Examining flower thrips distribution in southern highbush blueberries utilizing geostatistical methods to improve monitoring techniques

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Introduction

Blueberries in Florida

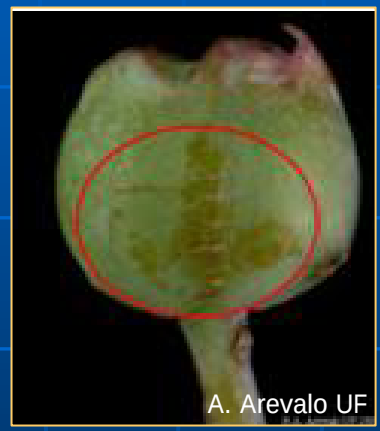
- Rabbiteye
  - Mainly for U-pick and local sales
    - Ripen later than southern highbush
    - Blueberry gall midge, *Dasineura oxycoccana* Johnson
- Southern Highbush
  - fresh market blueberries
  - 2007 (USDA, 2008)
    - 3.54 million kg (7.8 million lbs)
    - 1,052.2 ha
    - Average of $11.00 per kg ($5.00 per lb)

Flower Thrips

- ~90% of thrips captured in FL blueberries are *Frankliniella bispinosa* (Morgan) (Arevalo, 2006)
- ~1mm in length
- Bristle-like wings and “punch and suck” mouthparts
- Wide host range

Thrips Injury

- Thrips injure flowers in two ways
  - Feeding



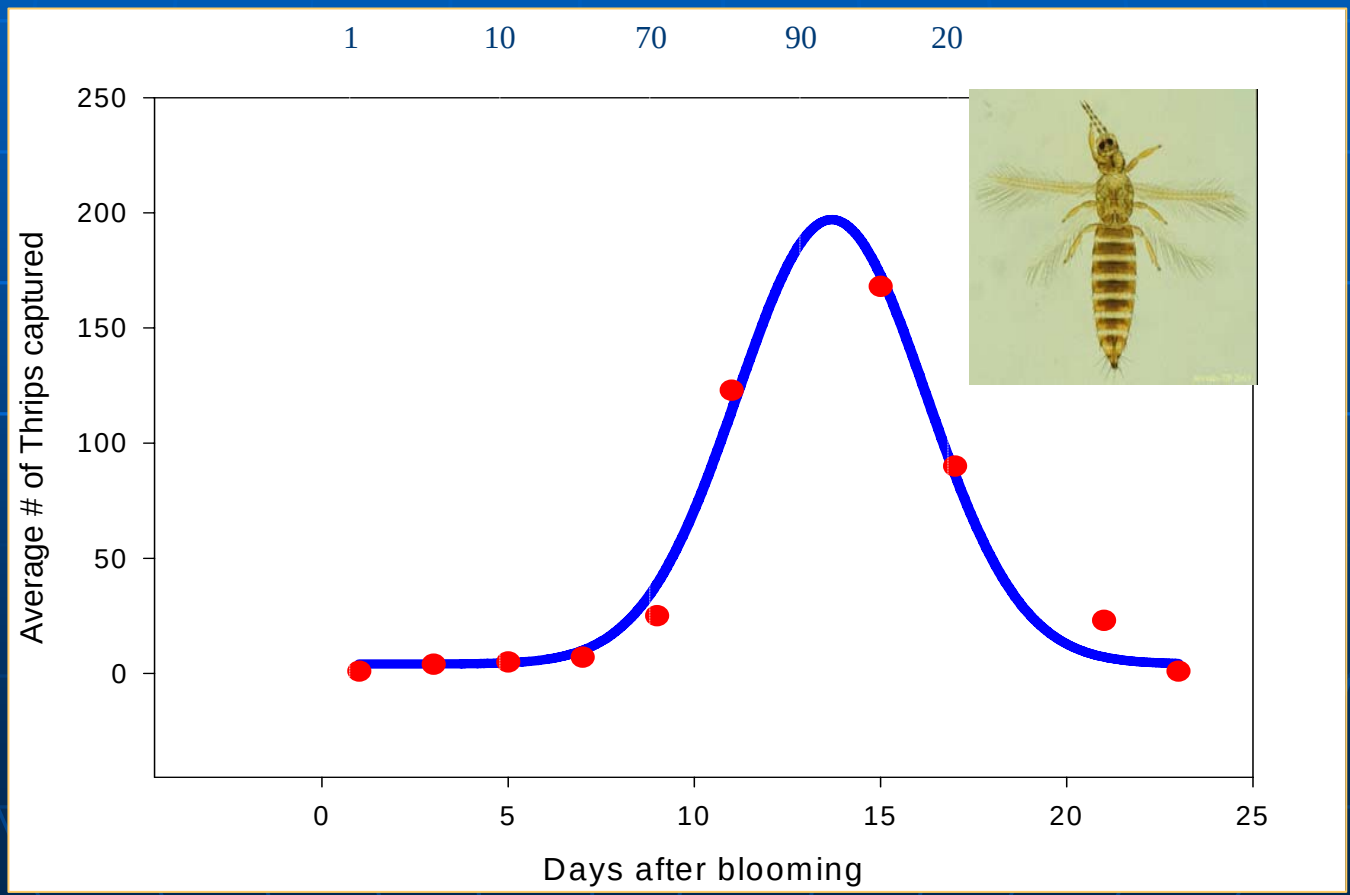
  - Oviposition

Size of thrips populations in relation to flower phenology





Percentage of open flowers



Arevalo, 2006

Geostatistics

- "...a set of tools for incorporating the spatial and temporal coordinates of observations in data processing." – P. Goovaerts, 1997
- Spatial variation among a set of sample points is modeled and the model is used to predict values at unsampled locations

Objective

- To model thrips populations utilizing geostatistical methods
  - To determine optimum trap spacing
  - To examine the effect of various environmental factors on the formation of ‘hot spots’

HYPOTHESIS: The spatial variability of flower thrips populations in southern highbush blueberries can be modeled by semivariograms

Methods

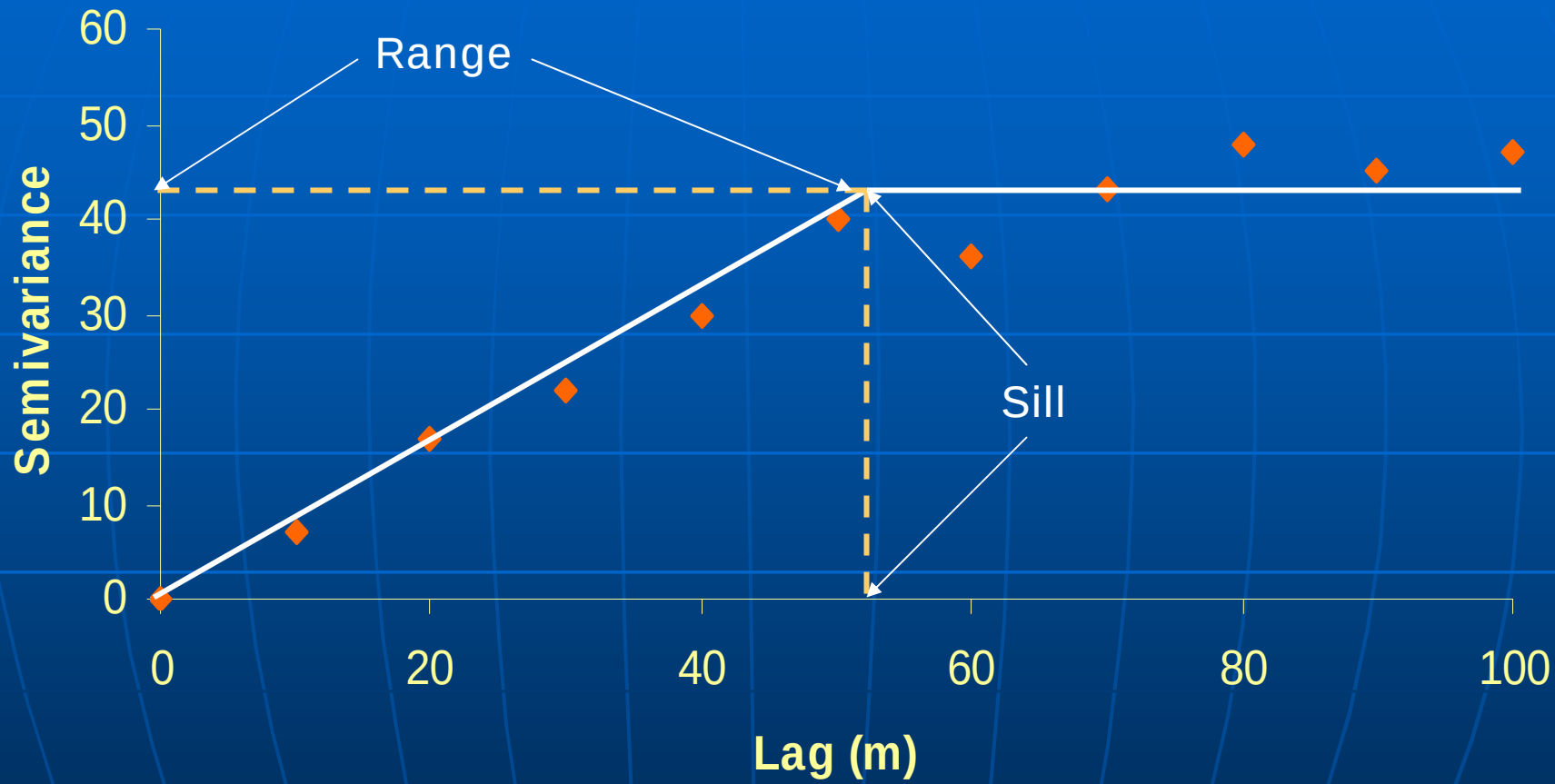
Sampling

- Sampled over a 3 week period
  - Feb. 7 – Feb. 14, 2008
  - Feb. 14 – Feb. 21, 2008
  - Feb. 21 – Feb. 28, 2008
- White sticky traps (130 total)
  - 100 on the 15.24 m grid
  - 30 placed randomly

Study Area


Study Area 2008
Inverness, Florida
Legend
grid traps
random traps
Bumble bees
Honeybees
Pathways
Fences
Sheds
Blueberries
Other trees
0 5 10 20 30 40
Meters
N
Source:
Field survey
GeoXT GPS reciver
Date: 2/28/2008
Creator: Elena M. Rhodes

Semivariogram Modeling



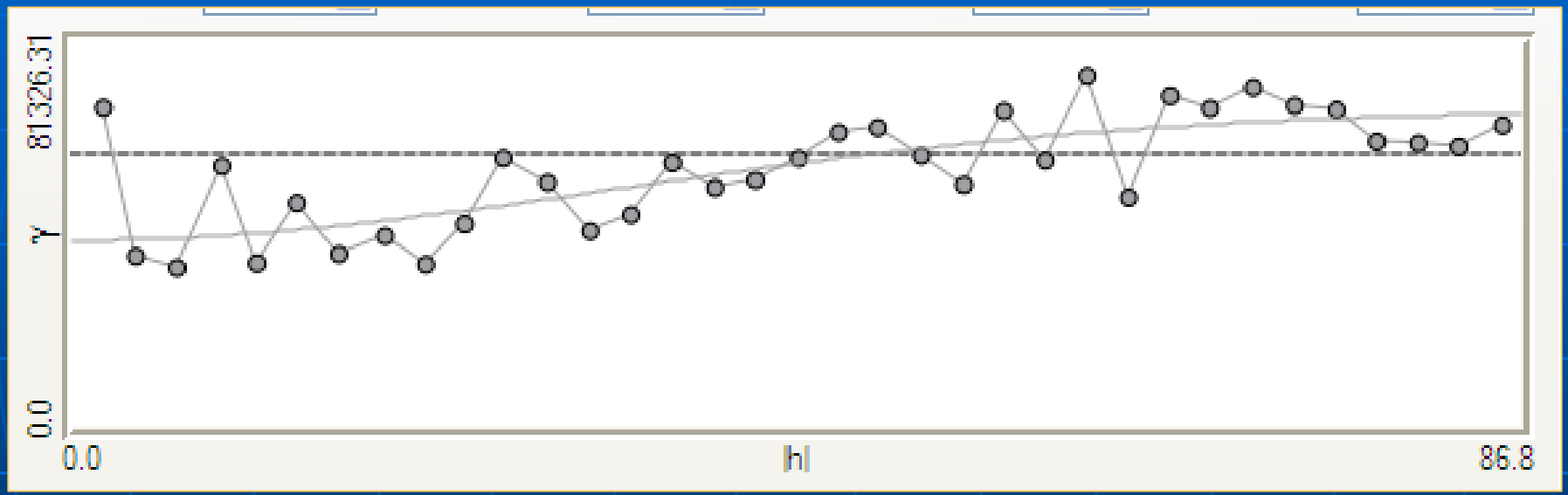
Nugget = the semivariance at 0 lag

Semivariogram Modeling

- Semivariograms were constructed for each week
  - Terraseer STIS
  - 2.5 m lags (total of 35)
  - Isotropic (directional independence)
- Ordinary kriging was performed for each week utilizing the semivariogram models

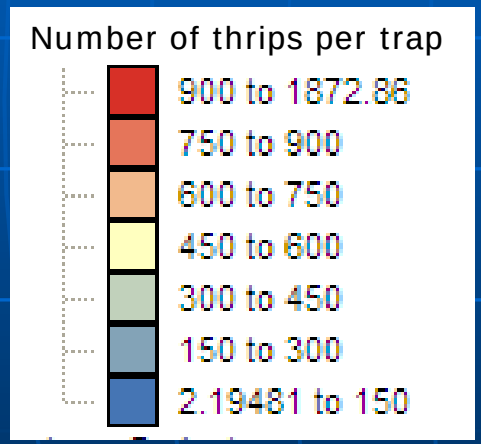
Results

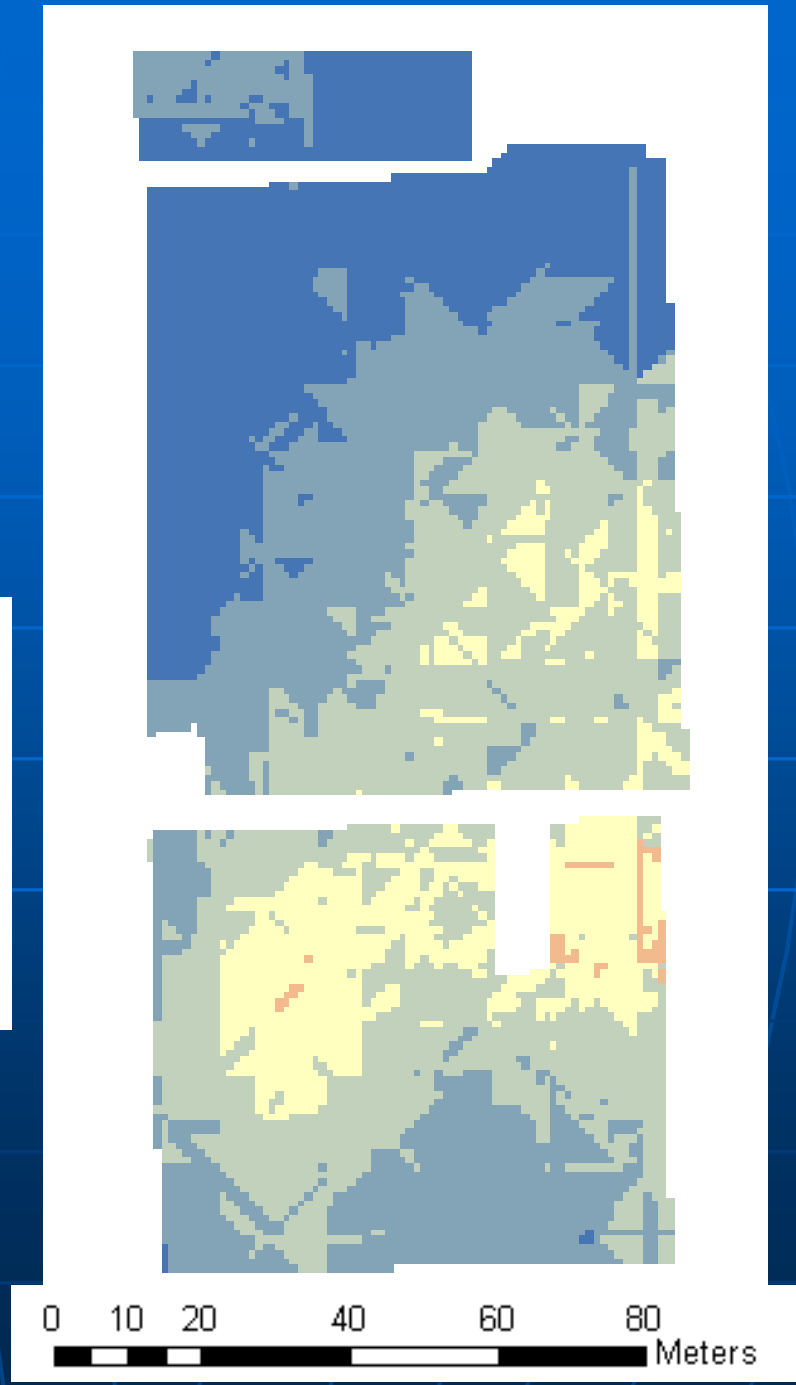
Feb. 14 Semivariogram



Model	Range	Sill	Nugget	MSS error
Gaussian 1	79.71	8342.28	39444.49	0.015
Gaussian 2	79.77	19086.94		

Feb. 14 Flower thrips distribution





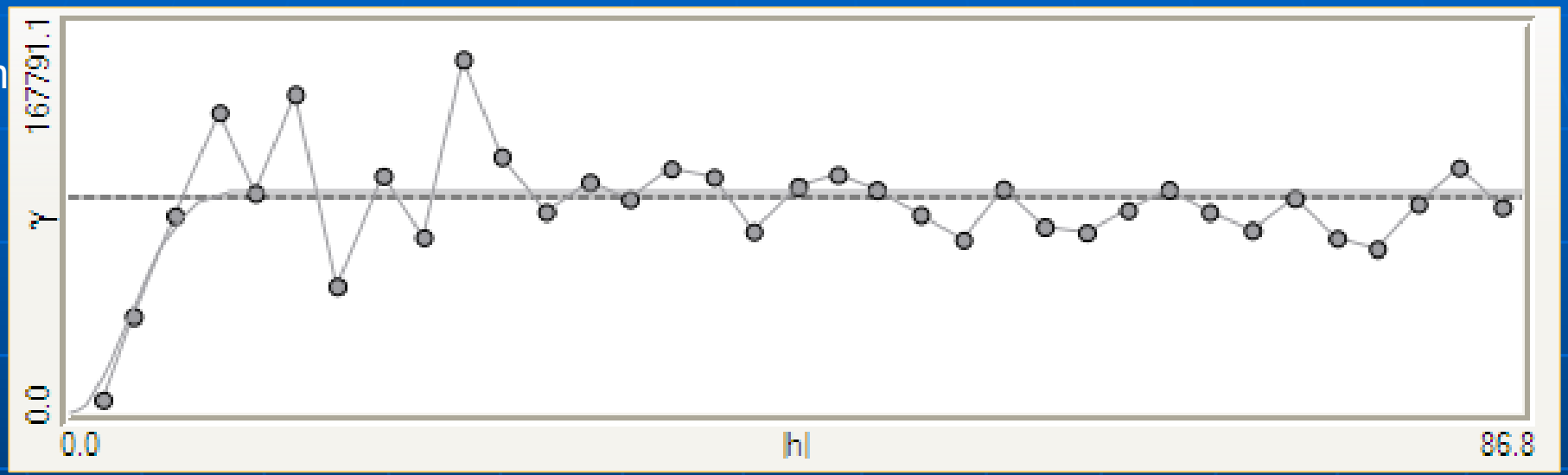
Data source
Small Fruits and Vegetables IPM laboratory
Entomology and Nematology Department, UF

Traps: Collected Feb. 14, 2008

Map Produced by: E. Rhodes

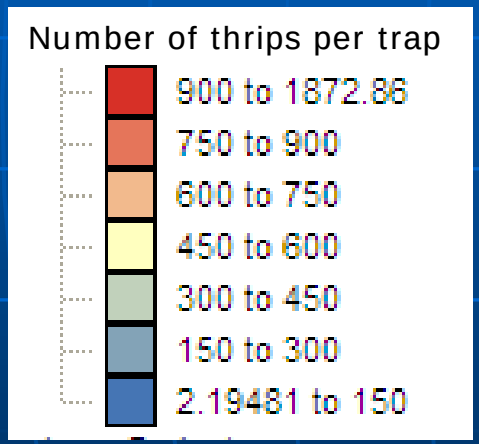
Map produced by: Ordinary kriging

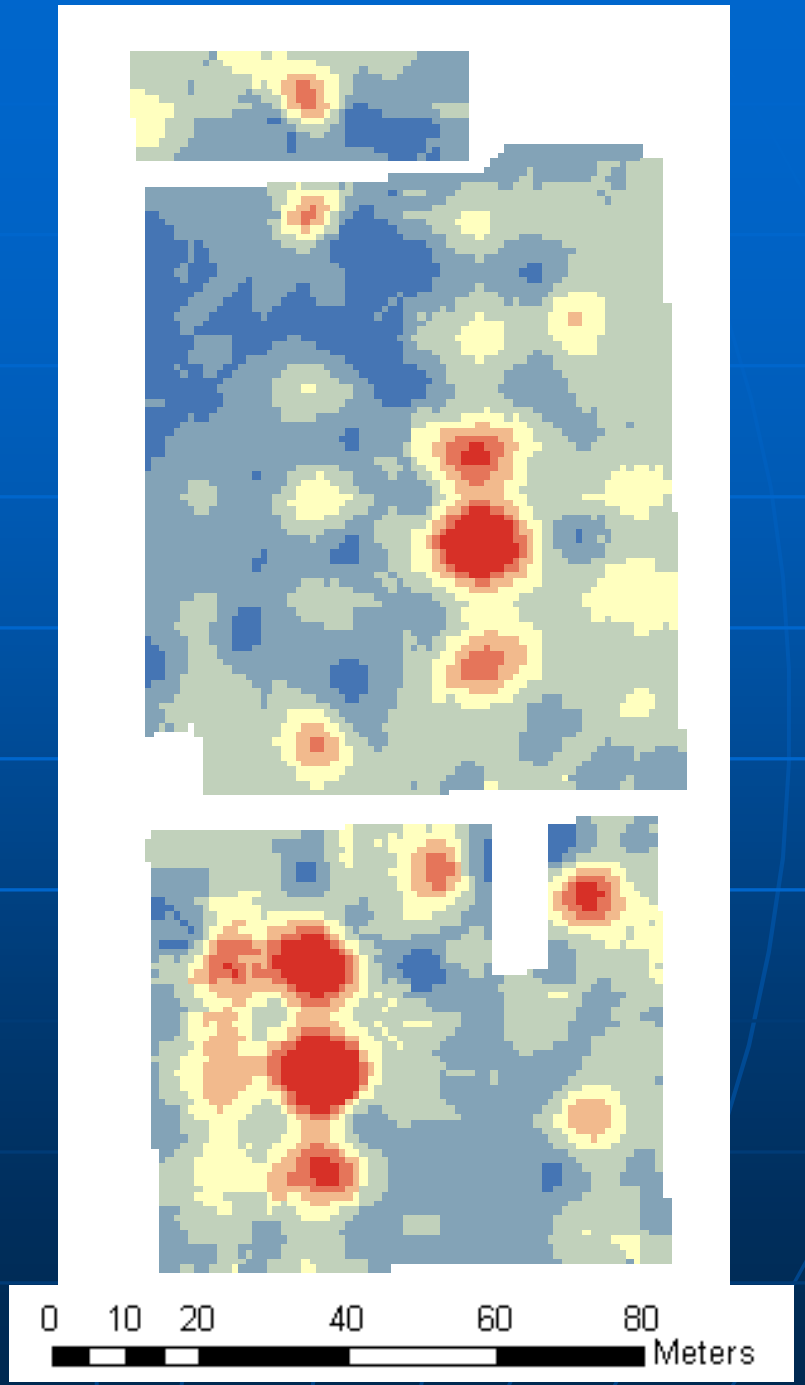
Feb. 21 Semivariogram



Model	Range	Sill	Nugget	MSS error
Cubic	11.04	95681.63	0.14	0.038

Feb. 21 Flower thrips distribution





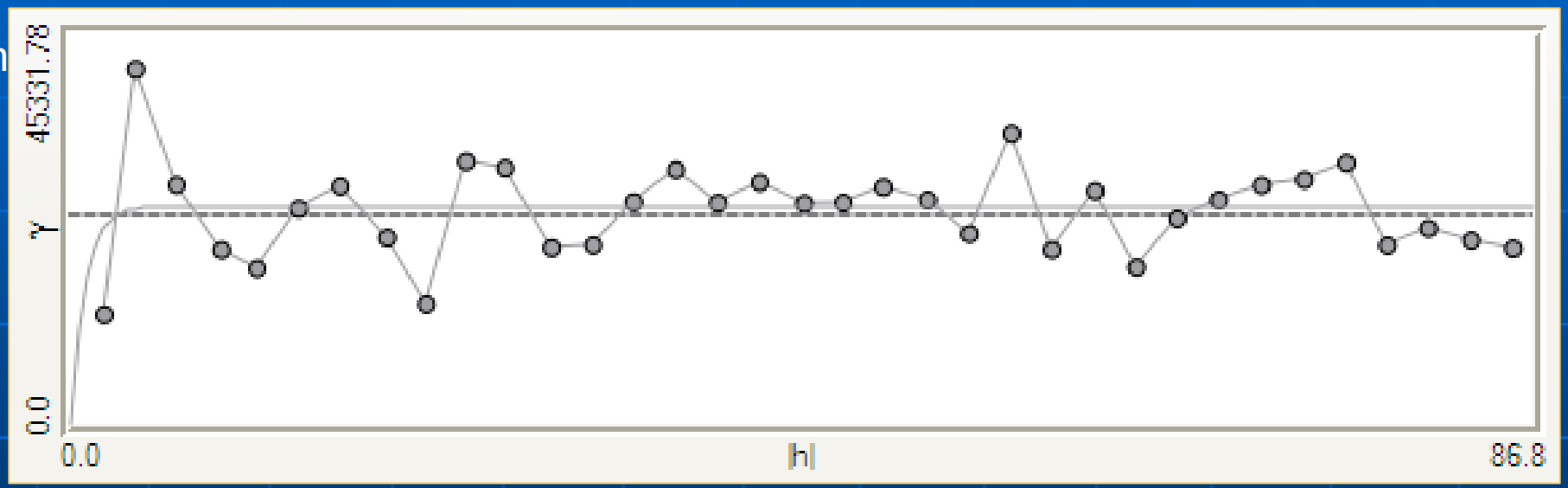
Data source
Small Fruits and Vegetables IPM laboratory
Entomology and Nematology Department, UF

Traps: Collected Feb. 21, 2008

Map Produced by: E. Rhodes

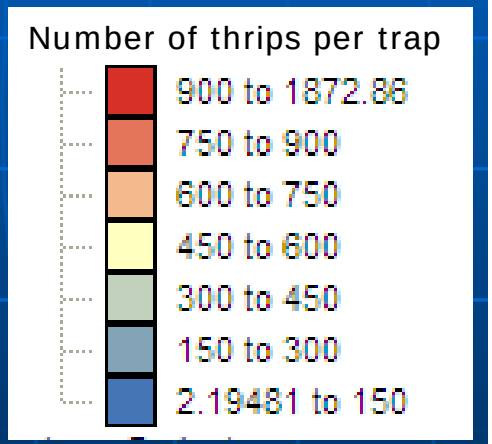
Map produced by: Ordinary kriging

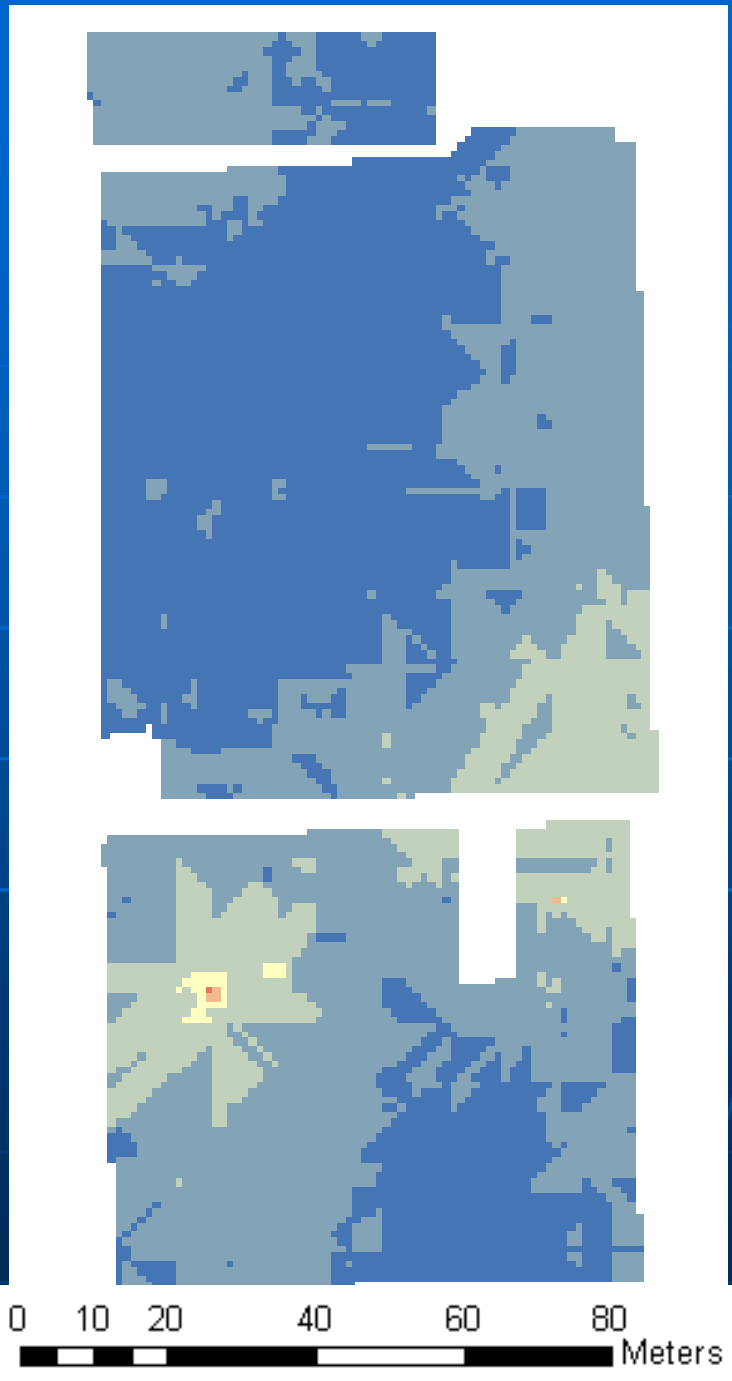
Feb. 28 Semivariogram



Model	Range	Sill	Nugget	MSS error
Exponential	2.51	25354.64	0.0018	0.04

Feb. 28 Flower thrips distribution





Data source
Small Fruits and Vegetables IPM laboratory
Entomology and Nematology Department, UF

Traps: Collected Feb. 28, 2008

Map Produced by: E. Rhodes

Map produced by: Ordinary kriging

Summary

- The spatial variability of flower thrips in blueberries was modeled well for the second week (Feb. 21) of the study (nugget = 0.14 and MSS error = 0.037)
- The semivariogram for week 1 (Feb. 14) had a very large nugget (39444.49)
- The curve of the semivariogram for week 3 (Feb. 28) was based on a single point

Discussion

- The distribution of thrips may be strongly affected by the distribution of blueberry flowers
- Not enough sample pairs with lags below the actual range
  - Range of Feb. 21 semivariogram = 11.04 m
  - 15.24 m grid
- Traps should be placed at least 11.04 m apart to ensure that they are collecting independent samples

Future Research

- Spring 2009
  - 7.62 m grid of 100 traps and 30 random traps
  - Record field observations of blueberry flower distribution

Acknowledgements

- Dr. Oscar Liburd
- Dr. Joseph Funderburk
- Dr. Robert McSorley
- Dr. Sabine Grunwald

- Florida Blueberry Grower's Association

- Small Fruit and Vegetable IPM laboratory staff and students

Questions?