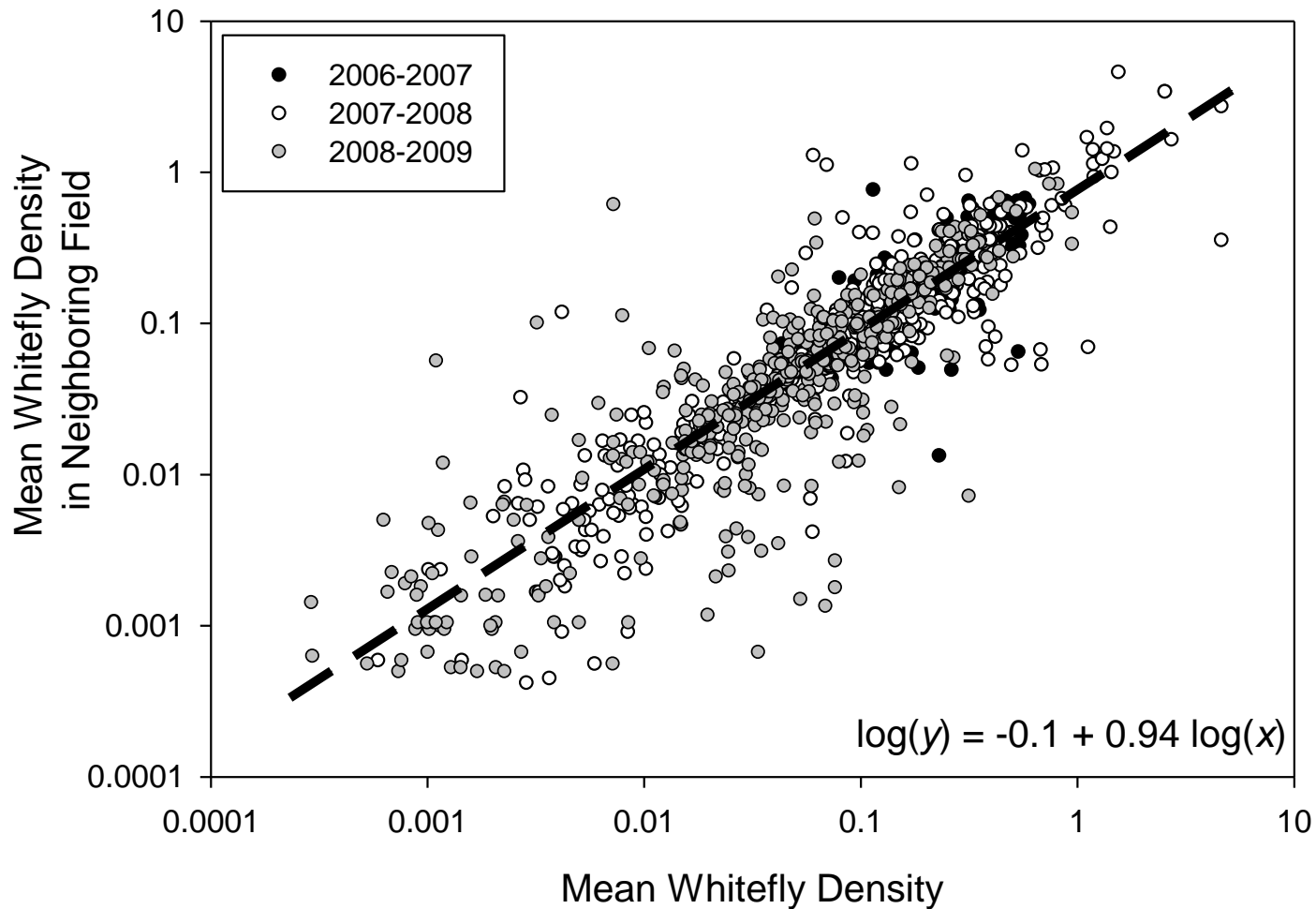
# Mean Whitefly (2007-2008)



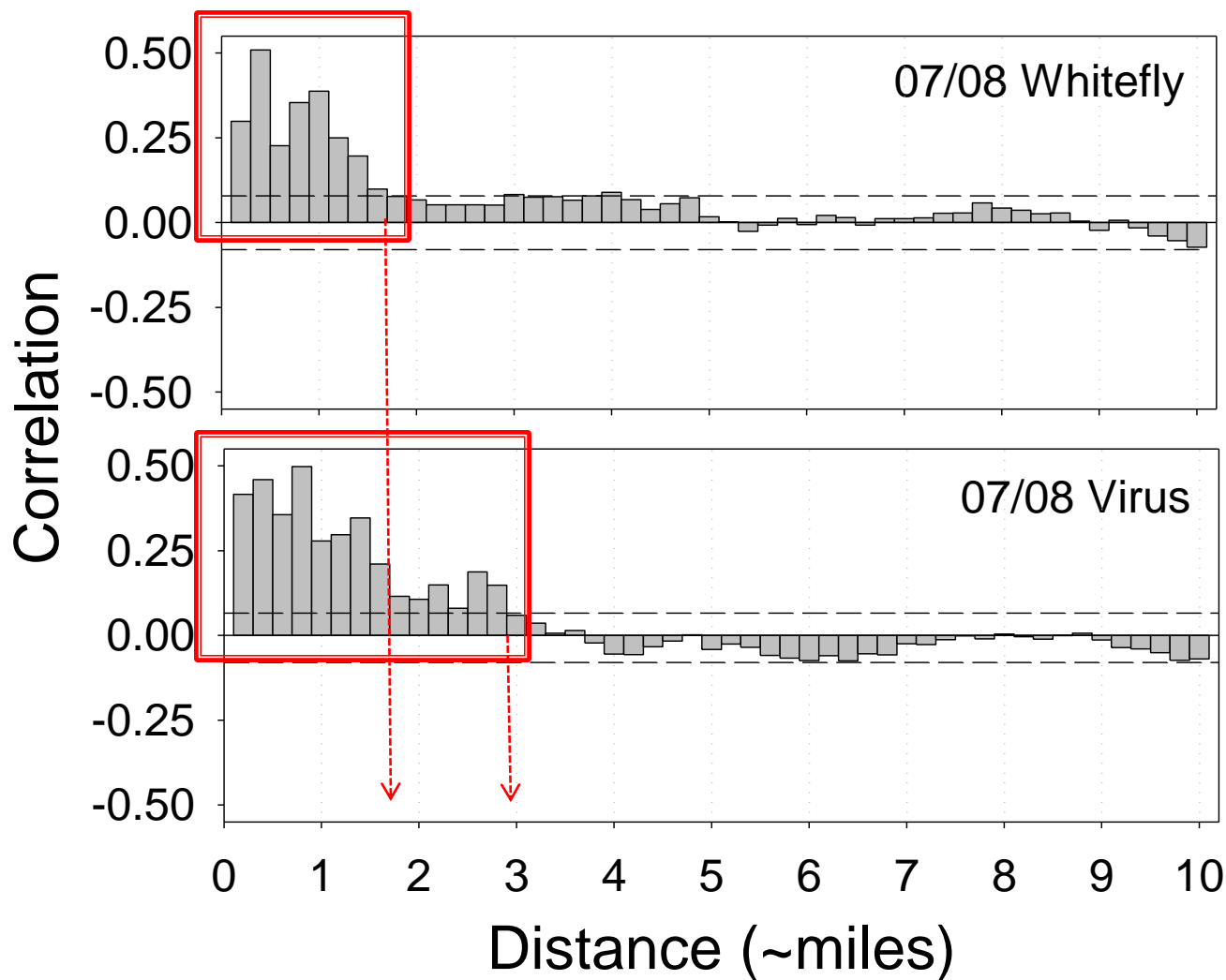
# Maximum Whitefly (2007-2008)



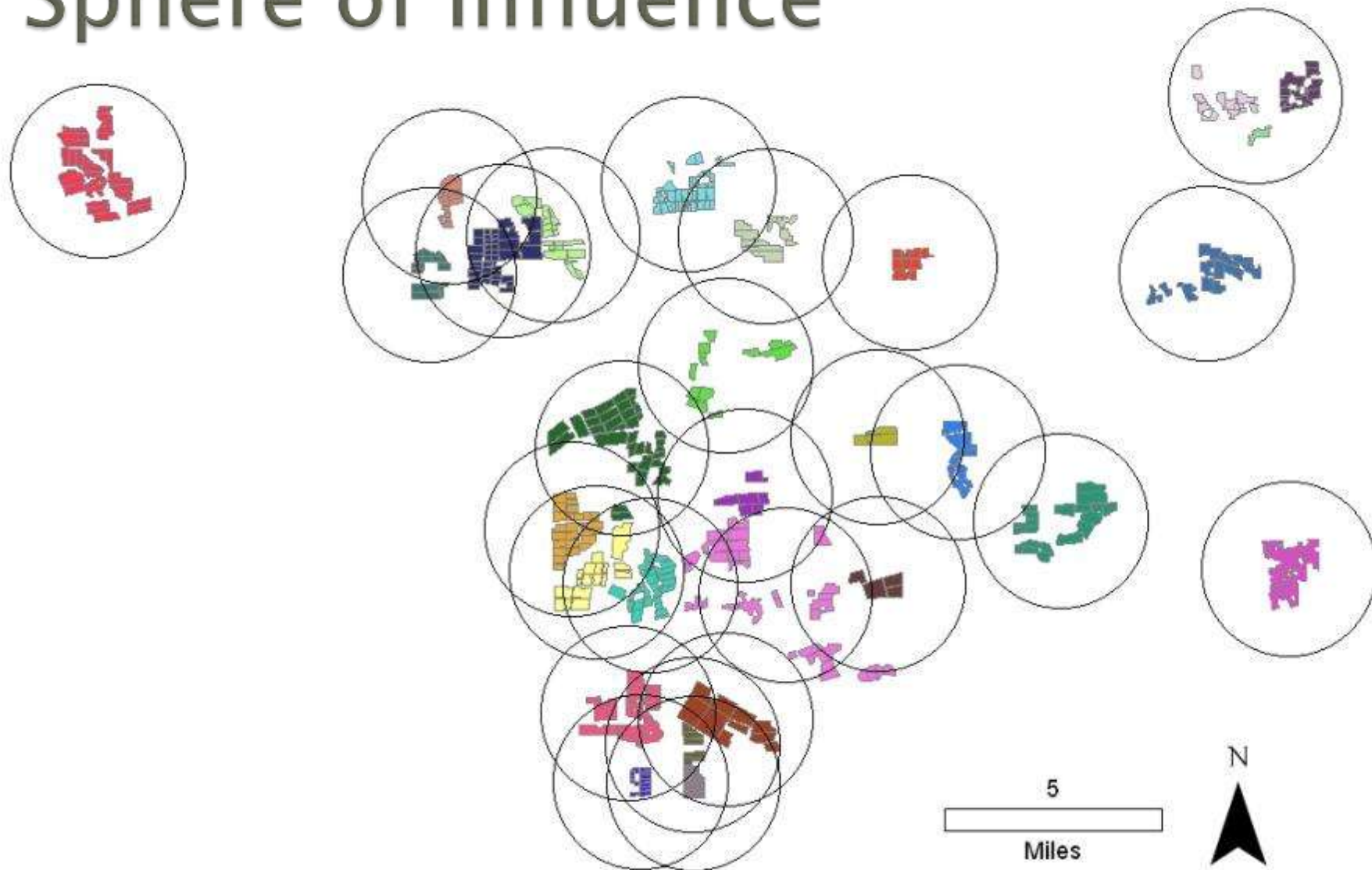
# 1<sup>st</sup> Order Nearest Neighbors (whiteflies)



# Correlation Analysis



# Sphere of Influence





# Regional Survey

- ▶ An understanding of which factors contribute to “local” outbreaks of whiteflies & the viruses they transmit
  - Identify common features associated with problem locations (e.g., land usage, border fields, production practices)
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- ▶ ***Decision Support System***
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# Pest & Di

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Grower USDA-ARS-USHRL

Farm Parking Lots

Field NE Parking Lot

Scout

Obs Date 2010-08-27

Crop Origin

Crop Tomato

Crop Type Large Fruited

Crop Variety Florida 47

Crop Stage First Open Flowers

Field Entry Yes

Field Status Normal

Pest Type Insect

Pest Name Whitefly (adults)

Pest Units - Select Pest Units -

Pest Amount 0

Disease Type Viral Diseases

Disease Name Tomato Yellow Leaf C

Disease Units Percent Infection

Disease Amount 0

Comments

Add Pest

Save

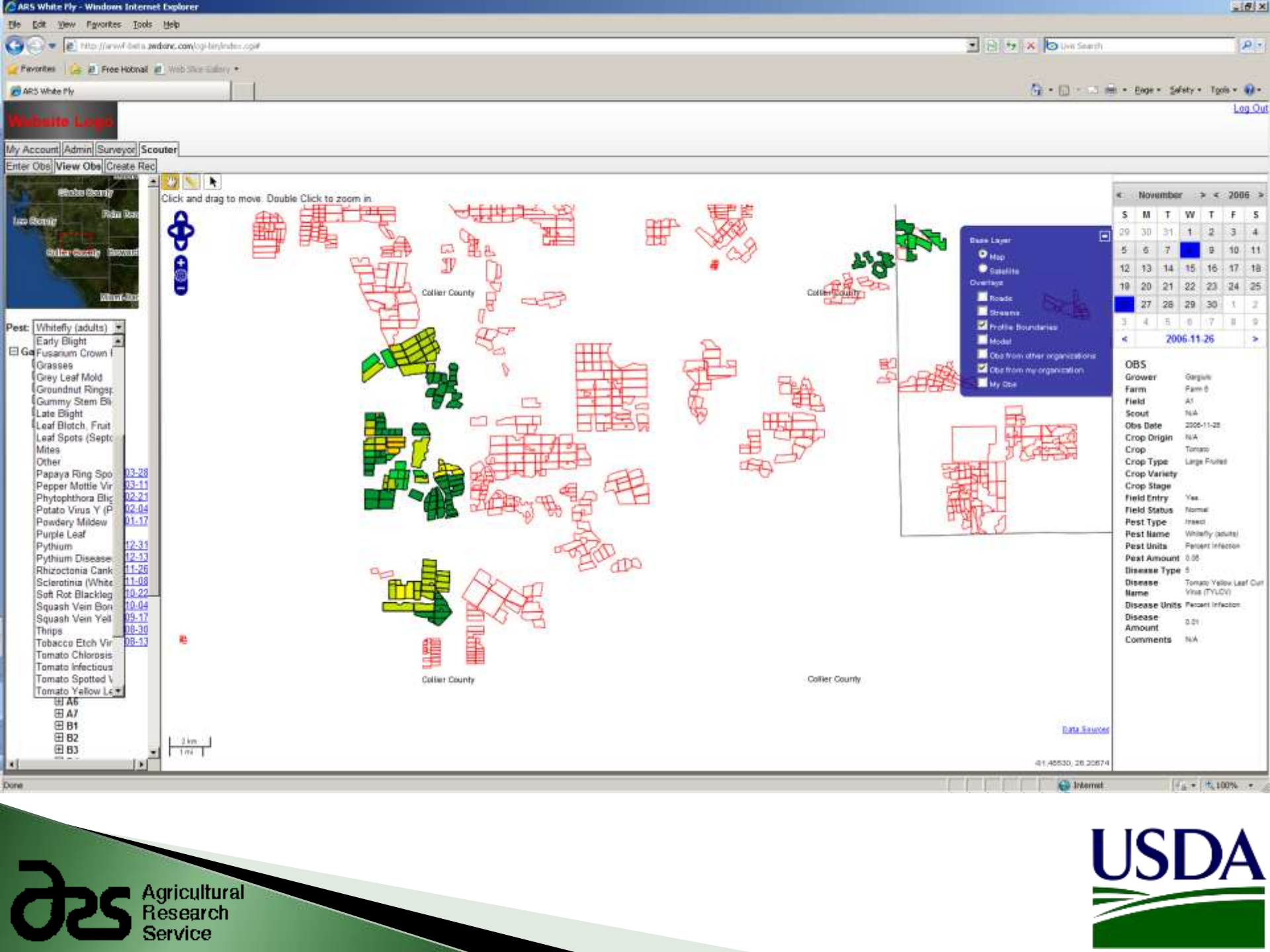
Prev Next

Clear All

Del Pest

Del All

Done



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RECS

Date 2010-08-27

Consultant Bill Turechek

Select Grower, Crop, Pest

Select Application

Select Adjuvant

Select Carrier and Tank

Comment

Save Clear

Done

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Enter Obs View Obs Create Rec

RECS

Date 2010-08-27

Consultant Bill Turechek

Select Grower, Crop, Pest

Select Application

1 Add

App. Type Fungicide

Trade Name

Chemical Fam. Unknown

EPA # 432-888

REI Unknown

PHI Unknown

Form Unknown

User Concentration 4.5 oz/acre

User Spray Rate 100 gal/acre

Product Amt. 1 pound

Product Cost 35 \$/pound

Product Cost Total 35.00 dollars

Select Adjuvant

Select Carrier and Tank

Comment

Save Clear All Del All

Done

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http://arwf-beta.zedarc.com/login/index.cgi#

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User Concentration 4.5 oz/acre

User Spray Rate 100 gal/acre

Product Amt. 1 pound

Product Cost 35 \$/pound

Product Cost Total 35.00 dollars

Select Adjuvant

Select Carrier and Tank

Comment

Save Clear All Del All

Done



AT&T 3G 9:42 AM  
ARS White Fly

AT&T 3G 9:43 AM  
ARS White Fly

Select a Tool: My Account  
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State Email  
Count Country

City State  
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Fax

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Password

Previous Next

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Enter Obs  
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Logout

ARS Agricultural Research Service

Comp

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Obs Date  
Crop Origin

Crop  
Crop Type

Crop Variety  
Crop Stage

Field Entry  
Field Status

Previous Next

Pota

Squa

Tom

Water

Field Entry  
Field Status

Pest Type  
Pest Name  
Pest Units

Field Entry  
Field Status

AT&T 3G 9:46 AM

Field -- Select Field -- Locate

Scout

Obs Date 2010-08-31

Crop Origin

Crop Tomato

Crop Type Large Fruited

Crop Variety Florida 47

Crop Stage First Buds

Field Entry Yes

Field Status Normal

Pest Type Bacterial Diseases

Pest Name Bacterial Speck

Pest Units Percent Infection

Pest Amount 021

Comments

Navigation icons: back, forward, home, app store, settings

# Conclusions

- ▶ It is possible to predict the severity of TYLCV & whitefly density with select weather variables
  - Cold events
- ▶ Geographical features are perhaps the best predictor of these pests
  - Natural scale of these pests is regional
- ▶ Developing or coordinating an area-wide pest management protocol is perhaps the best bet for maximizing control
  - The *Decision Support Tool* could facilitate such an effort.



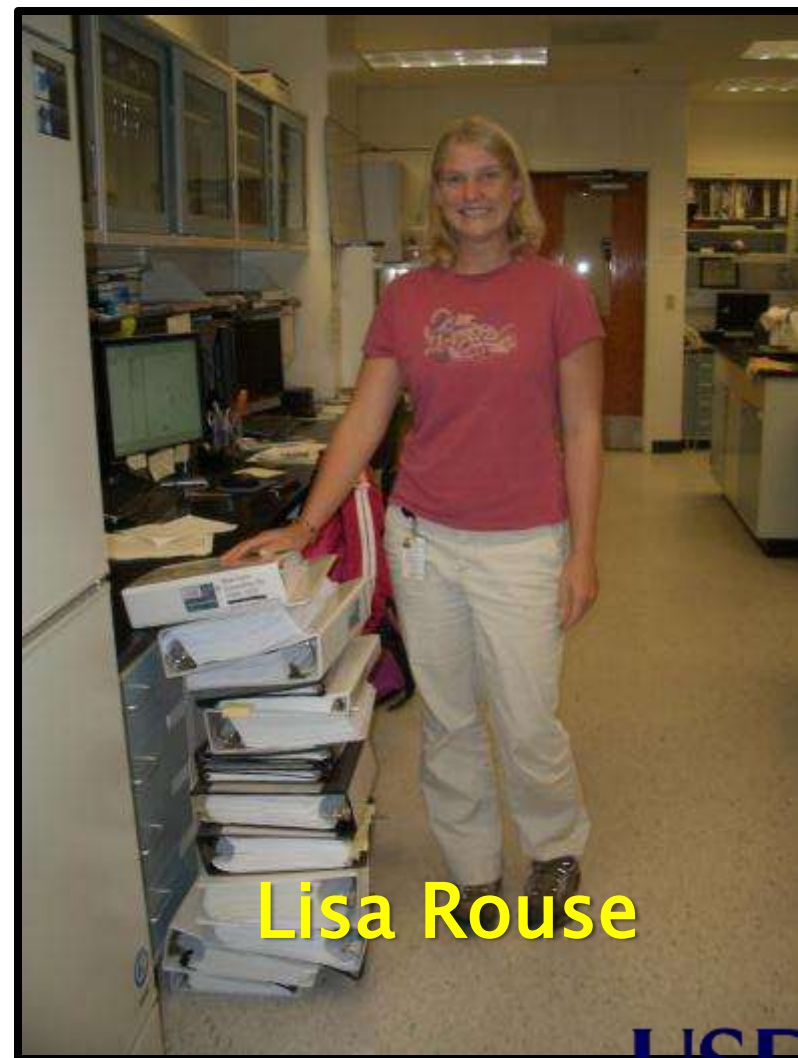
# Groundnut ringspot virus (GRSV)

- ▶ Relative of *Tomato spotted wilt virus* (TSWV)
  - Thrips vectored
- ▶ Found in south Florida tomatoes in fall 2009 and spring 2010
  - Glades Crop Care
  - Dr. Scott Adkins



# Acknowledgements

- ▶ Agmart
- ▶ Gargiulo
- ▶ Glades Crop Care
- ▶ Immokalee Tomato Growers
- ▶ Pacific Tomato
- ▶ Red Gator Consulting
- ▶ Six L's
- ▶ West Coast Tomato
- ▶ Wolf Island



Lisa Rouse