

# Spatial Distribution of Insecticide Use for California Red Scale Control in San Joaquin Valley Citrus

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# Insect Pest Management in Citrus

- California Red Scale is a primary insect pest of citrus in the San Joaquin Valley
- Control of red scale has relied heavily on the use of organophosphate insecticides
- Few alternatives to the organophosphates have existed until recently
- Repeated use of organophosphates has led to documented insecticide resistance in California Red Scale

# Control of California Red Scale

- Organophosphate insecticides are rapidly losing favor due to regulatory and environmental issues as well as insecticide resistance
- New insecticides for red scale control
  - Insect Growth Regulators (Applaud, Esteem)
  - Considered to be reduced risk because of low mammalian toxicity
  - Can be highly effective in controlling red scale



## California Red Scale on Orange

Scale populations begin the season on twigs and branches and move onto fruit as it develops

Timing of insecticide treatments targets the early instars of California Red Scale, as later instars are more difficult to control with chemicals.



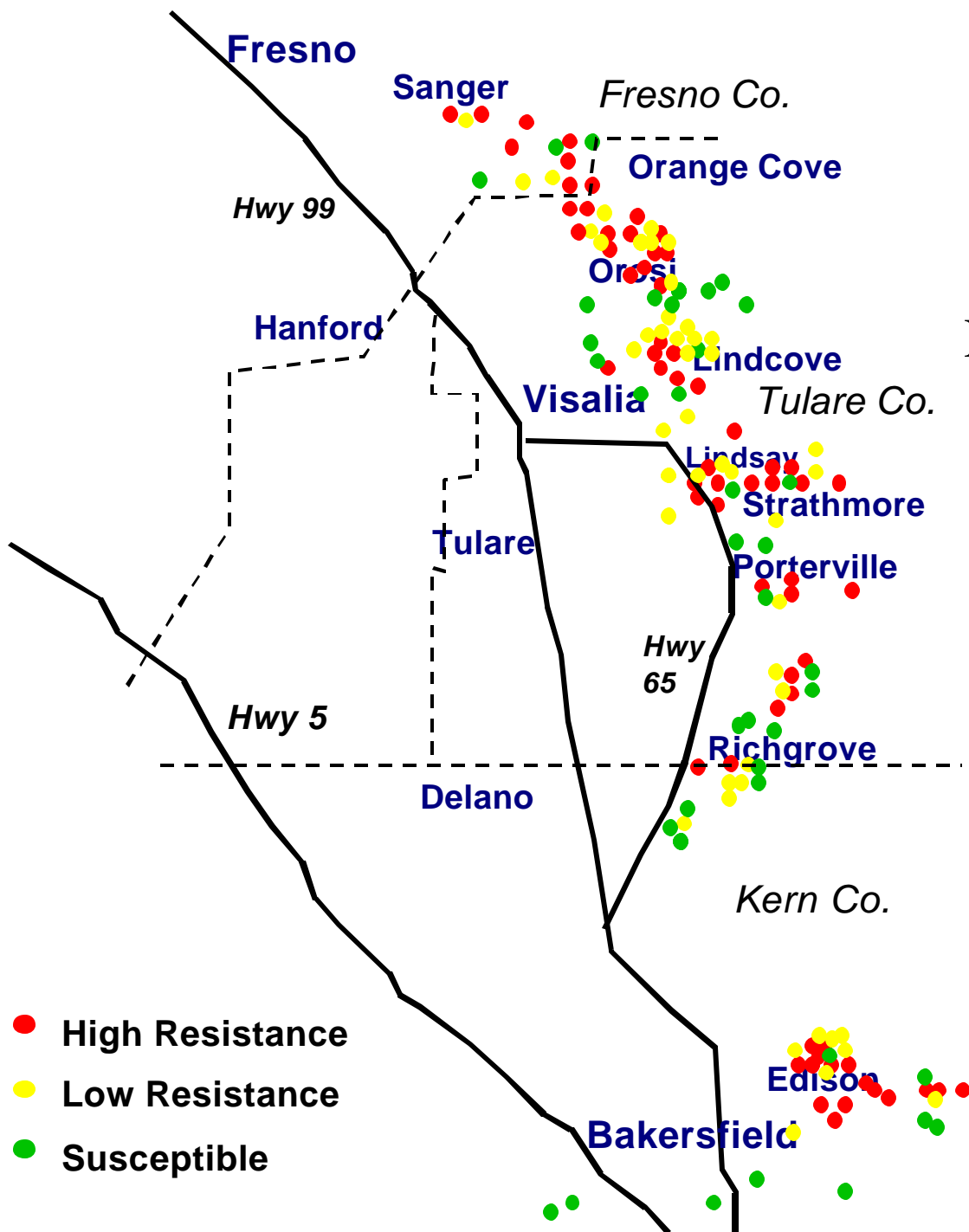


Heavy scale populations will result in economic loss to the grower





# Populations of California Red Scale Resistant to Organophosphate Insecticides

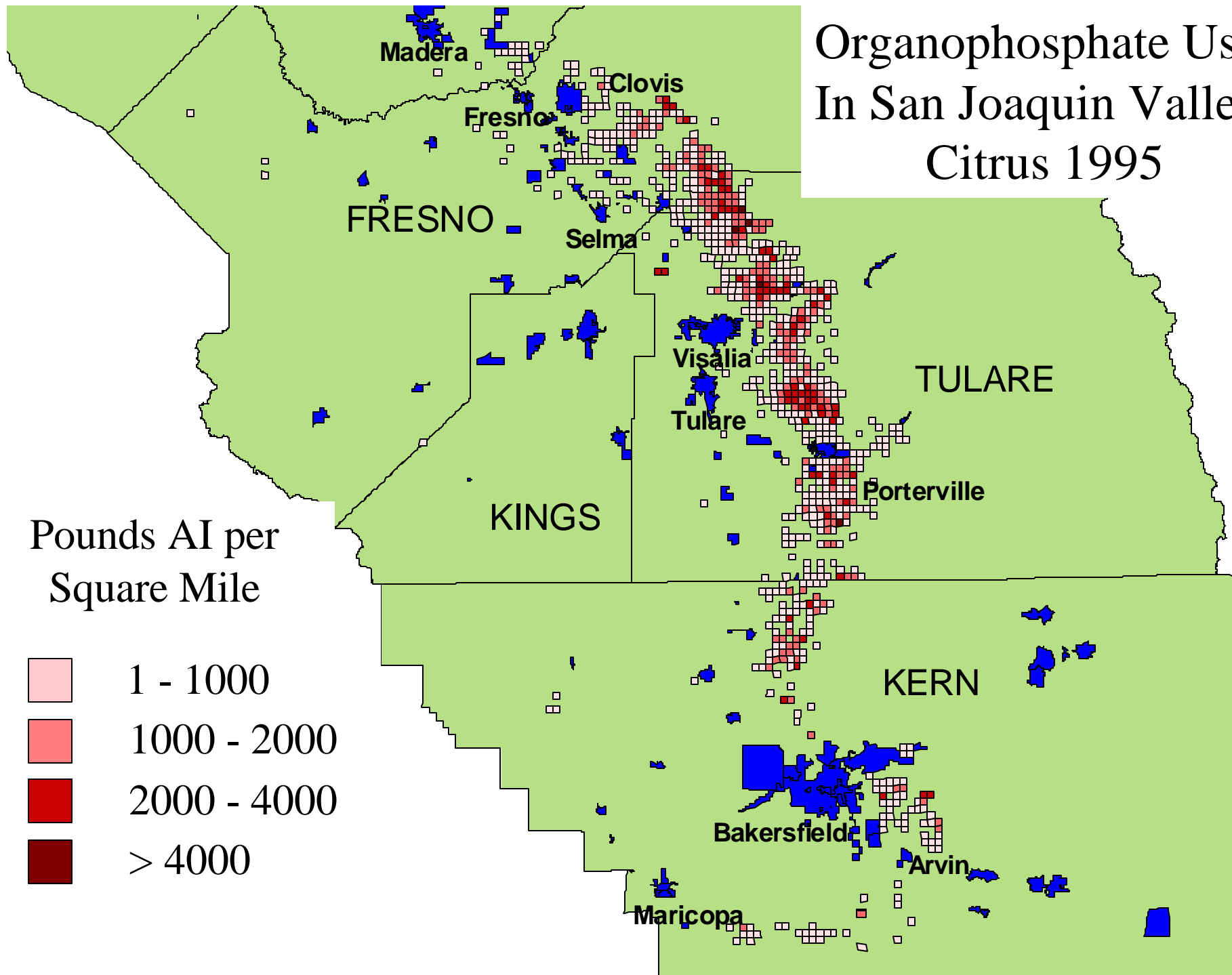


# Spatial Analysis of Insecticide Use

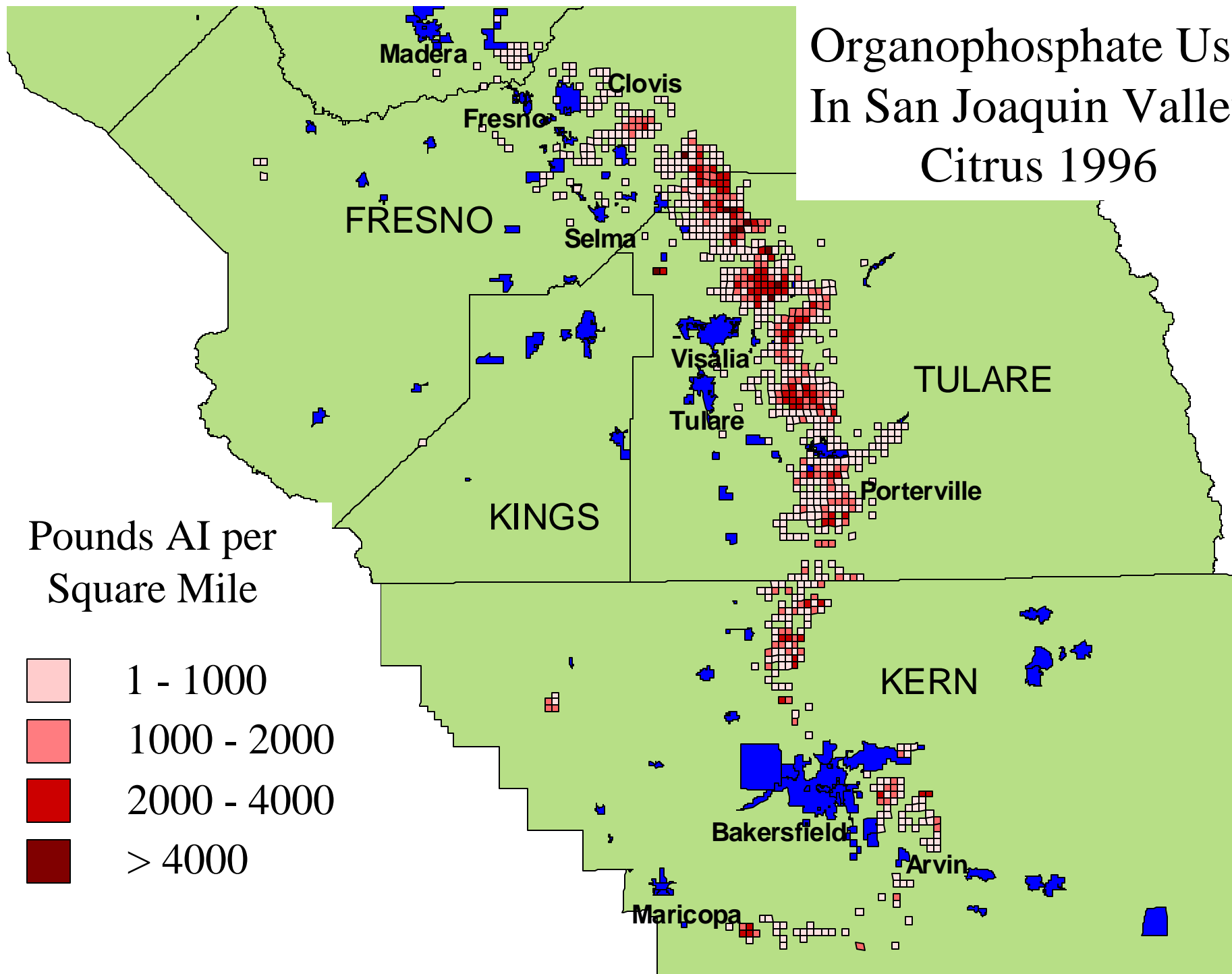
- Through mapping of pesticide use data, geographical areas where insecticide use is higher than average may be identified
- These areas may be targeted for monitoring of insecticide resistance development and secondary pest outbreaks
- These areas may also be prioritized for programs that promote alternative control measures



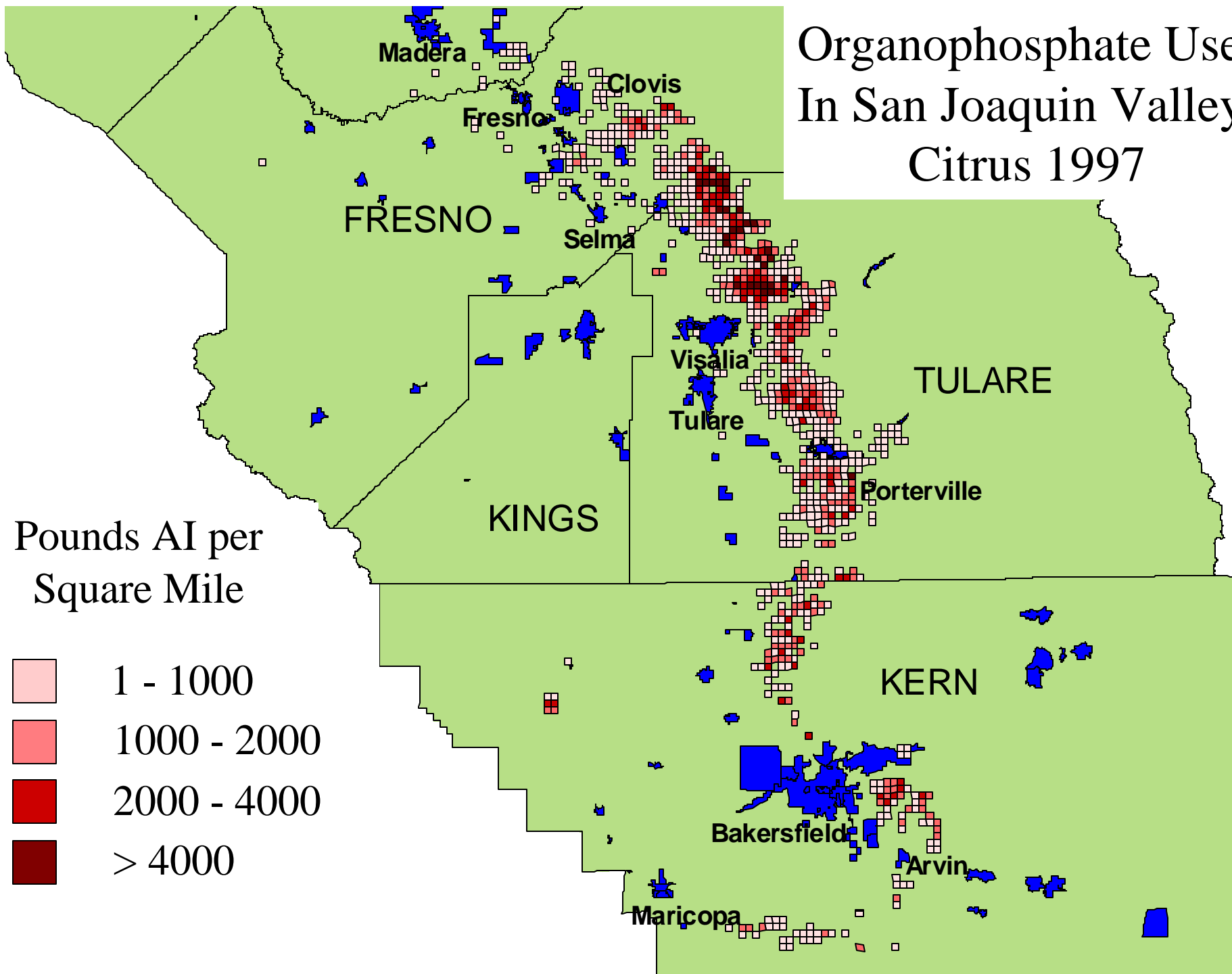
# Organophosphate Use In San Joaquin Valley Citrus 1995



# Organophosphate Use In San Joaquin Valley Citrus 1996



# Organophosphate Use In San Joaquin Valley Citrus 1997



# Insect Growth Regulators for California Red Scale Control

Buprofezin (Applaud®)  
(Chitin synthesis inhibitor)

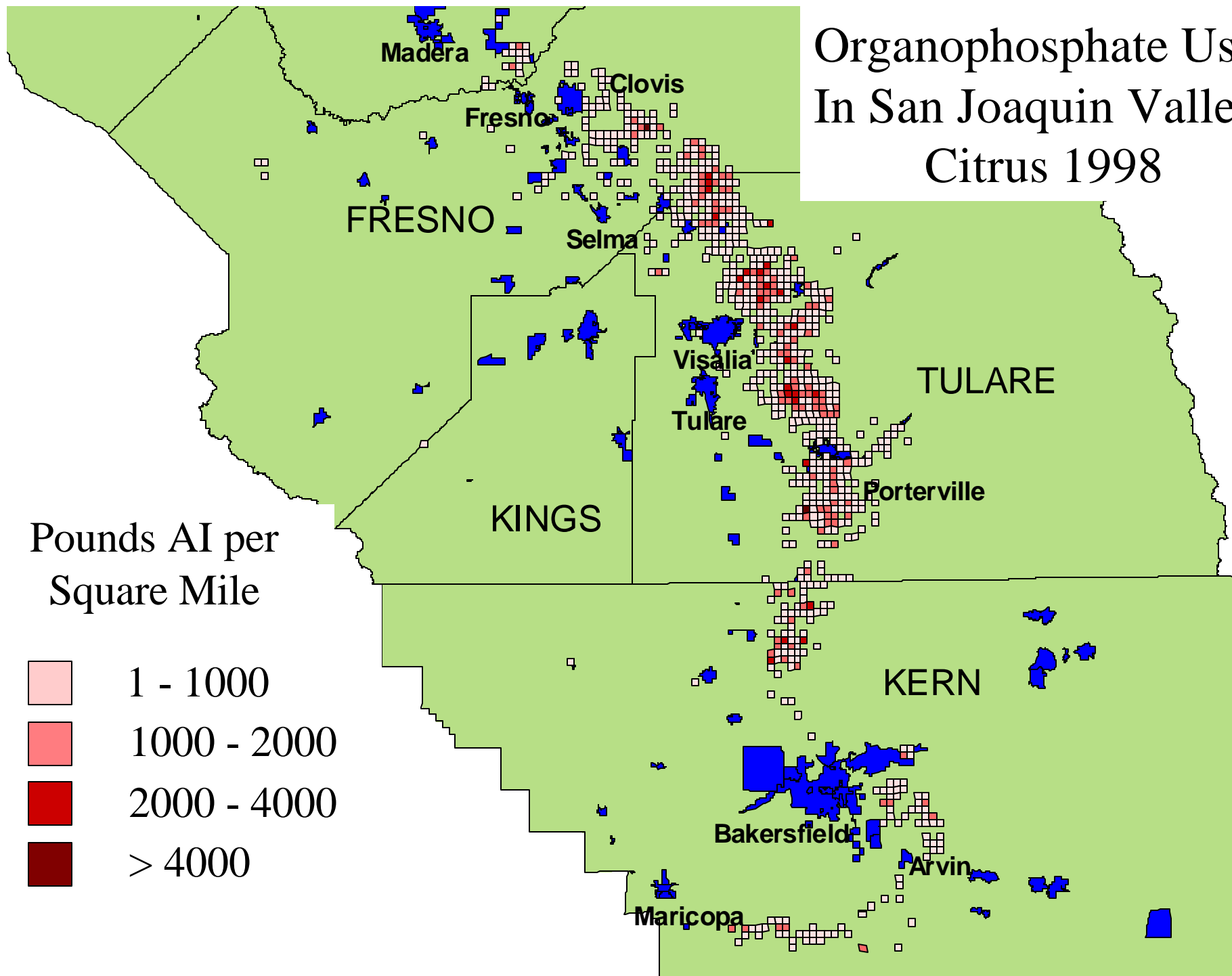
Pyriproxyfen (Esteem®)  
(Juvenile hormone mimic)

- 1997 • Section 18
- 1998 • Section 18
- 1999 • Section 18
- 2000 • Not Registered

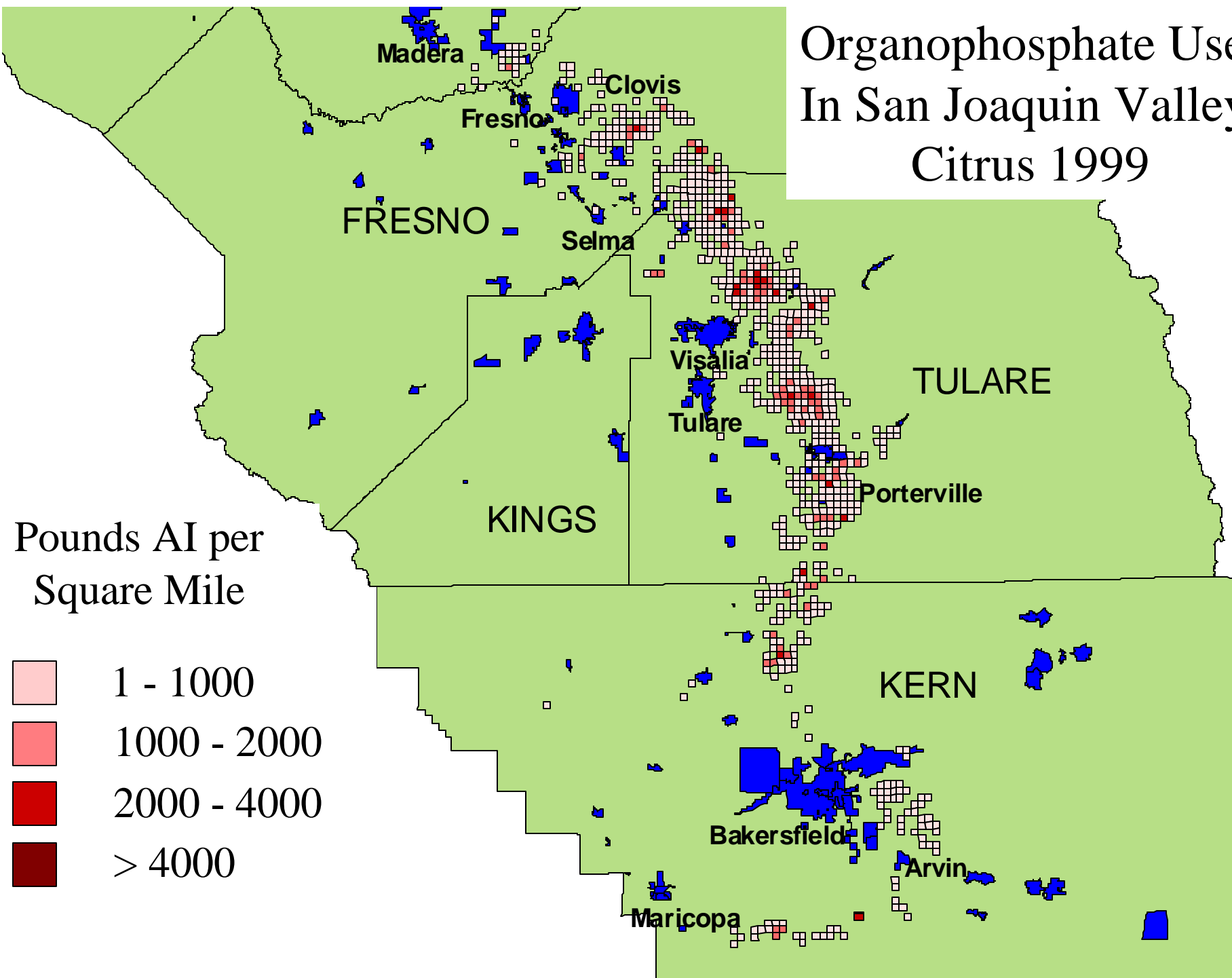
- Not Registered
- Section 18
- Section 18
- Full Registration



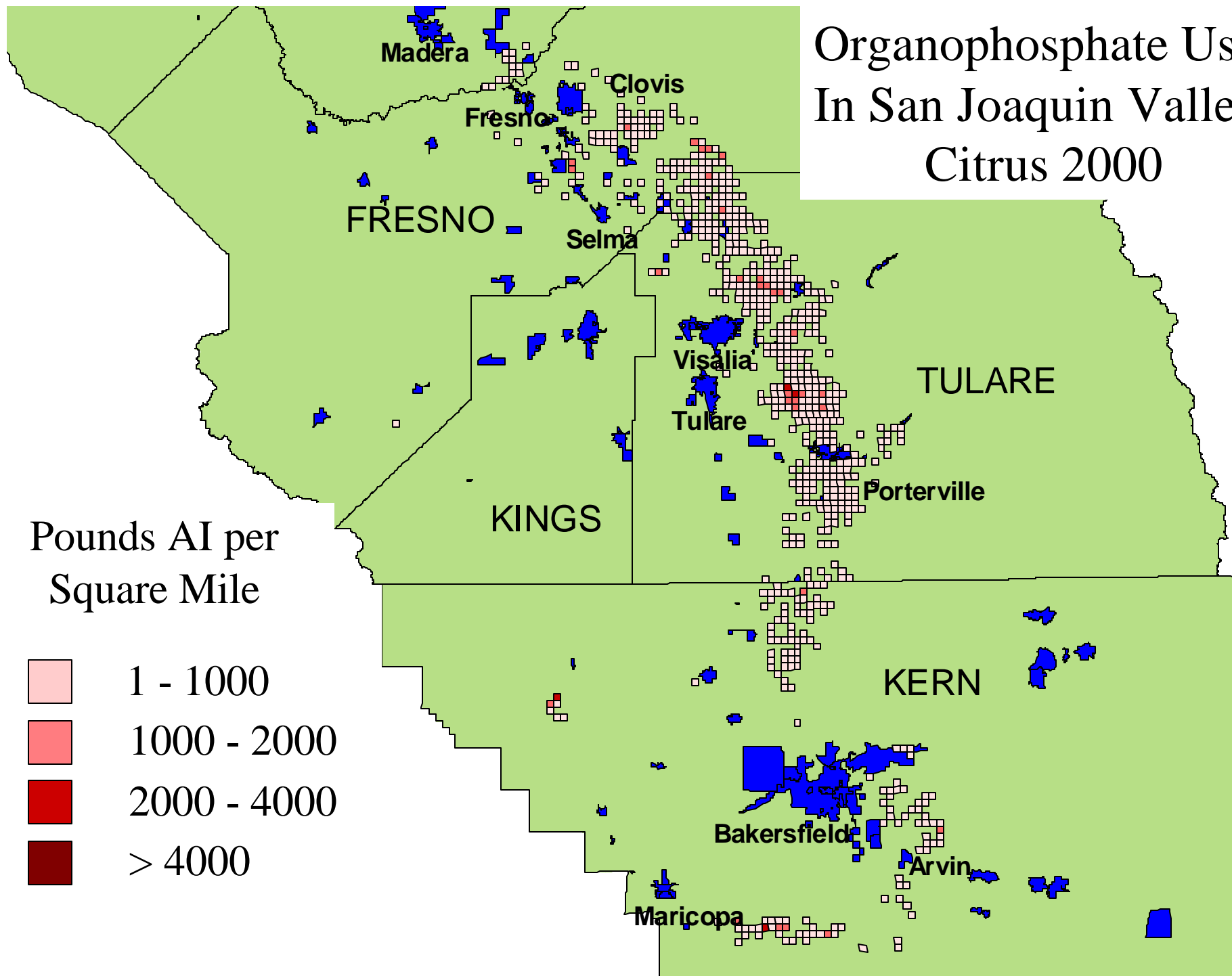
# Organophosphate Use In San Joaquin Valley Citrus 1998



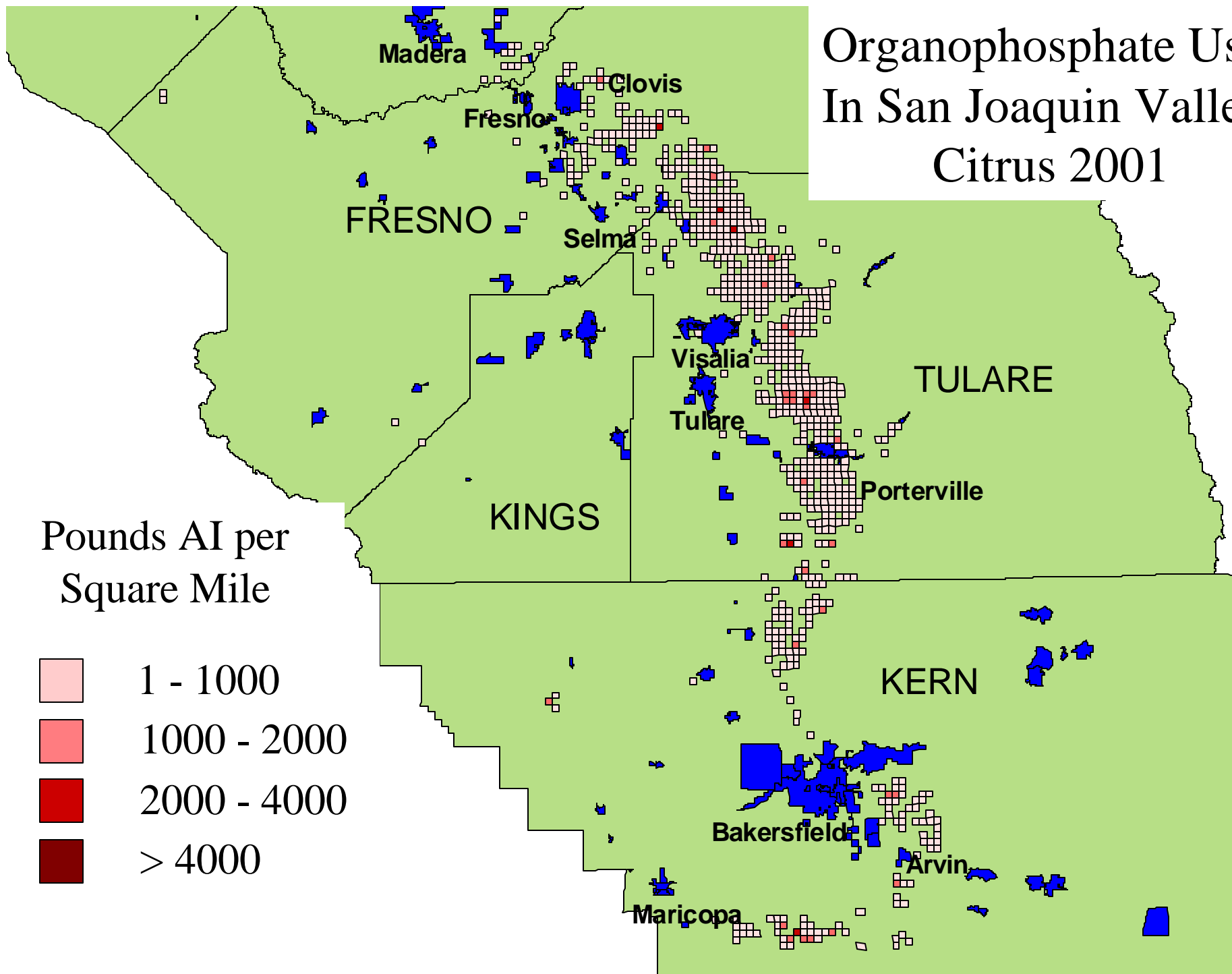
# Organophosphate Use In San Joaquin Valley Citrus 1999



# Organophosphate Use In San Joaquin Valley Citrus 2000

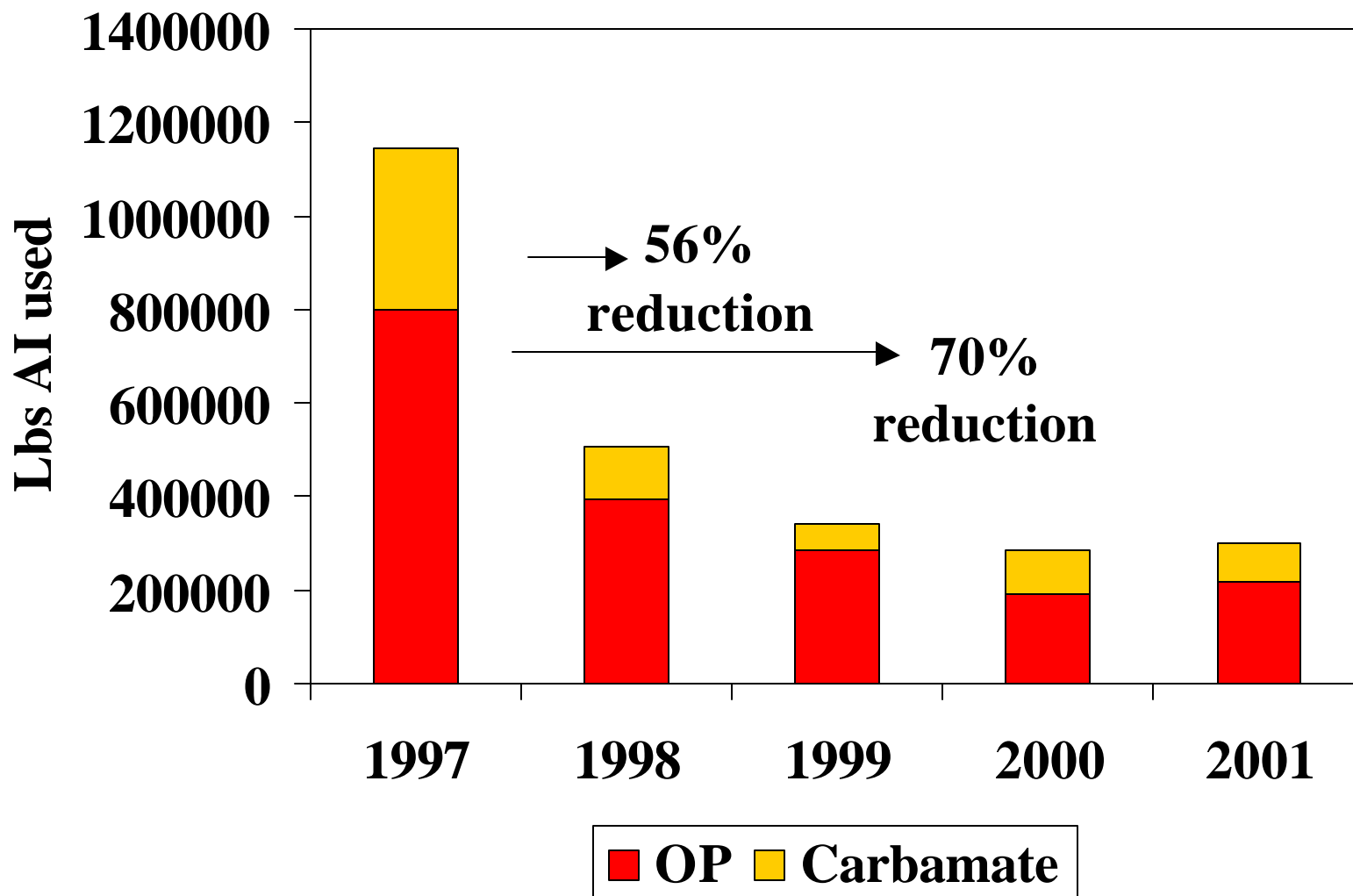


# Organophosphate Use In San Joaquin Valley Citrus 2001

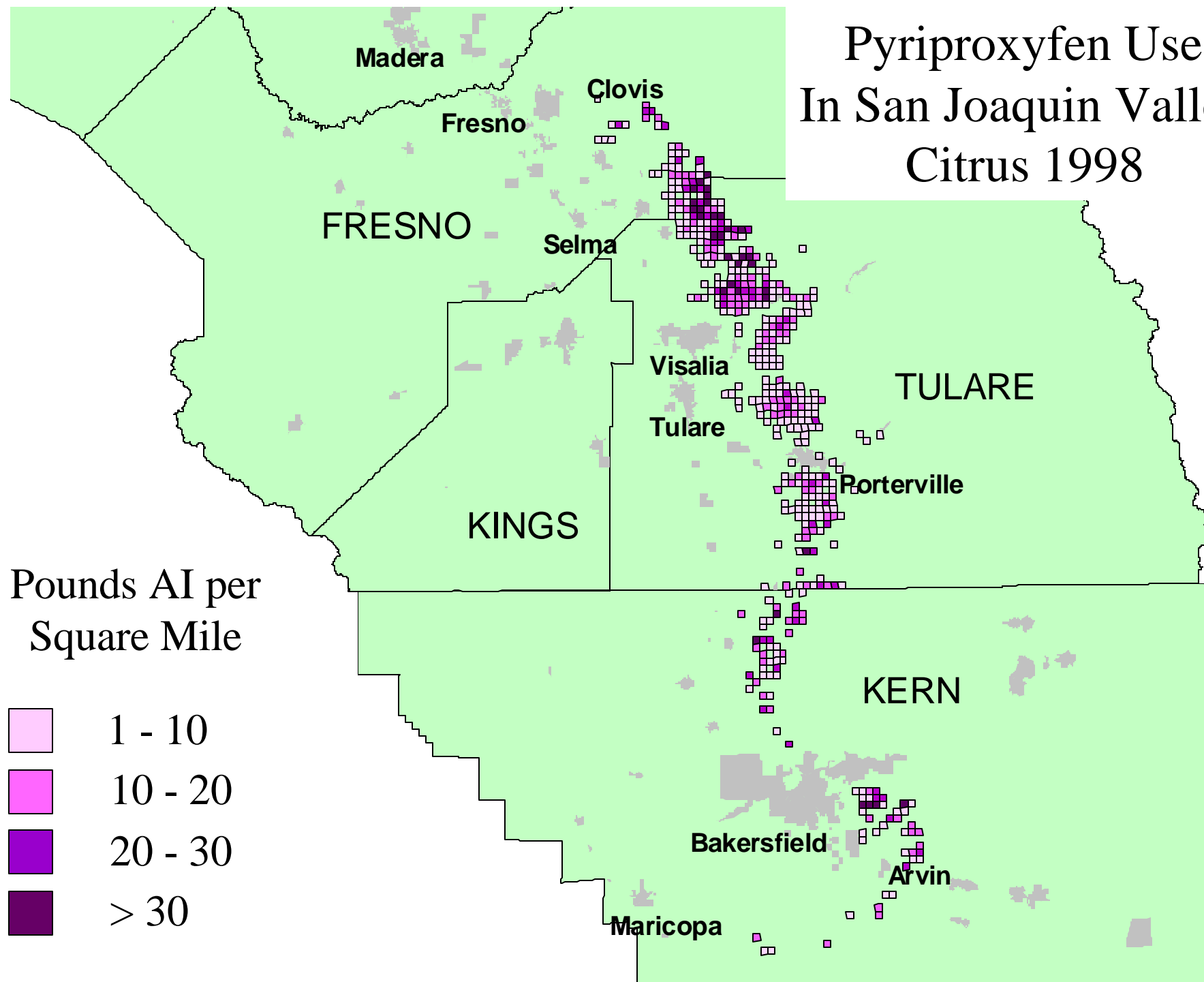




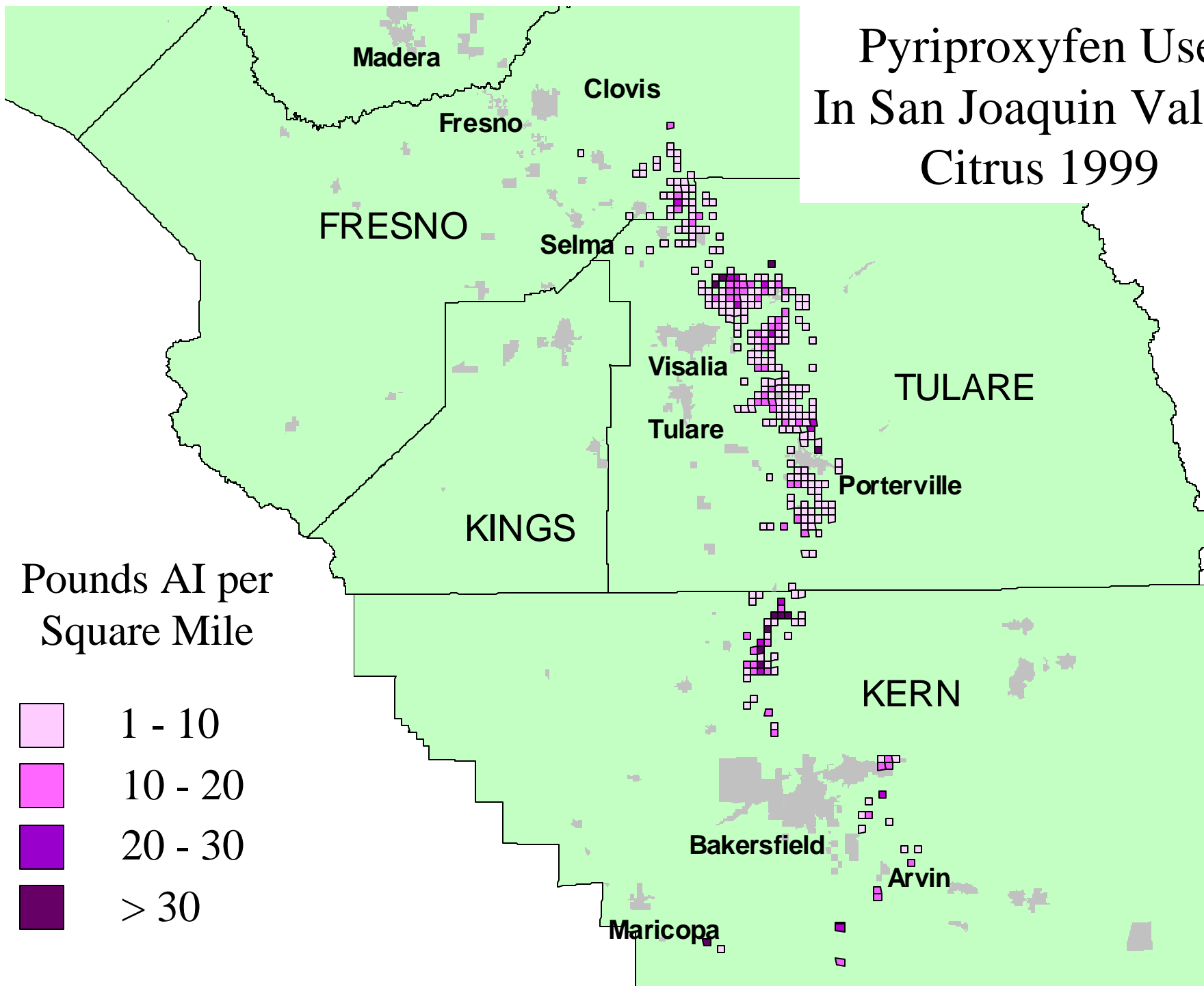
# Organophosphate and Carbamate Use in SJV Citrus



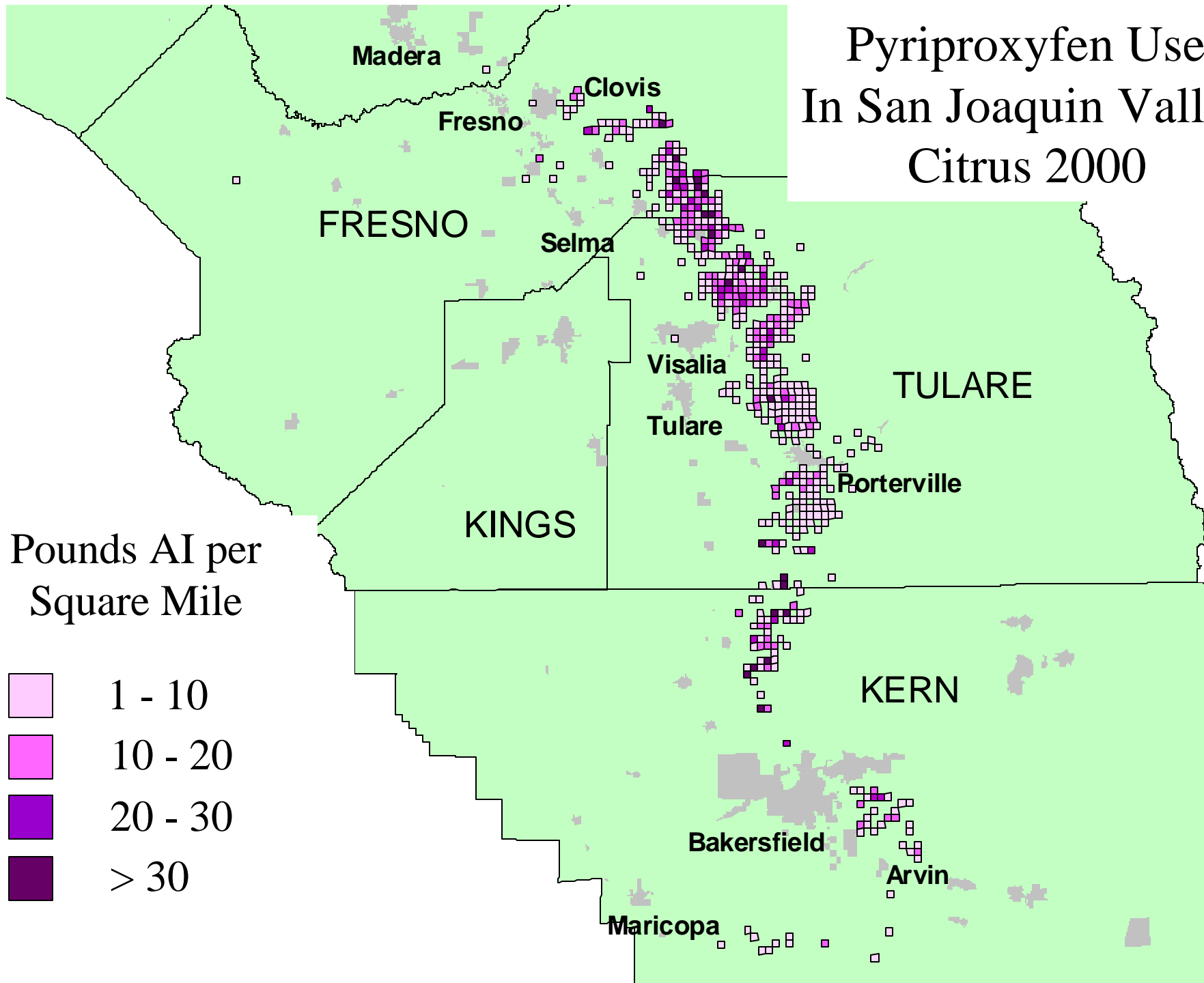
# Pyriproxyfen Use In San Joaquin Valley Citrus 1998



# Pyriproxyfen Use In San Joaquin Valley Citrus 1999

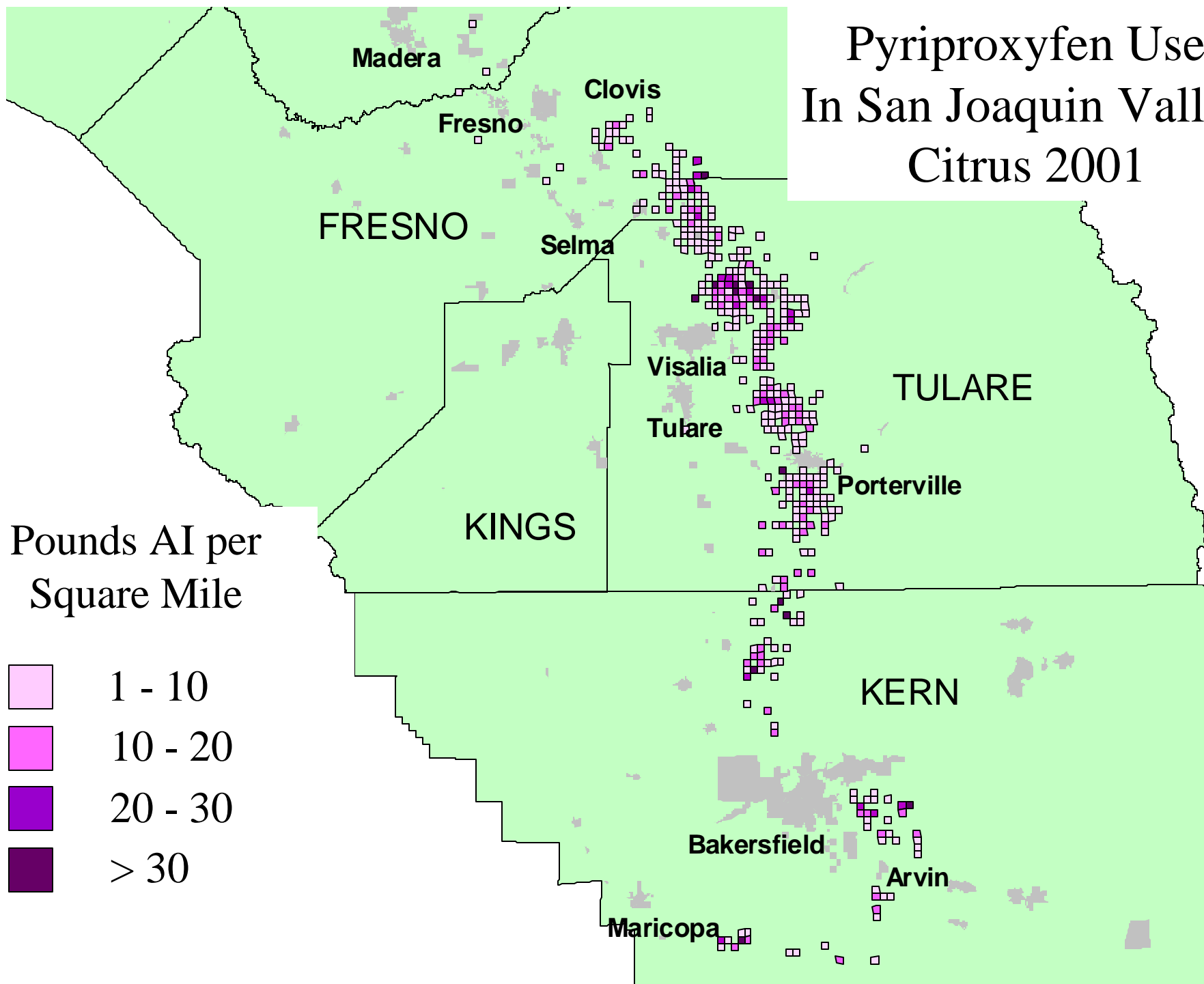


# Pyriproxyfen Use In San Joaquin Valley Citrus 2000





# Pyriproxyfen Use In San Joaquin Valley Citrus 2011



# Comparison of Insect Growth Regulators

## Buprofezin (Applaud®)

## Pyriproxyfen (Esteem®)

- 1997 • Section 18
- 1998 • Section 18
- 1999 • Section 18
- 2000 • Not Registered
- 2001 • Not Registered
- 2002 • Full Registration
- 2003 • Full Registration

- Not Registered
- Section 18
- Section 18
- Full Registration
- Full Registration
- Full Registration
- Full Registration

# Insect Growth Regulators for Red Scale Control

- Positives
  - Good control of scale populations
  - Reduces use of organophosphates dramatically
  - Provides opportunity for insecticide rotation and resistance management
- Negatives
  - Insecticide resistance will develop over time
  - May provoke outbreaks of secondary pests



Cottony Cushion Scale, a potential pest where alternative insecticides for California Red Scale are used

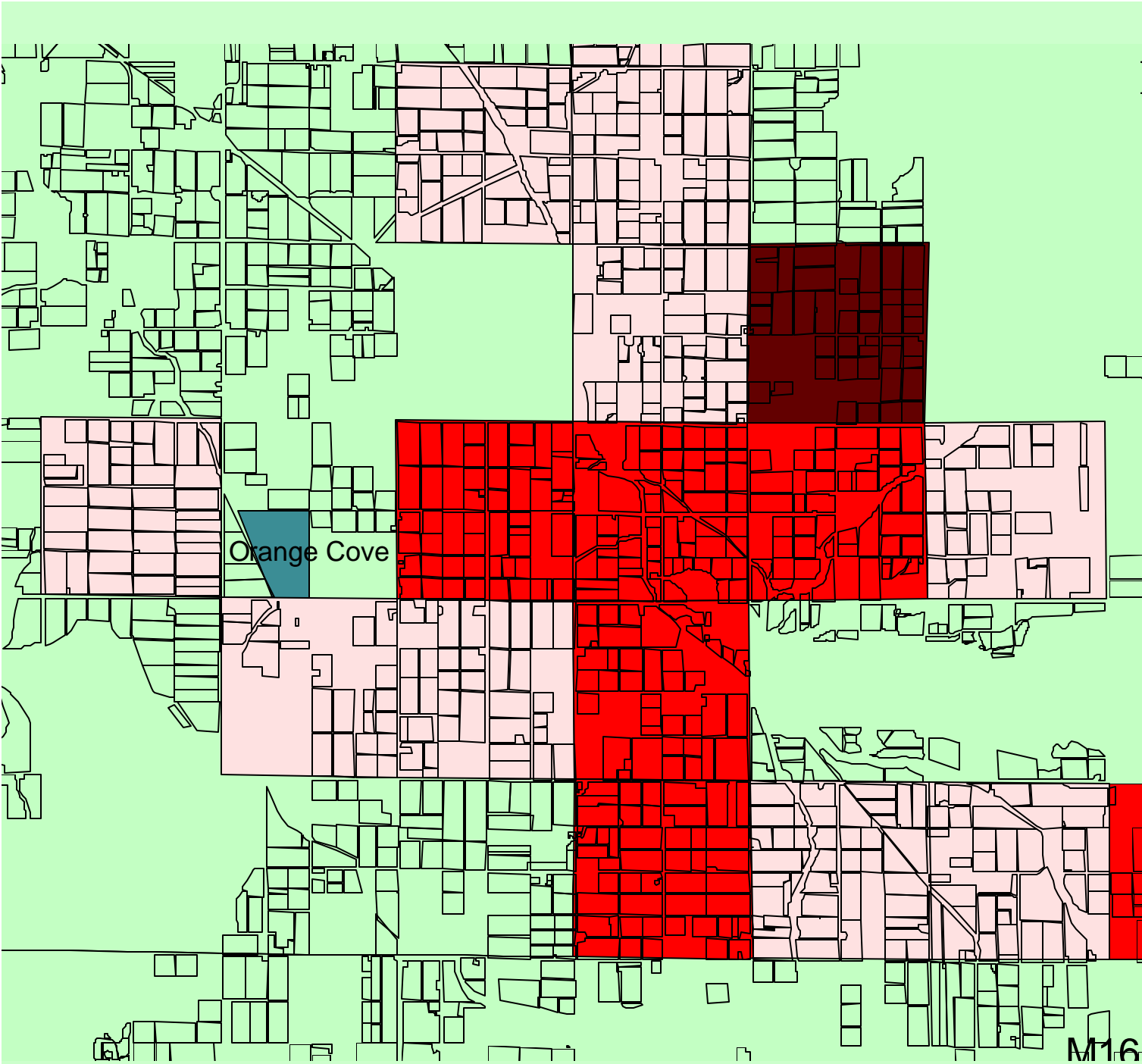
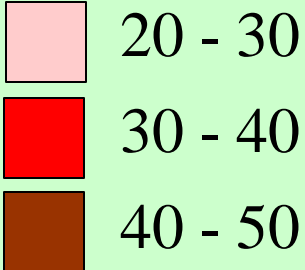




The Vedalia Beetle, a highly effective predator of Cottony Cushion Scale

# Pyriproxifen (Esteem) Treatments

Number of  
Applications  
1998 - 2001



# Conclusions

Observing pesticide use patterns spatially over time allows researchers and growers to identify trends and mitigate potential hazards

- Pesticide Resistance Management
- Secondary Pest Outbreaks
- Regulatory Issues
- Environmental Issues

# More Information

- [www.uckac.edu/citrusent](http://www.uckac.edu/citrusent)
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  - [Bethgc@uckac.edu](mailto:Bethgc@uckac.edu)
- [www.uckac.edu/gis](http://www.uckac.edu/gis)



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