SPRAGUE
SM

Reducing Pesticide Use Through Spatial Mapping and Precision Targeting

Jeffrey A. Weier
Sprague Pest Solutions

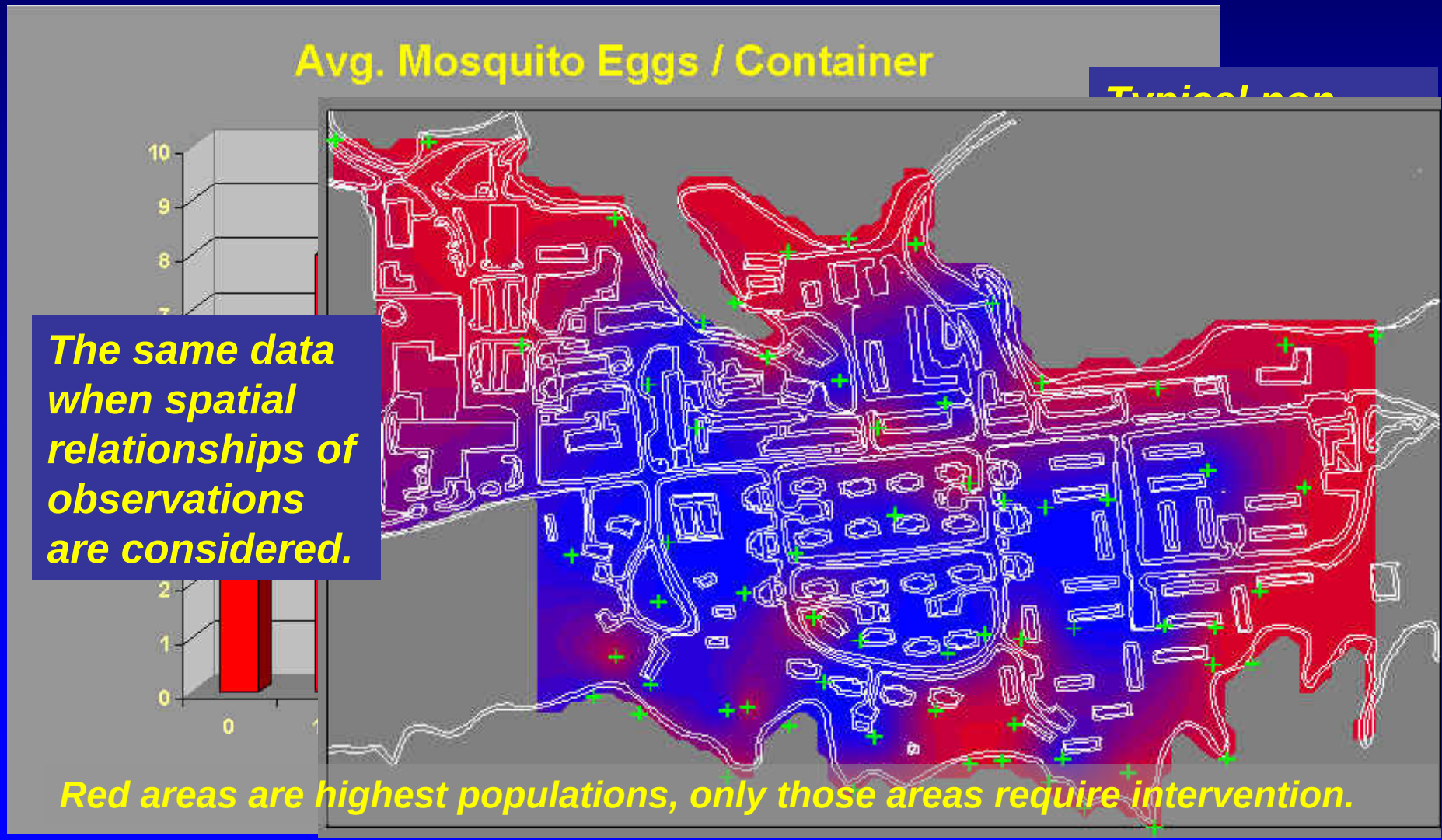
Expectations for New Technology

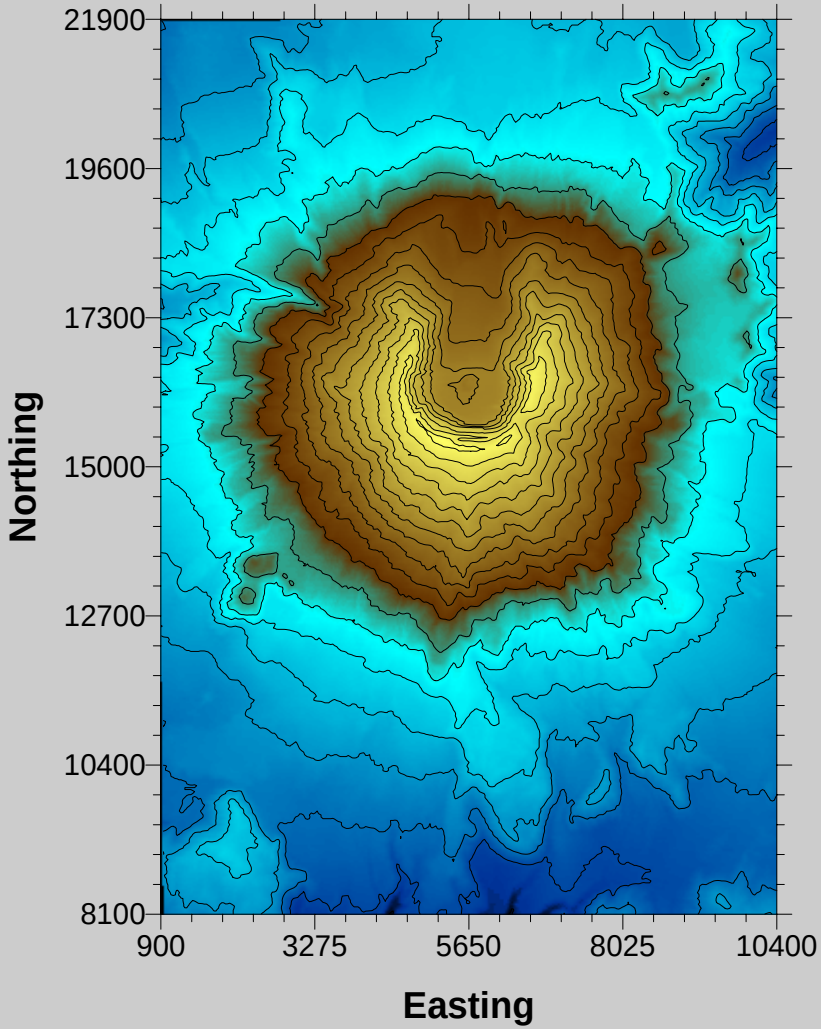
- Computer Modeling, “Killing Pests With Information”
- Increase Efficiency
- Decrease Pesticide Risk
- Proactive and Preventative

Using Spatial Analysis

- Locate source of infestation
- Determine magnitude of activity
- Precision targeting of control efforts
- Document changes in pest activity
- Document results of control efforts
- Locate immigration points
- Separate sources of multiple infestations

Illustration of Non-spatial vs. Spatial Data Analysis

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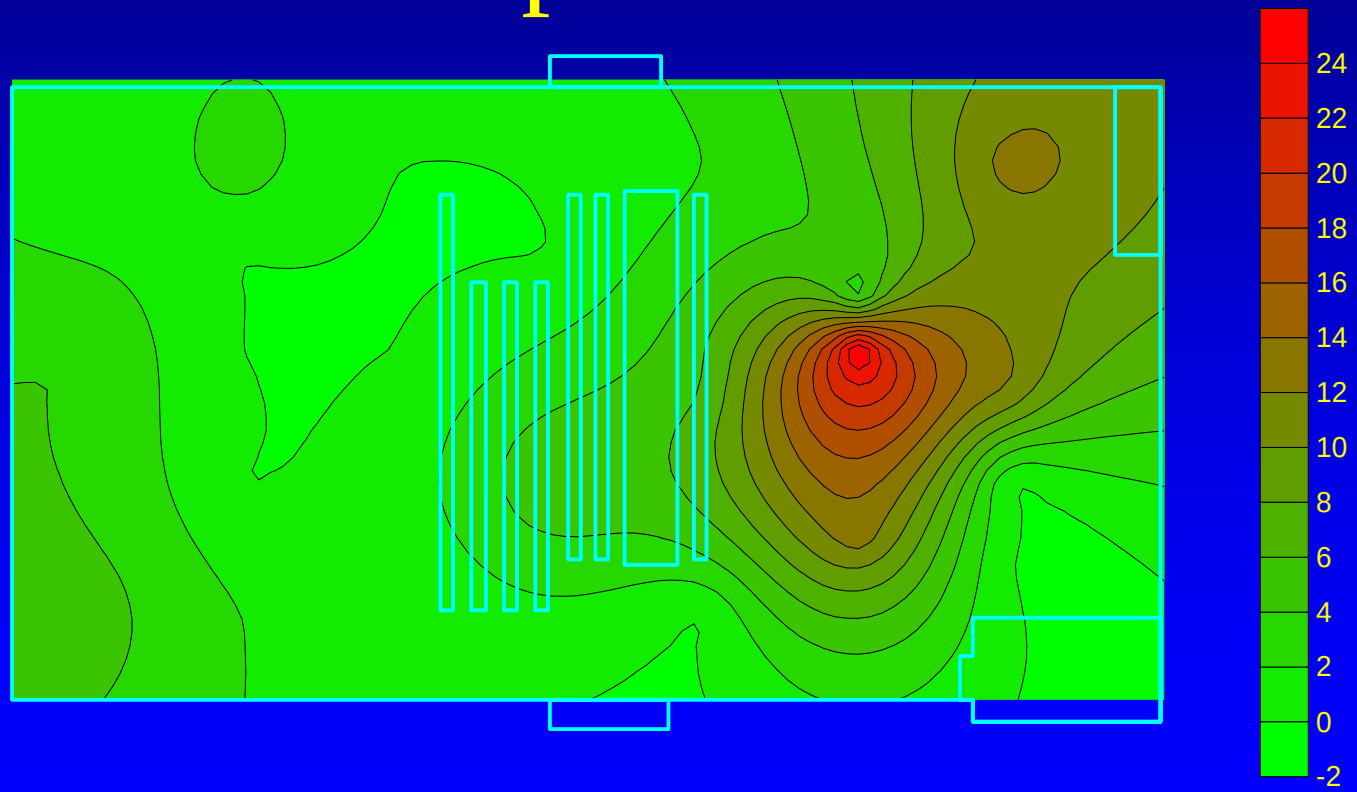
15000
12700
10400
8100
Northing
900
3275
5650
8025
10400
Easting

Mt. St. Helens

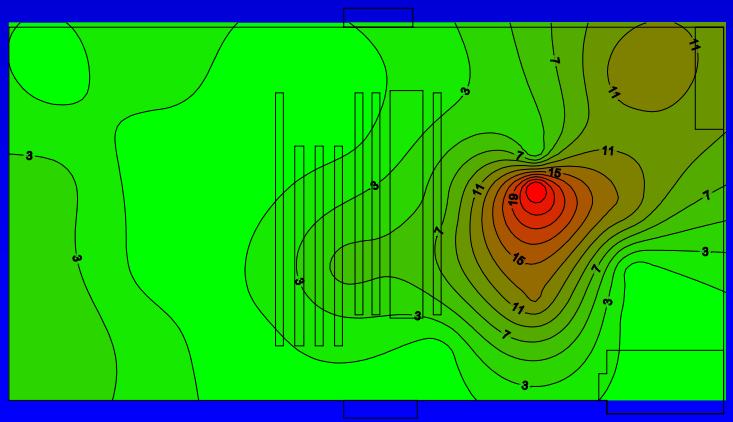
IMM Population Structure Based on Pheromone Trap Captures

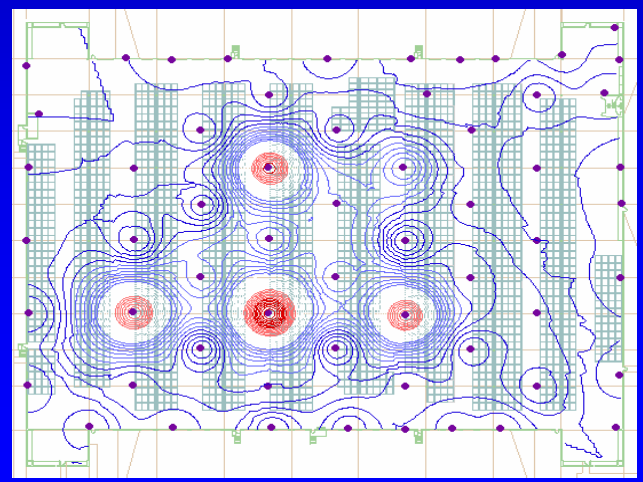


Two Software Packages

- Surfer
- Lower Cost
- Some Limitations

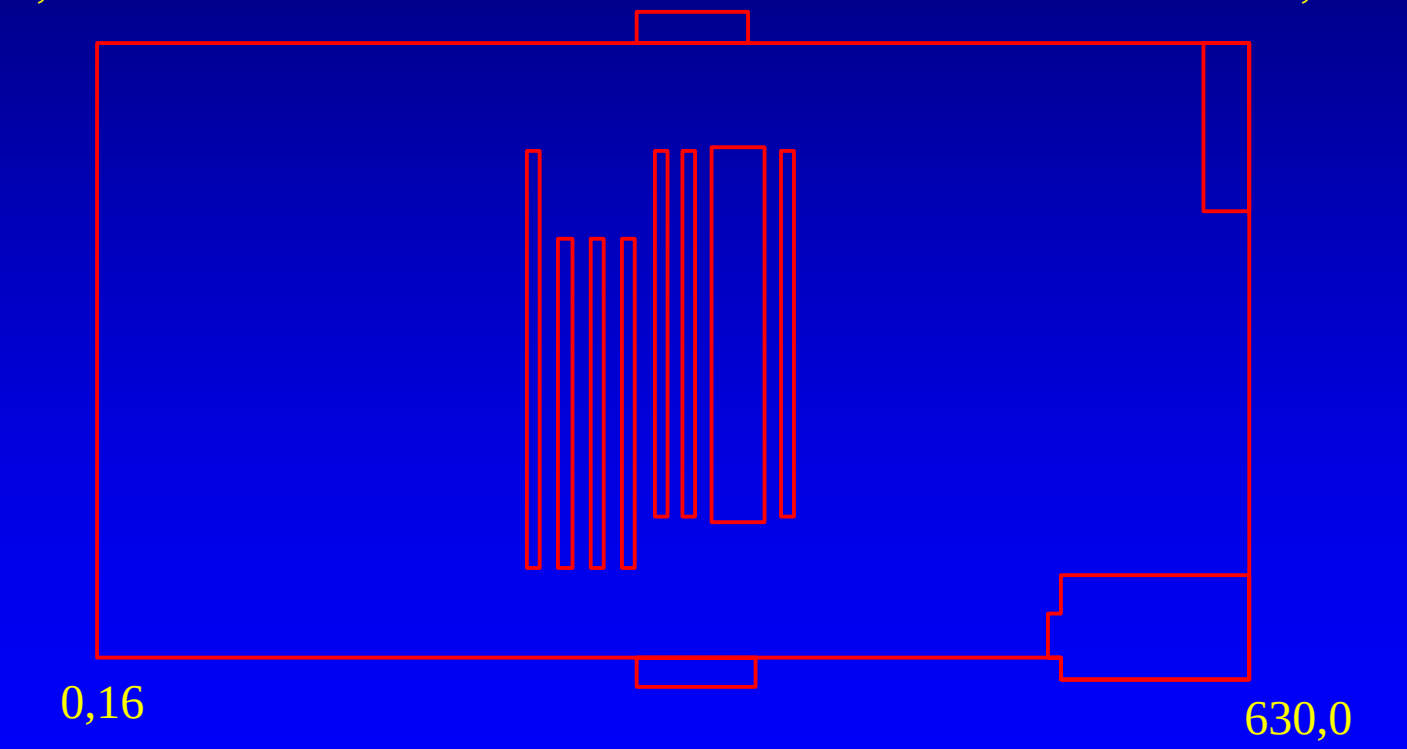
- Arcview GIS
- Higher Cost
- More Capable





Constructing Maps in Surfer

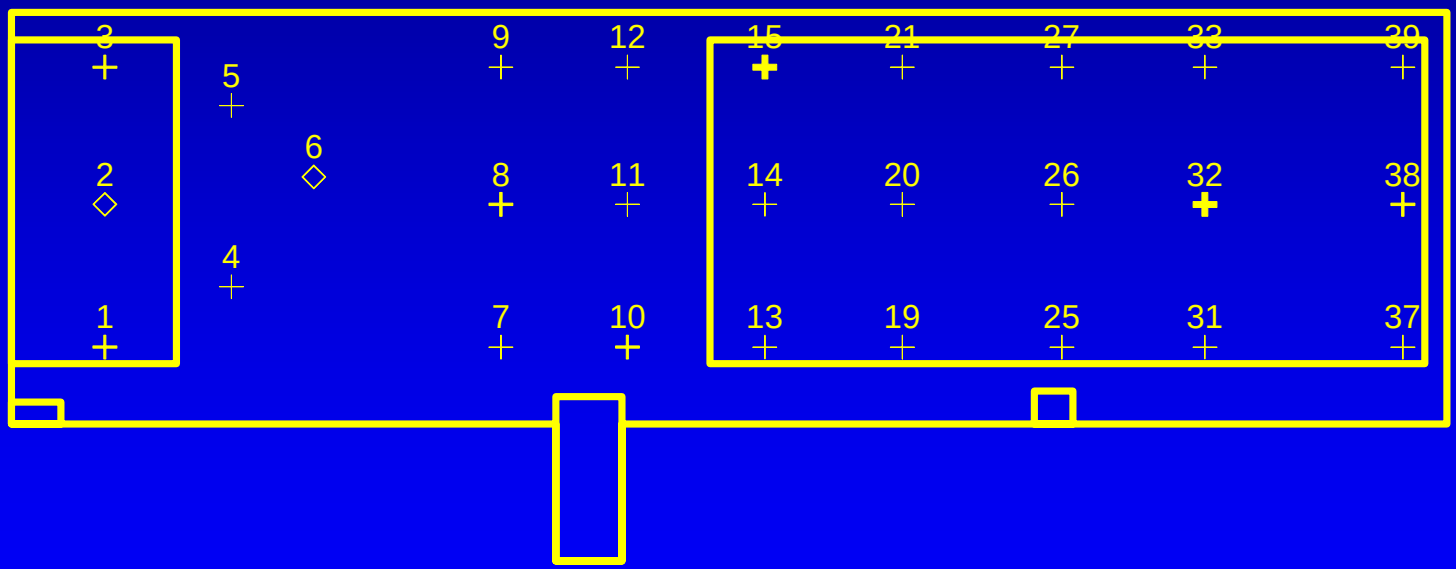
Base Map



Types of Data

- Sticky Traps (Number of Insects or Rodents Captured)
- Pheromone Traps (Number of Insects Captured)
- Light Traps (Weights or Numbers of Insects Captured)
- Rodent Traps or Baits (Consumption or Number Captured)

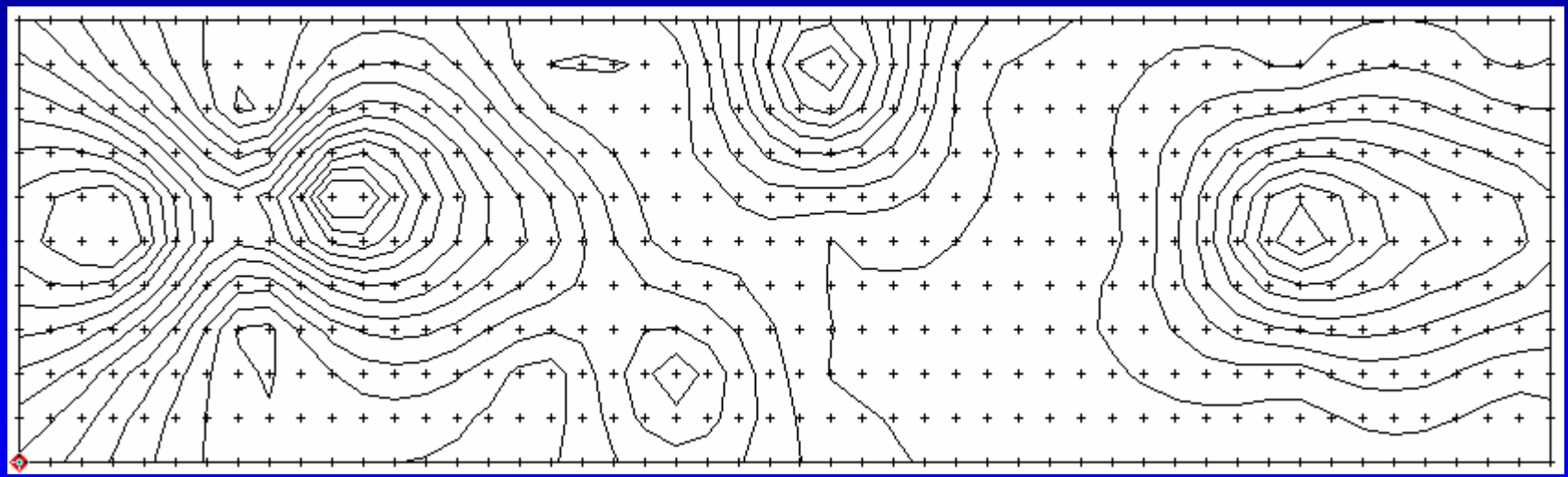
Trap Locations



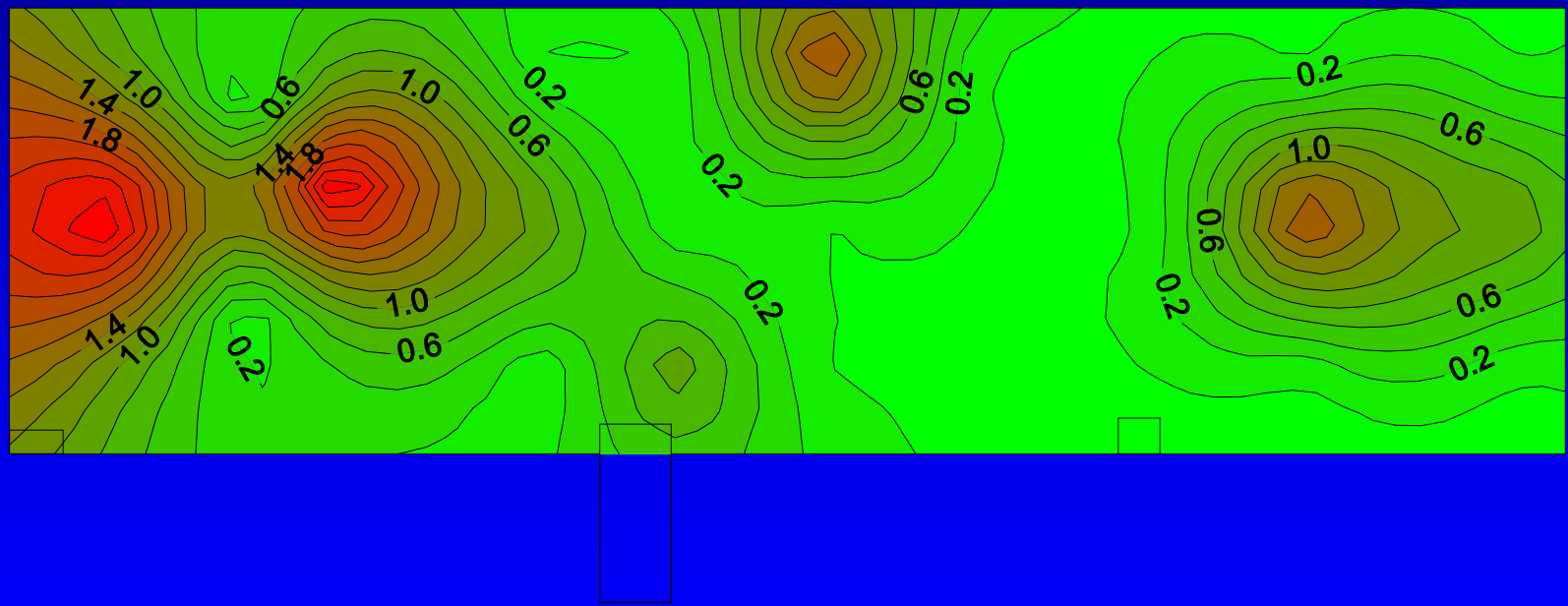
Contour Map Generation

- Computer software calculates grid nodes for the contour map (actual trap capture numbers are not used to generate contour map)
- Software created a 49x10 node grid
- Nodes with identical values are connected by smooth curves
- Spaces between contour curve are filled in with different colors

Nodes Created by Surfer



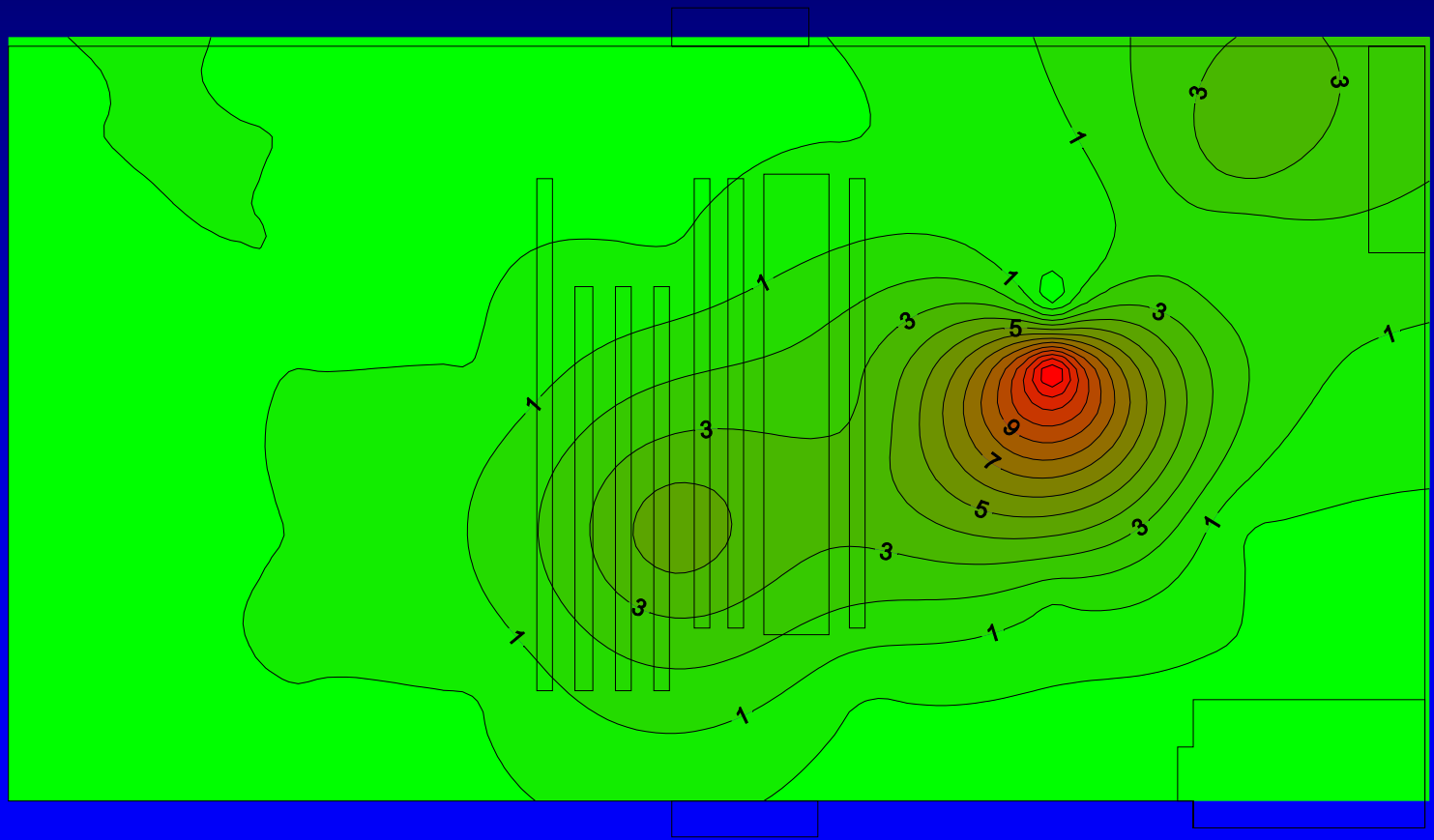
IMM Population Structure Based on Pheromone Trap Captures



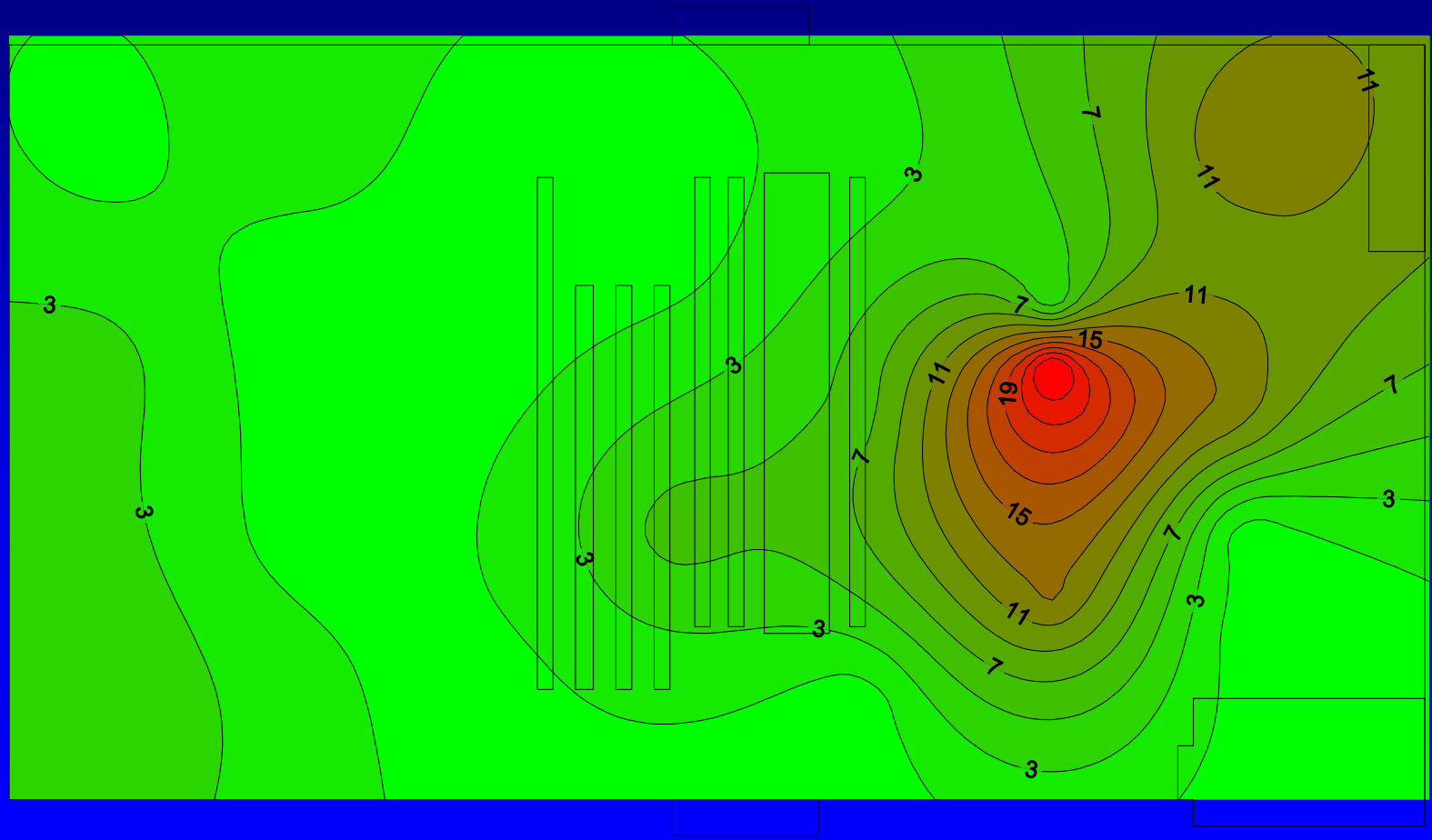
Using Contour Maps

- Locate source of infestation
- Determine magnitude of activity
- Locate immigration points
- Document changes in activity
- Document results of control efforts
- Separate sources of multiple infestations

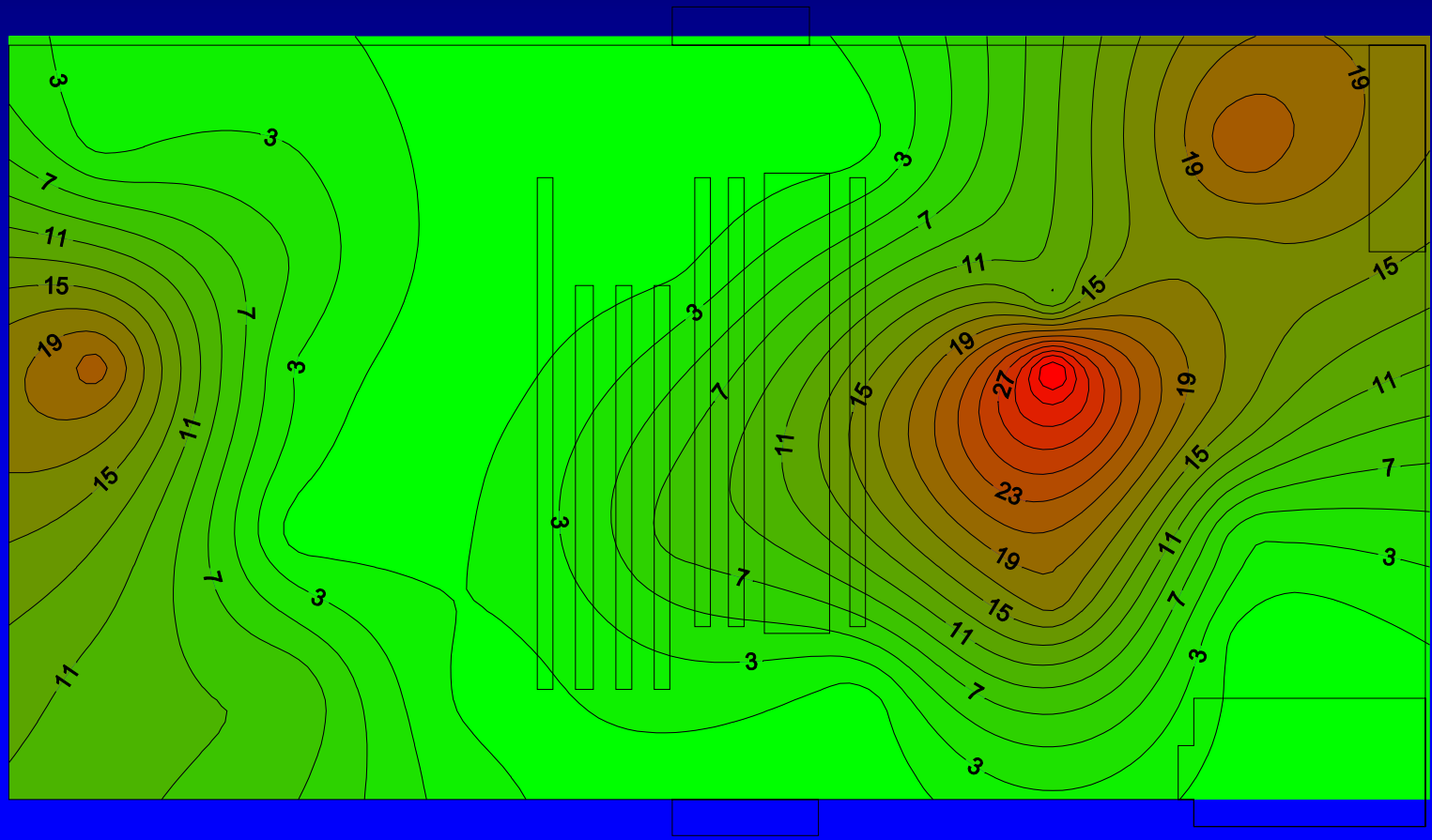
Initial Indian Meal Moth Activity



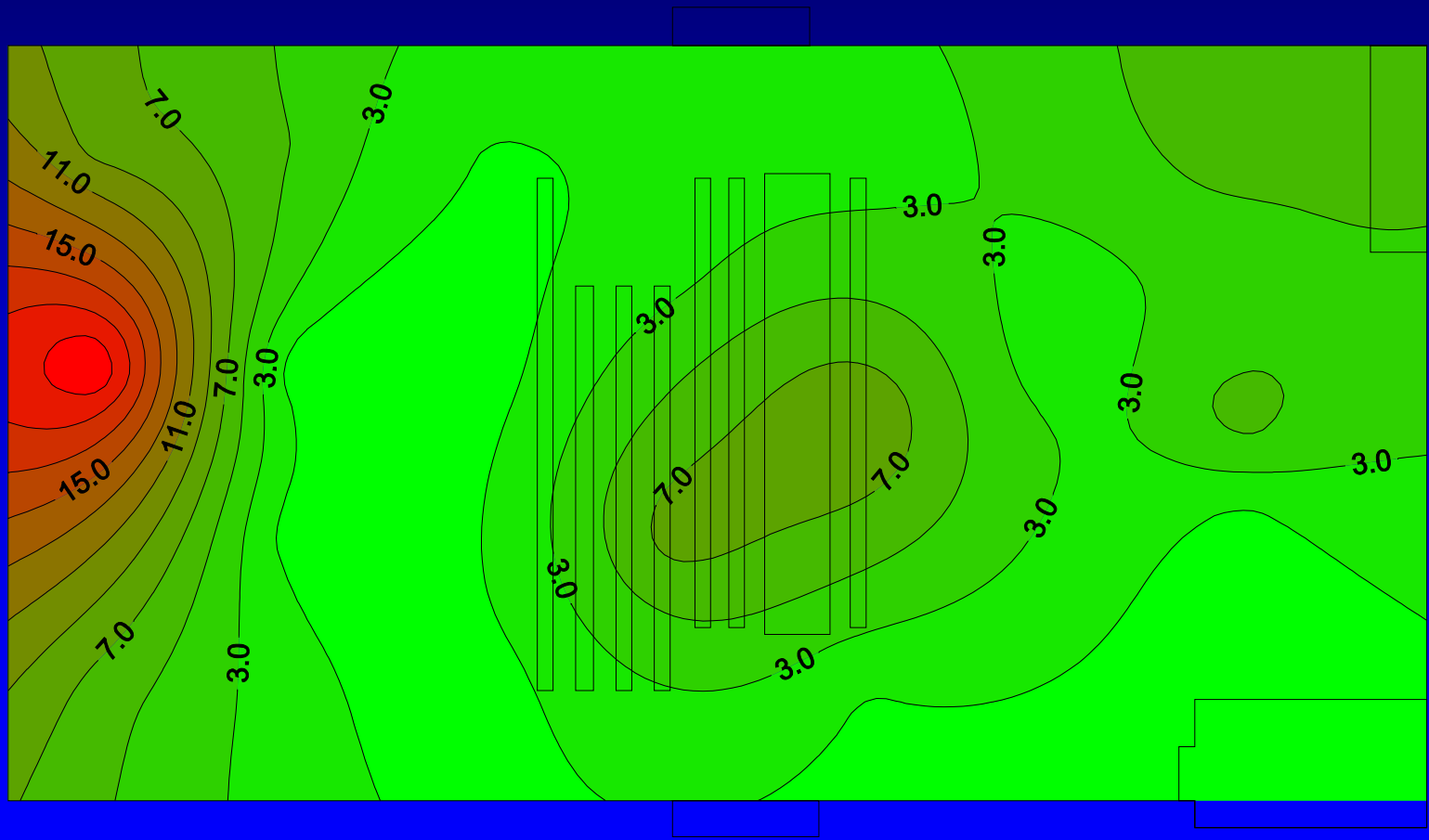
Infestation Growing



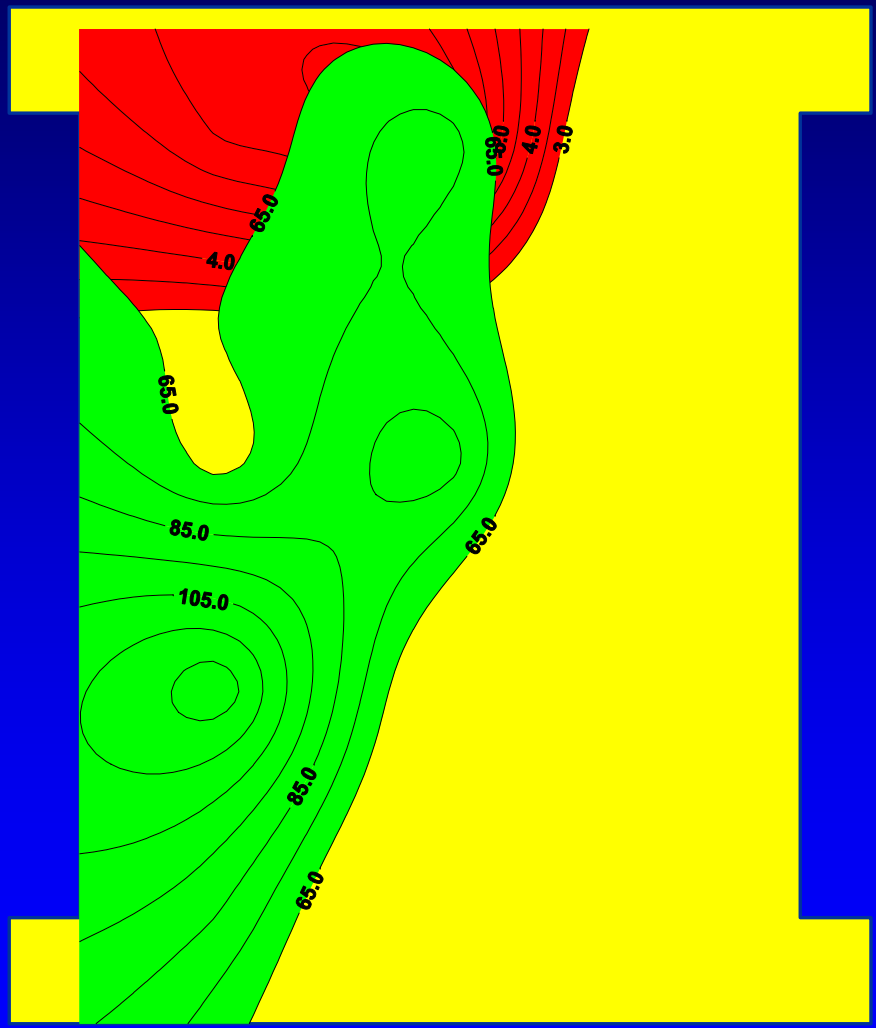
Infestation Spreads Throughout Warehouse



After Treatment of Infestation Foci



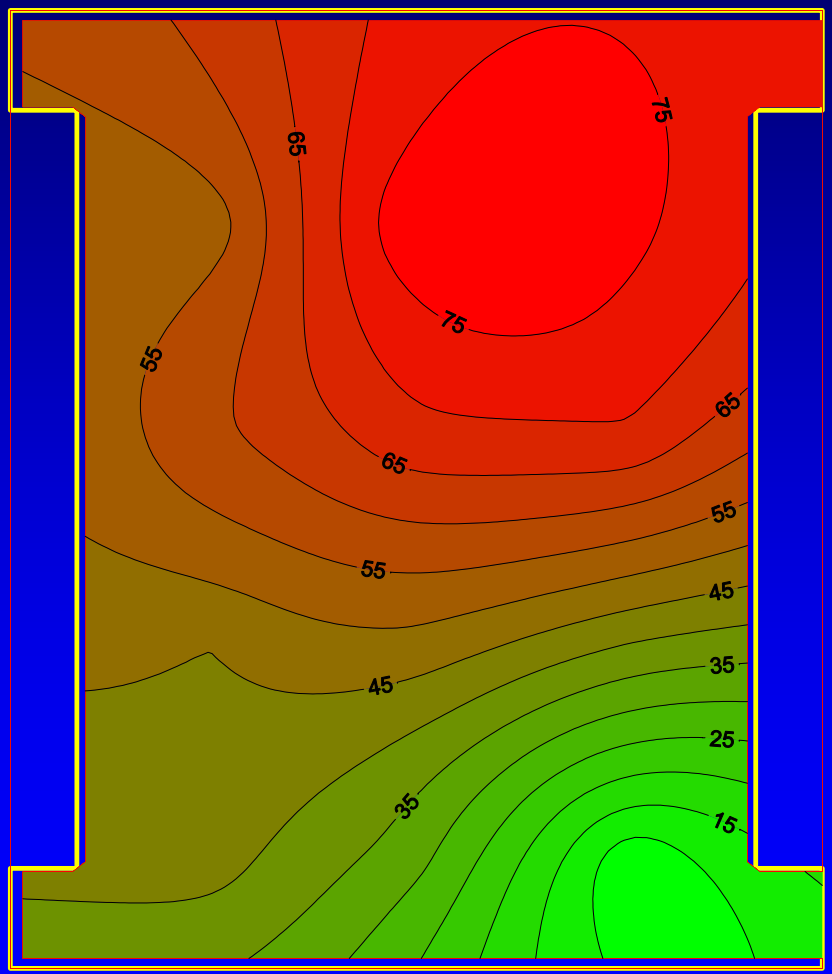
IMM and Cigarette Beetles



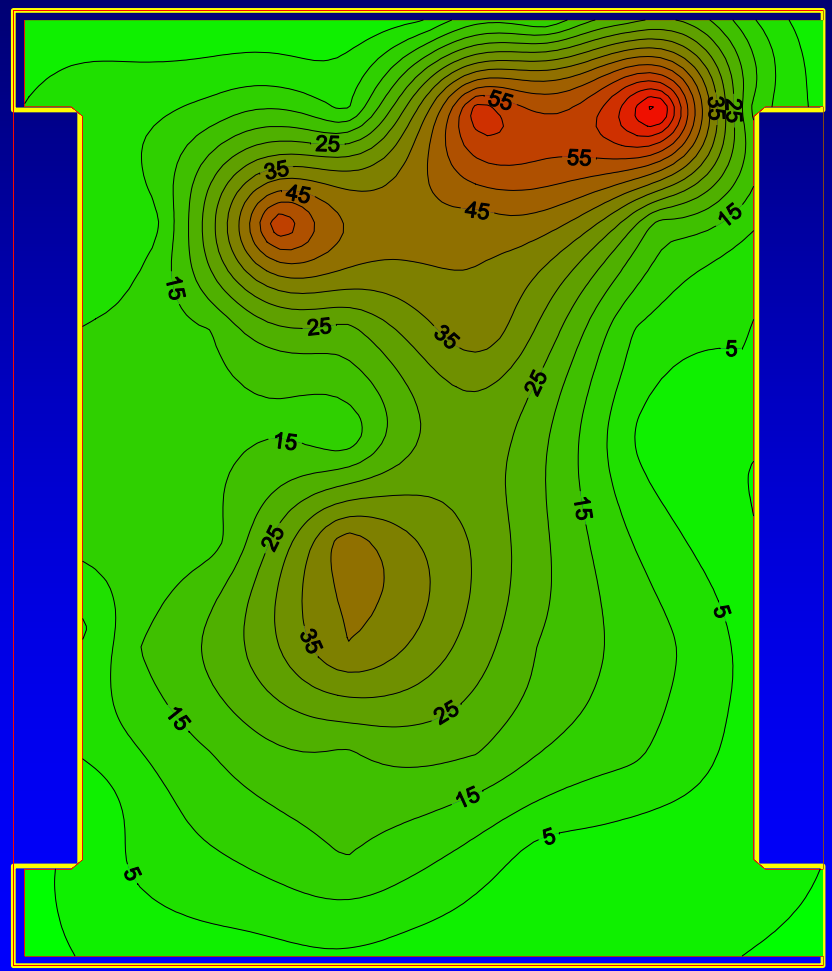
How Traps Affect Contour Map Accuracy

- More traps give better results
- Zero captures are as important as traps that capture insects
- Traps that attract over longer distances will make the maps less accurate. They will still give valuable information.
- Traps, used in mapping, should not be moved or shuffled

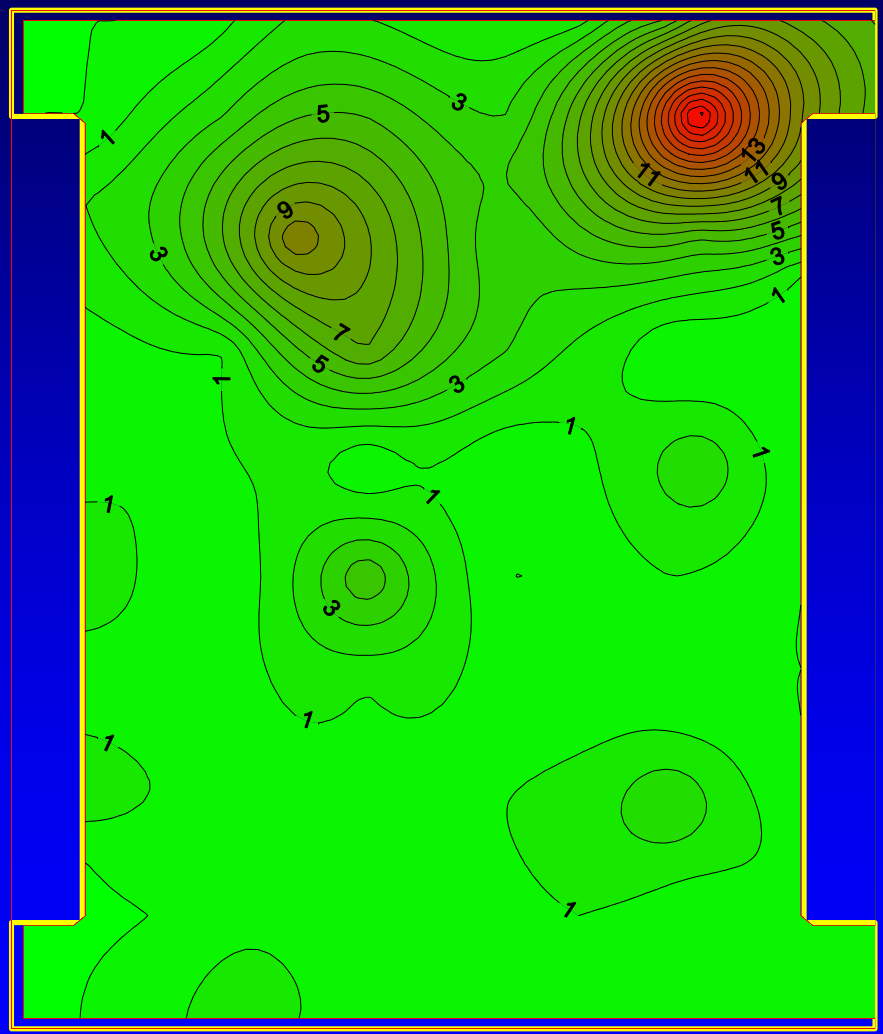
12 Traps



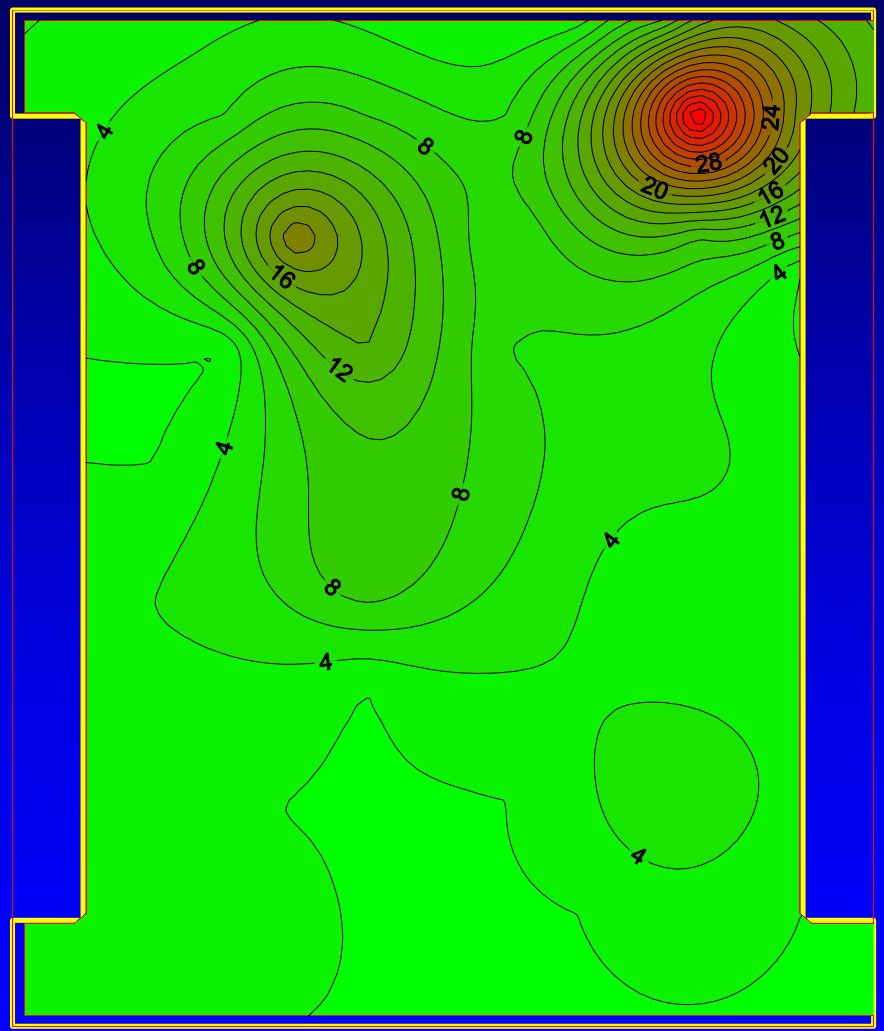
120 Traps



With Zeros



Without Zeros



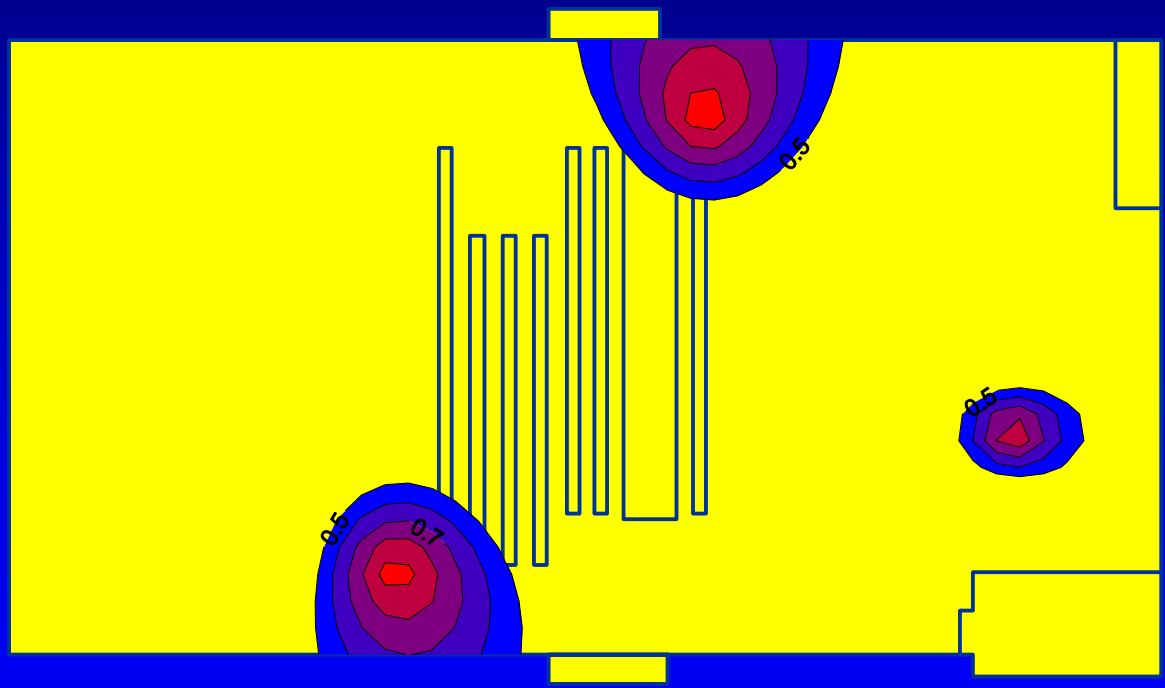
Probability Maps

- Sort traps by number of captures
- Calculate the summary percentage compared to total, ranking for each trap
- Assign a value of “1” to each trap until the 75% level is reached
- Assign a value of “0” to other traps
- Grid the 0 and 1 values and generate a contour map based on this grid

Probability Maps

- Actual number of insects captured by the trap at the 75% cumulative level is the threshold value
- Contour lines represent probability of capturing a number of insects greater than the threshold value.

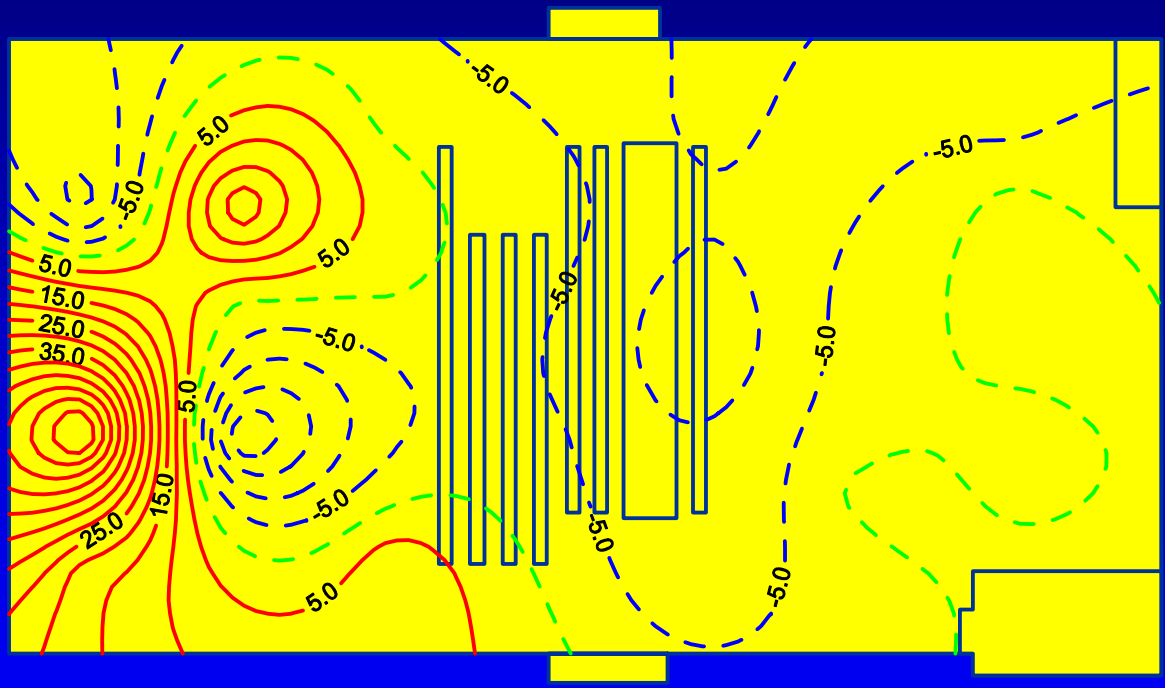
Probability Map



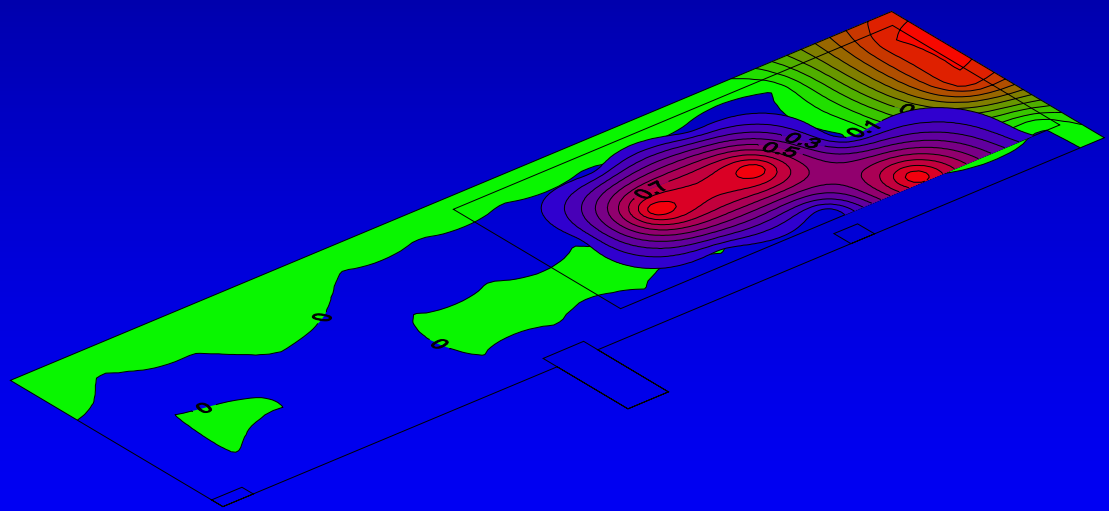
Spatial Dynamics Index

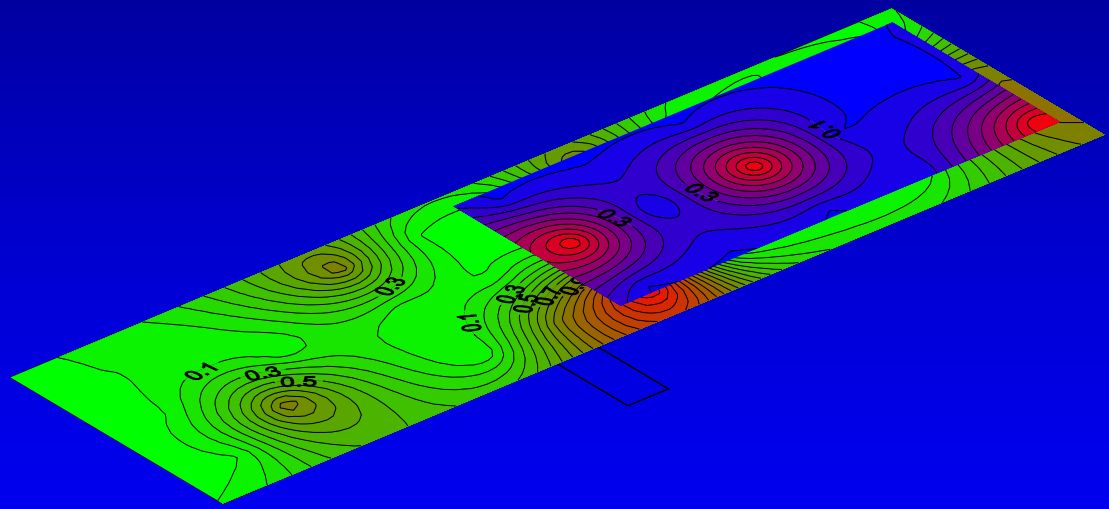
- Subtracts consecutive probability values to create a new grid.
- Compares pest populations from one service to the next.
- Negative values indicate population decrease; positive values equal population increase; Zero values indicate no change
- Because values represent probabilities the magnitude of number has no meaning

Spatial Dynamics Index



Representation of Multi Level Trapping

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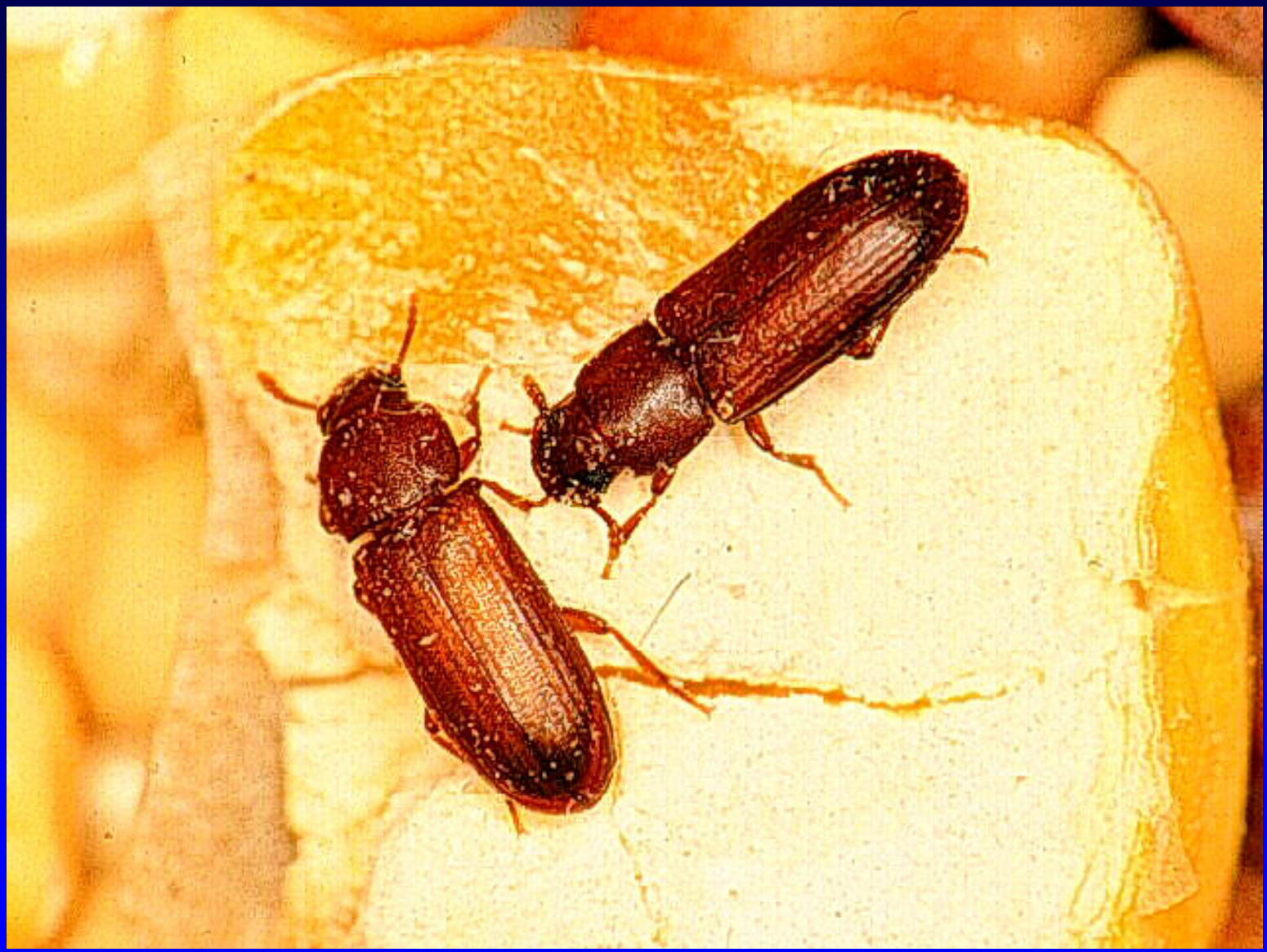


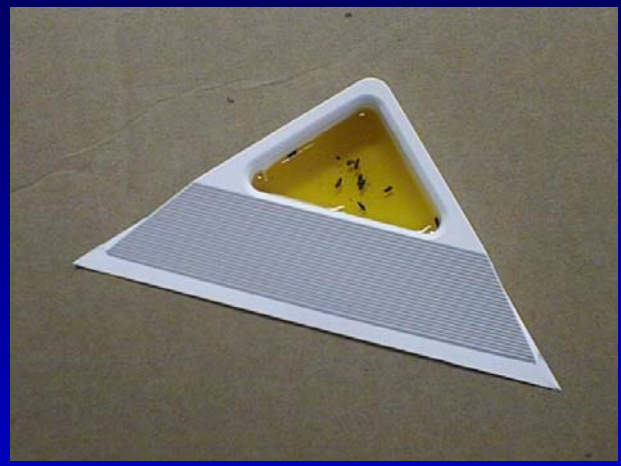
Red and Confused Flour Beetles

- Short range attraction; place close together near suspect product
- Must use a food attractant in combination with pheromone
- Use pitfall trap (Flitetrak M2) or Pantry Patrol
- Not practical for routine monitoring of entire facility; use near susceptible or suspect product

Where to Use Flour Beetle Traps

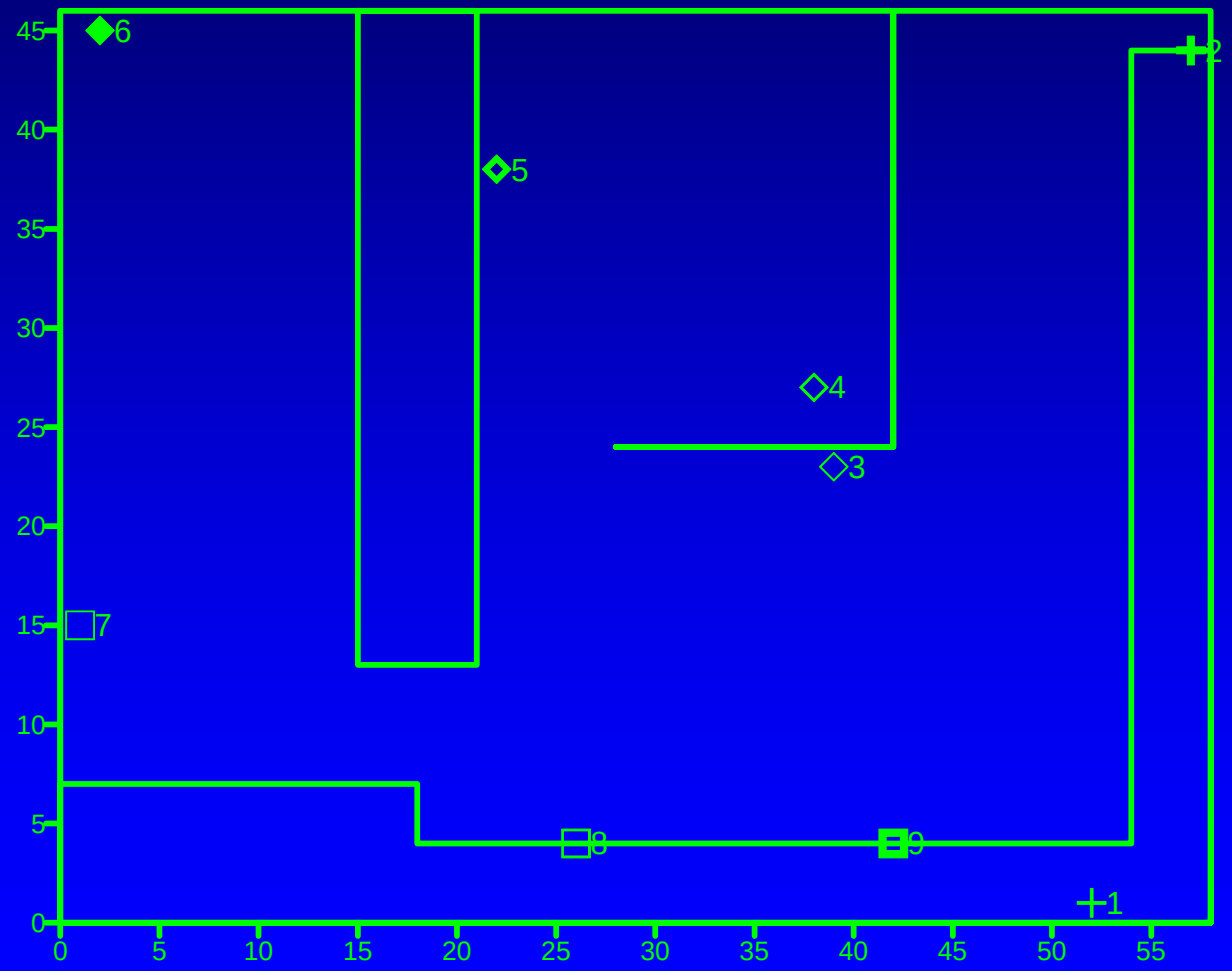
- Small rooms
- Specific products
- Before inspections
- Susceptible product in long term storage
- Suspect product

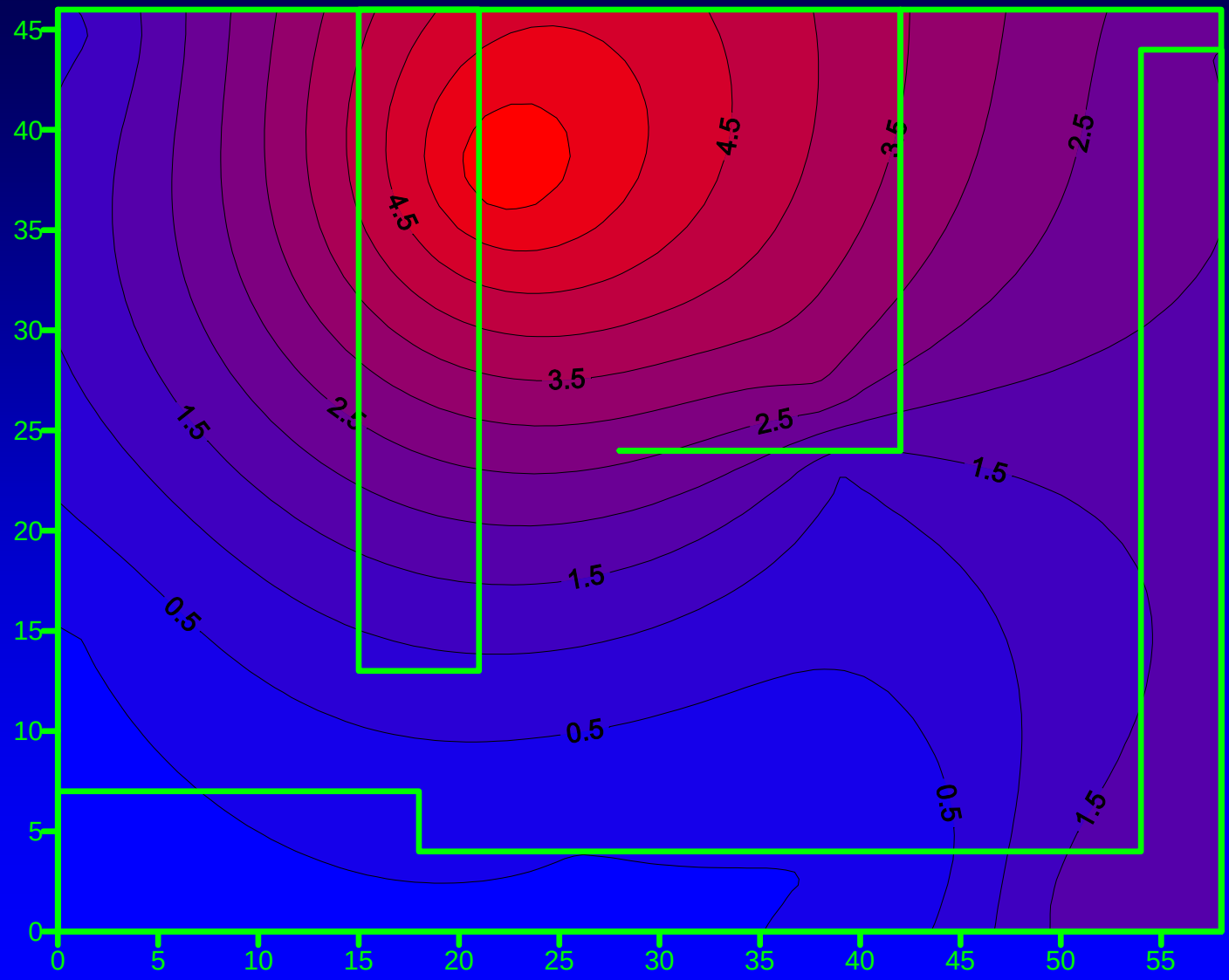
Pitfall Traps



53008
FLITeTRAK
FLITeTRAK

Flour Beetle Traps in Electrical Room

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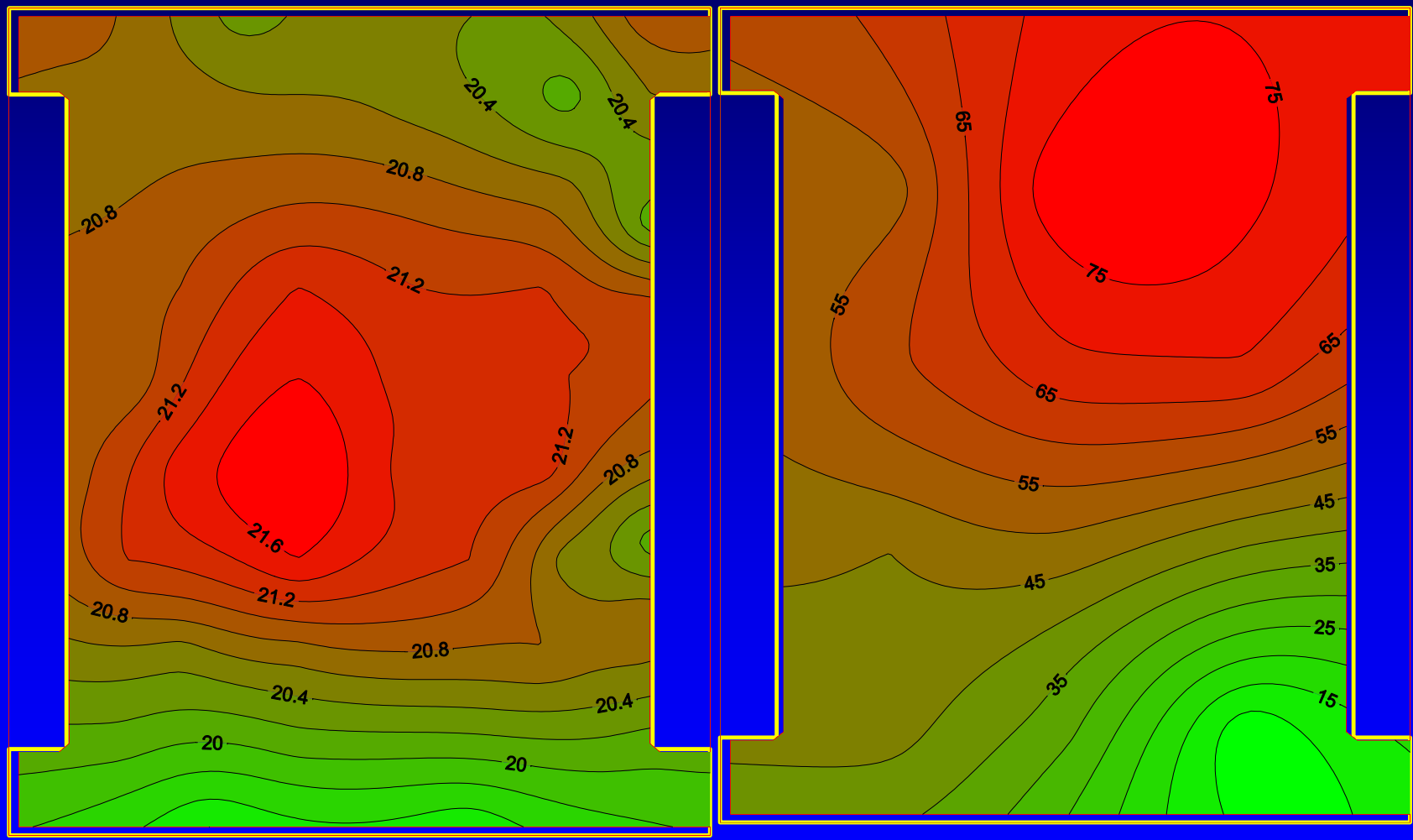
0.5
1.5

Environmental Effects

Warehouse Temperature

Pheromone Trap Captures



Summary

- **Contour maps help focus control measures**
- **Contour mapping can detect the source of low-level activity**
- **Mapping of environmental factors can help predict activity**
- **Spatial dynamics index can quantify changes in populations**
- **Contour maps can help pinpoint sources of immigration**
- **Contour maps can track efficacy of treatments**

Want to Know More?

Edward H. Isaaks and R. Mohan Srivastava. *Applied Geostatistics*, New York:Oxford University Press, 1989.

Richard J. Brenner, Dana A. Focks, Richard T. Arbogast, David K. Weaver, and Dennis Shuman. Practical Use of Spatial Analysis in Precision Targeting for Integrated Pest Management. Anonymous. Anonymous. *American Entomologist* 44(2):79-101, 1998.

R. T. Arbogast, P. E. Kendra, R. W. Mankin, and J. E. McGovern. Monitoring insect pests in retail stores by trapping and spatial analysis. Anonymous. Anonymous. *Journal of Economic Entomology* 93(5):1531-1542, 2000.