Ecological Risk Assessment for Aquatic Invertebrates Exposed to Imidacloprid Part A: Exposure Assessment

Michael Winchell[1], Lauren Padilla[1], Jane Tang[2], Melissa Whitfield Aslund[3]

1. Stone Environmental, 2. Bayer CropScience, 3. Intrinsik Environmental Sciences

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Introduction

Imidacloprid is a systemic insecticide widely used for the control of sucking insects

- Crop uses: 32 different crops
- Non-crop uses: turf, lawn, ornamental, and nursery/greenhouse

Regulatory standard exposure modeling approach is mostly deterministic, predicting exposure concentrations considering certain use patterns, weather, and soil conditions

A higher tier probabilistic assessment was performed within regulatory standard modeling framework to derive a more comprehensive and realistic range of imidacloprid exposure levels reflecting the spatial and temporal variability

Modeling Approach

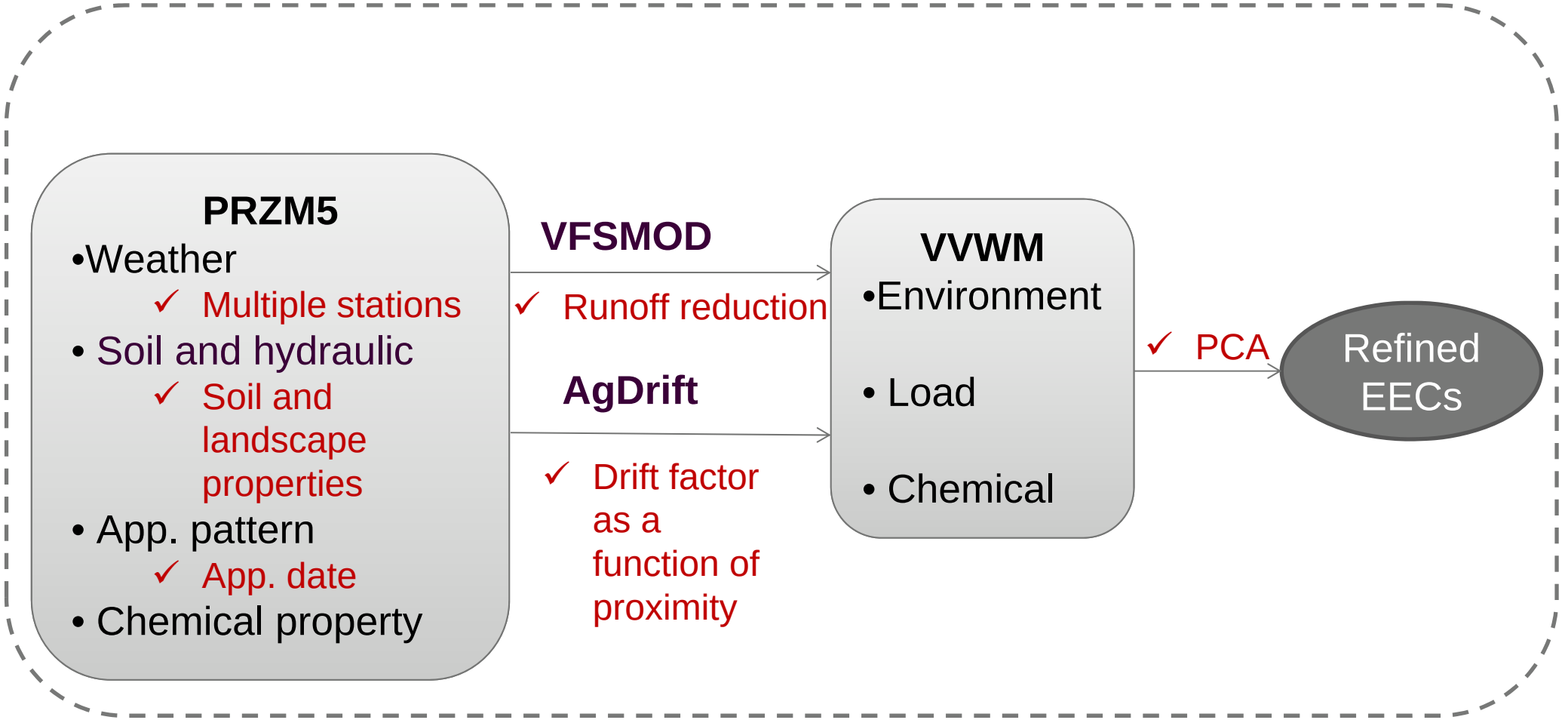
Incorporated mitigation measures on the product label into the assessment quantitatively

- Vegetative filter strip (10 ft)
- Spray drift buffer (150 ft for aerial and 25 ft for ground)

Considered variability/uncertainty of critical environmental and agronomic factors

- Developed probabilistic distributions of model input parameters
- Generated model simulations by sampling from these input distributions using a robust sampling method

Approach Diagram



1000 simulations for each crop scenario were defined using Latin Hypercube Sampling (LHS) of input distributions

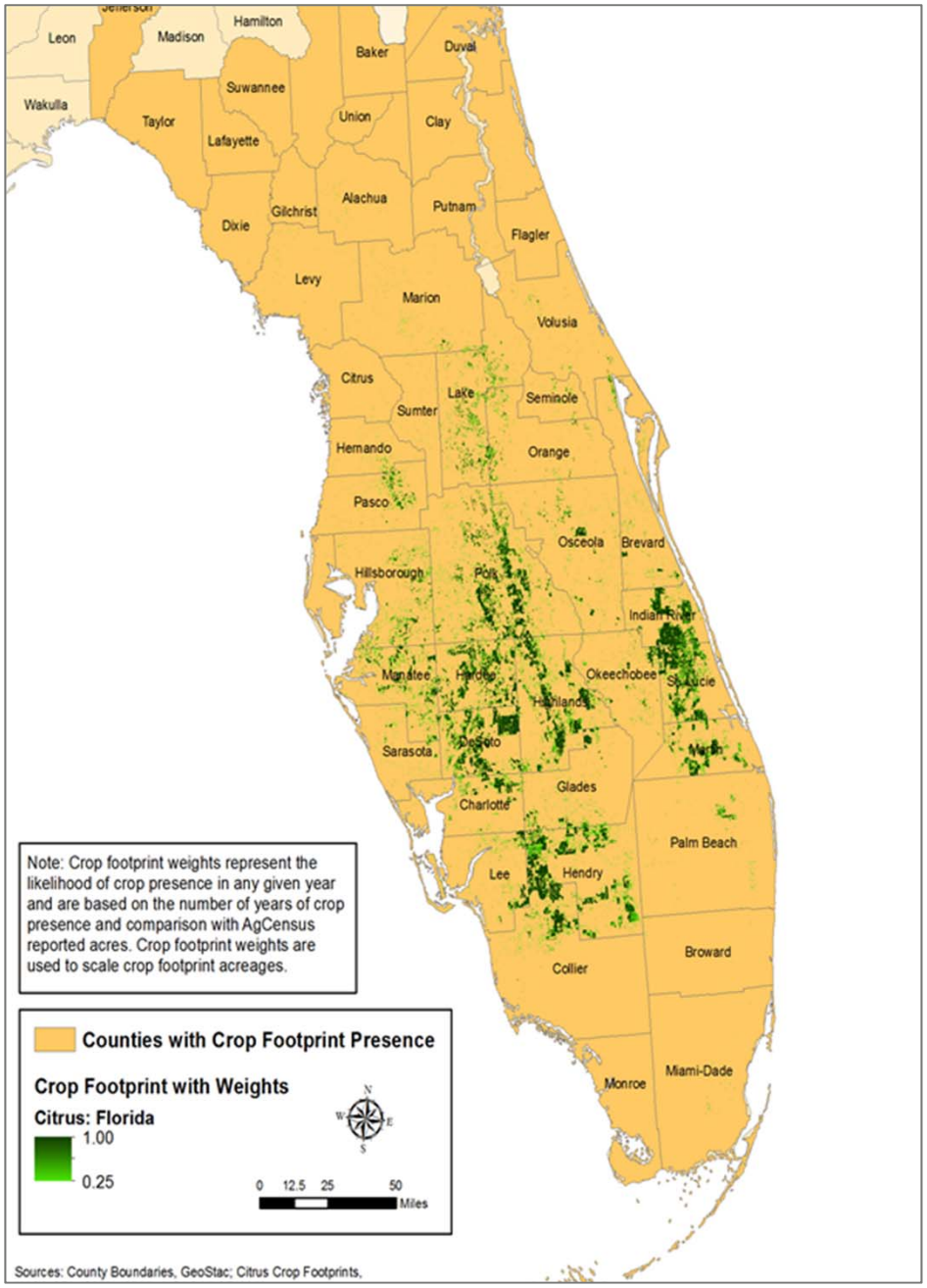
Crop Footprints

Developed to represent the areal extent of where applications could occur for the given labeled crops

CDL (2010-2013) was used

- 2011 NLCD
- 2012 NASS AgCensus
- NASS Quick states crop statistics (2010-13)

Assigned weight factor (0-1) to each pixel based on the presence of a target crop in the 4 years

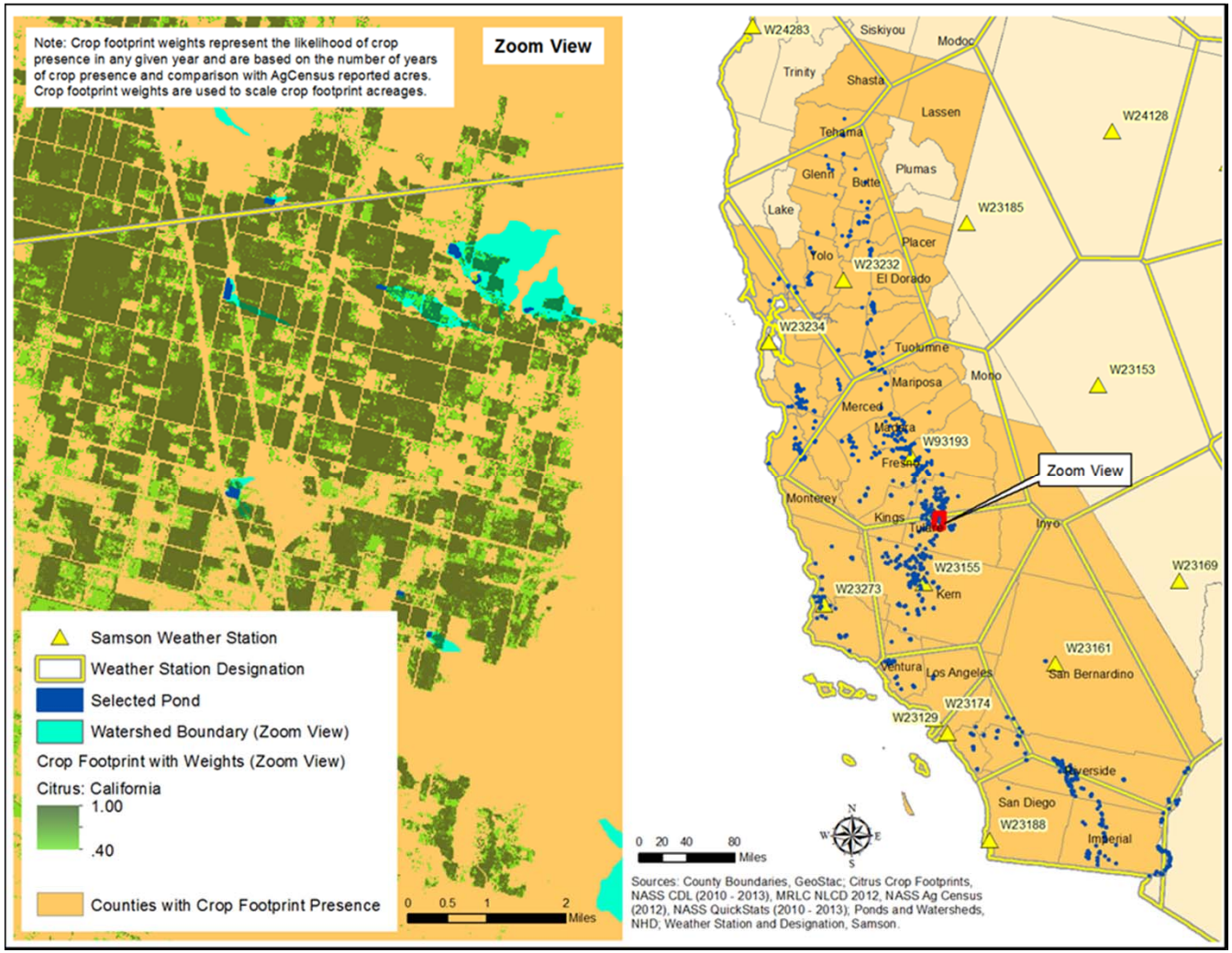


Pond Selection, Watershed Delineation, and Weather

Actual small ponds (0.5- 5.0 ha) associated with each crop scenario are selected from high resolution (1: 24k) NHD and characterized for input distribution development

Watersheds were delineated in order to identify relevant soils and percent cropped areas

Weather stations assigned to each pond, and probabilities based on the fraction of ponds associated with each station



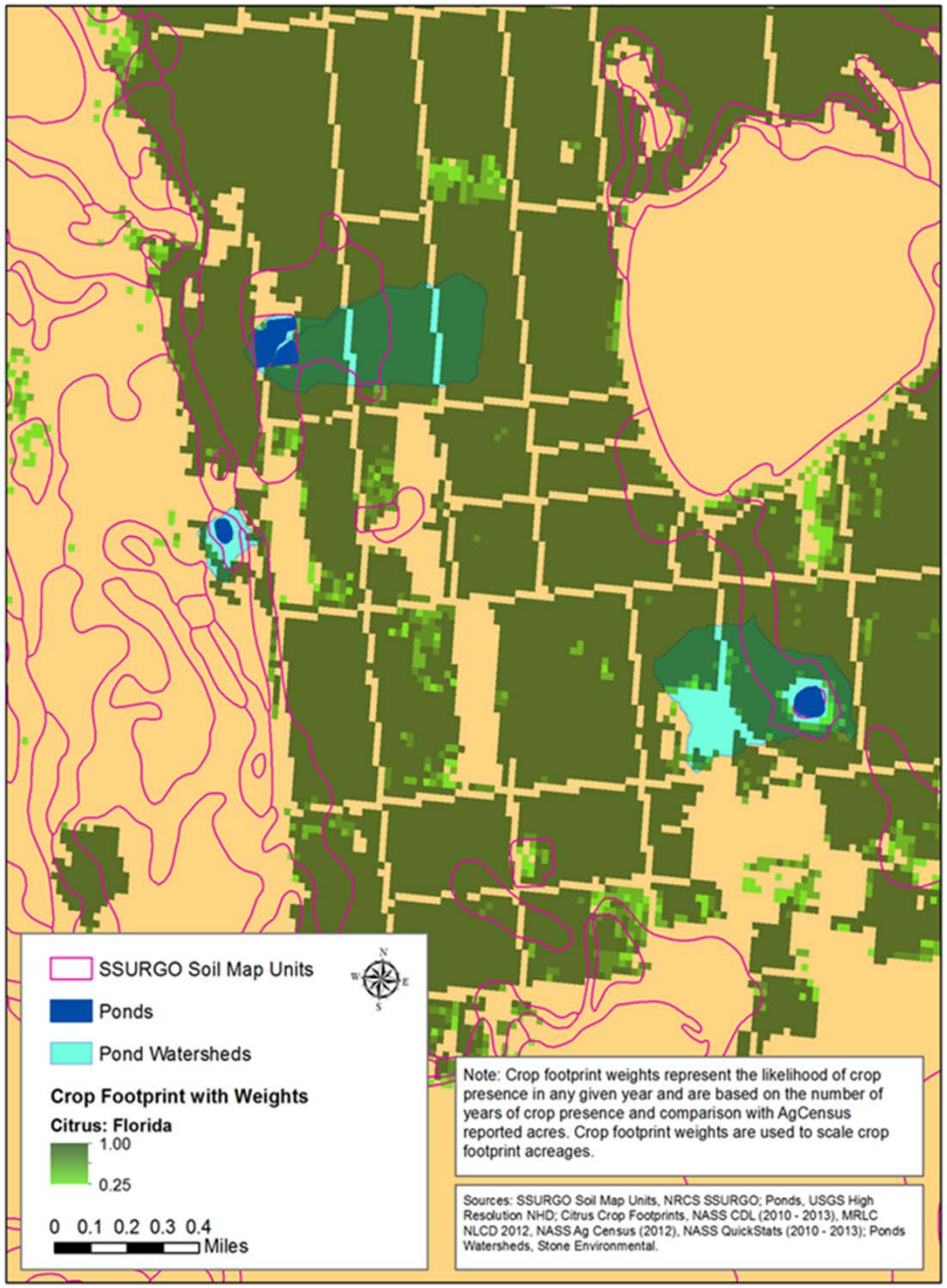
Probability Distribution: Soils

The soils co-occurring with crops within the identified watersheds were identified and grouped by:

- Hydrologic group
- USLE K-factor
- Organic carbon in surface layer
- Slope

One representative component for each group was identified to determine the remaining model input values related to the soil profile

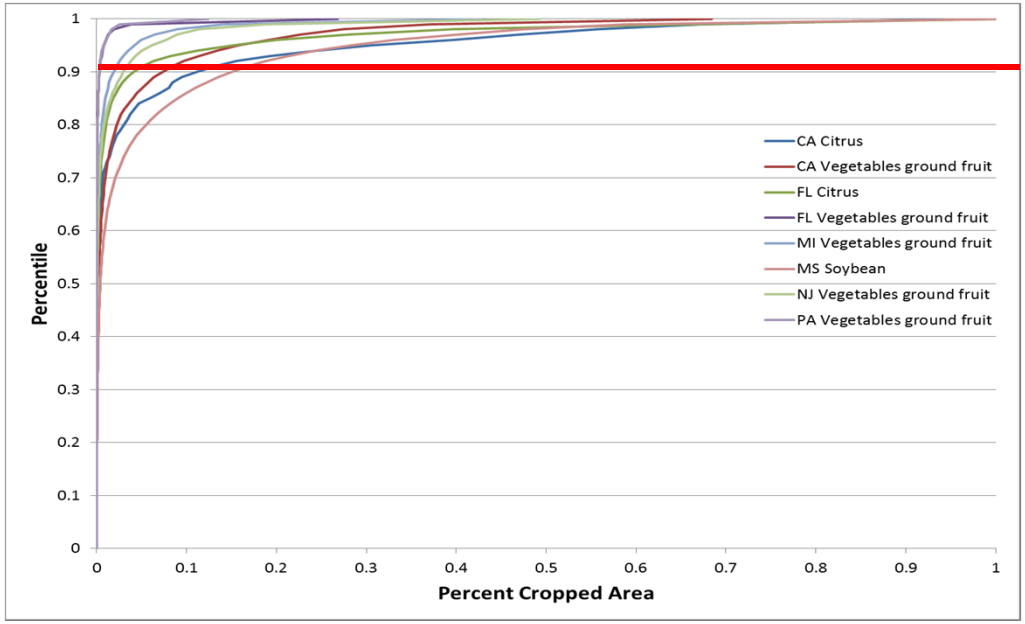
The total area of the soil components in each group out of the total area of all groups determined the soil group's likelihood of occurrence represented in a PRZM simulation

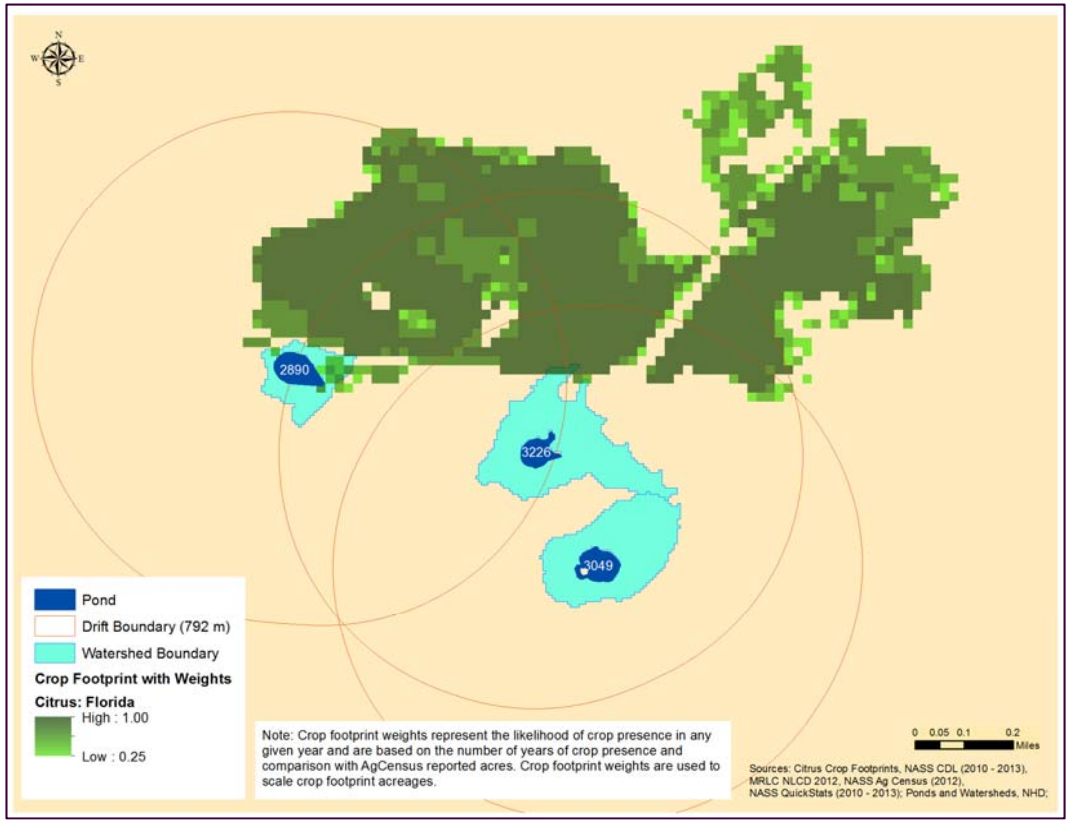


Probability Distribution: Percent Cropped Area (PCA)

Generated using the crop data layer, pond watersheds, and pond drift-sheds developed for each crop scenario

- The larger of the two PCA calculations for each pond was selected
- The upper 10th percentile PCAs were used in model runs



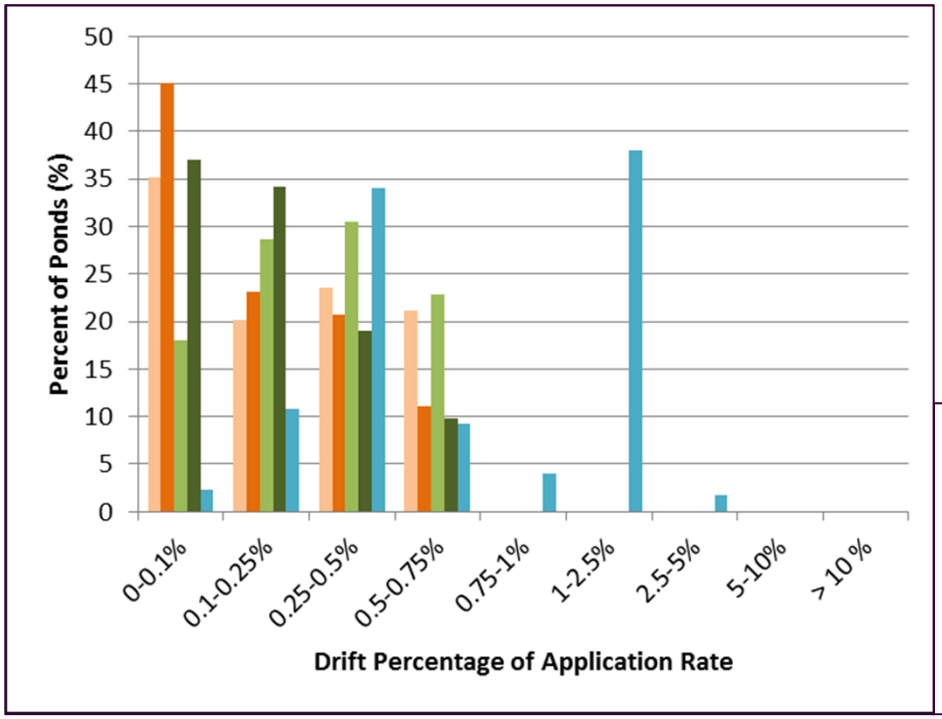


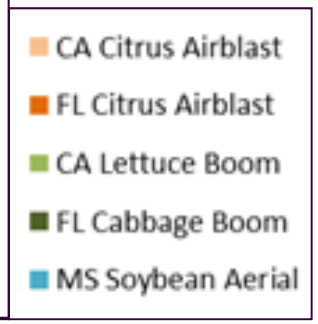
Probability Distribution: Drift Fraction

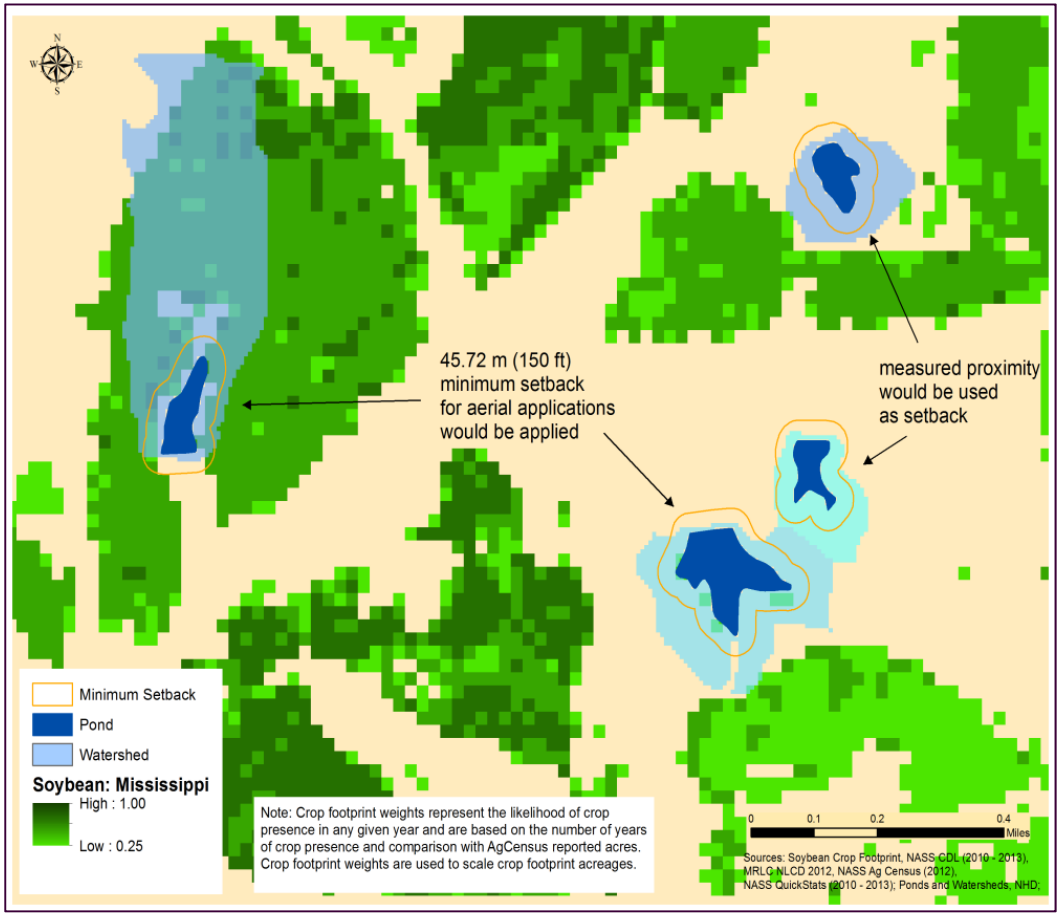
Calculated drift fractions based on actual distances between targeted crops and ponds using AgDrift

Minimum distance was set as drift buffer required on the label

- 150 ft for aerial and 25 ft for ground





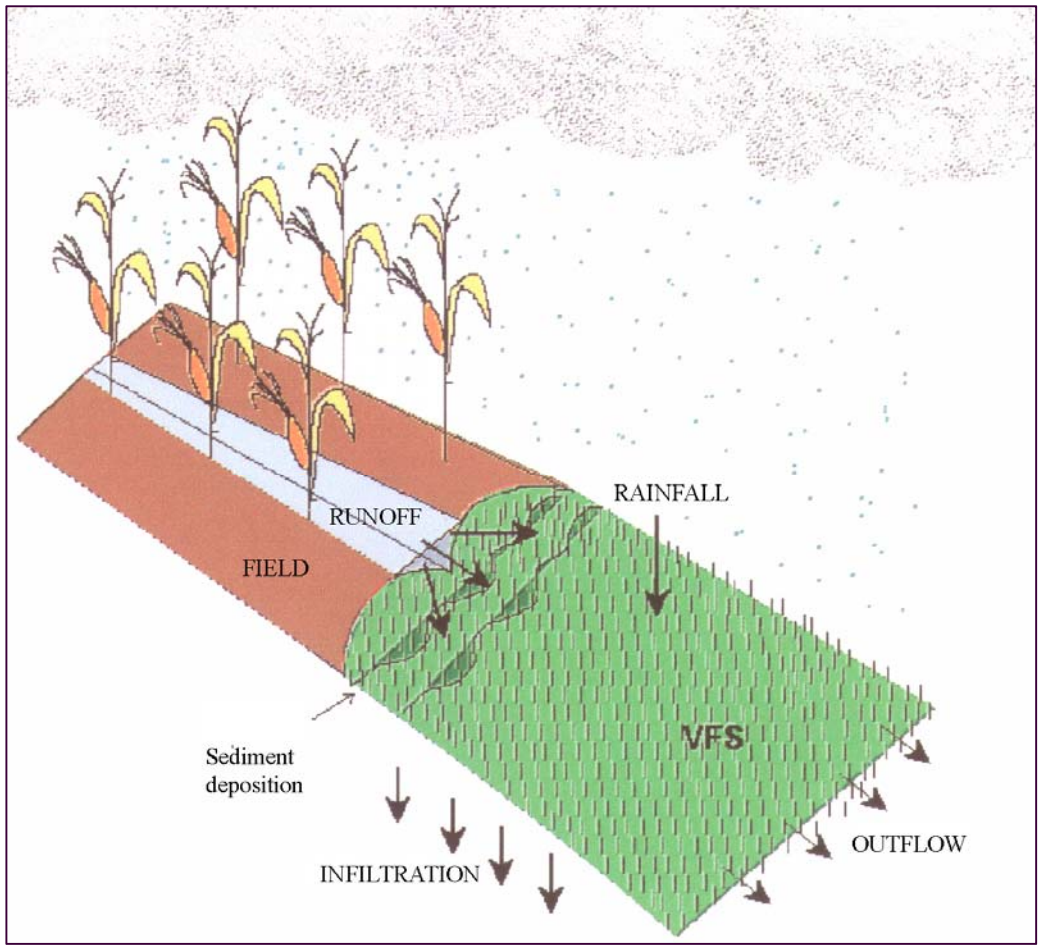


Simulation of Filter Strip Mitigation: VFSMOD

Vegetative Filter Strip MODel (VFSMOD) was used to estimate the efficiency of the runoff buffer (10 ft) required on the label

VFSMOD inputs based on the local soil and slope for each simulation

Depending on crop scenarios, the median percent reduction of imidacloprid in 30 year simulations ranged from 35% to 90%



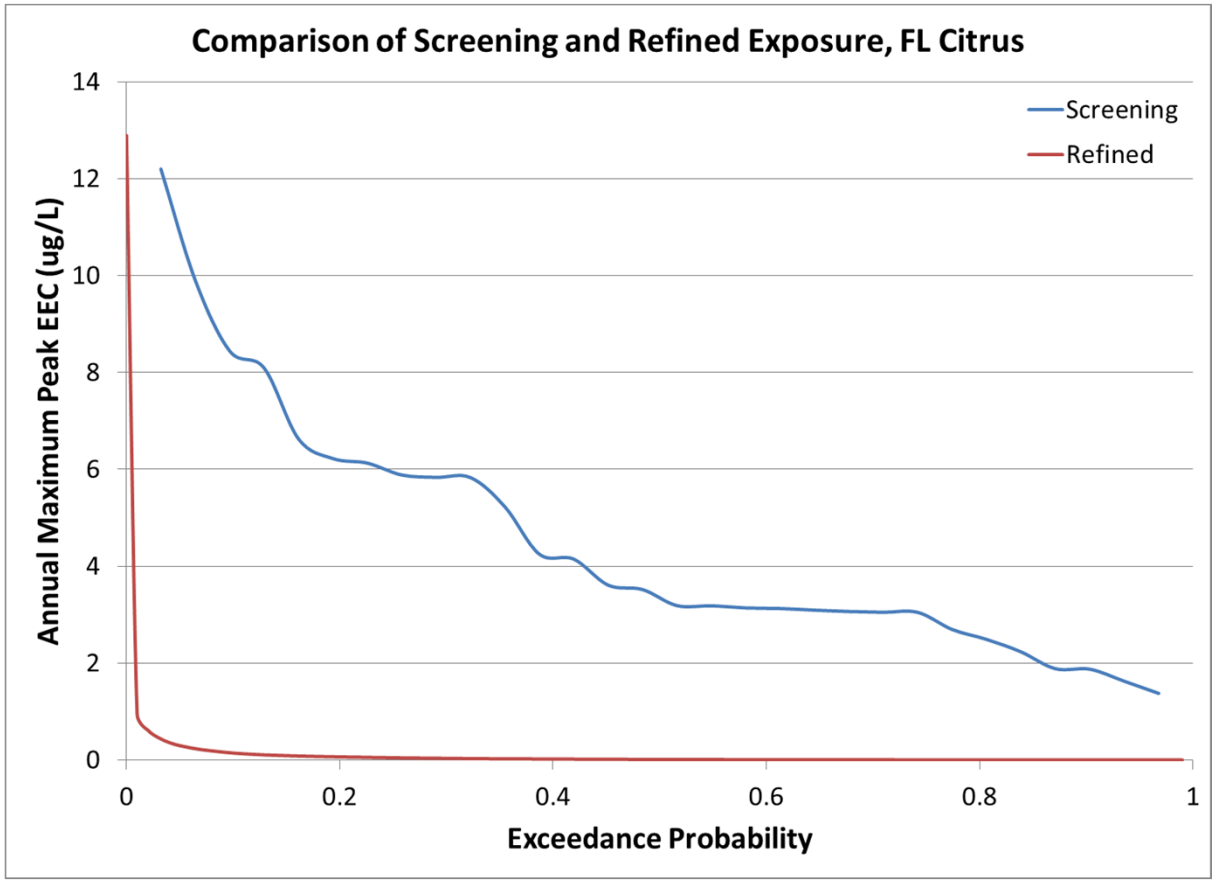
Exposure Modeling Results

Higher tier assessment was conducted for 14 crop scenarios, including citrus, vegetables, and cucurbits

Refined 90th percentile exposure concentrations are below 0.5 ppb

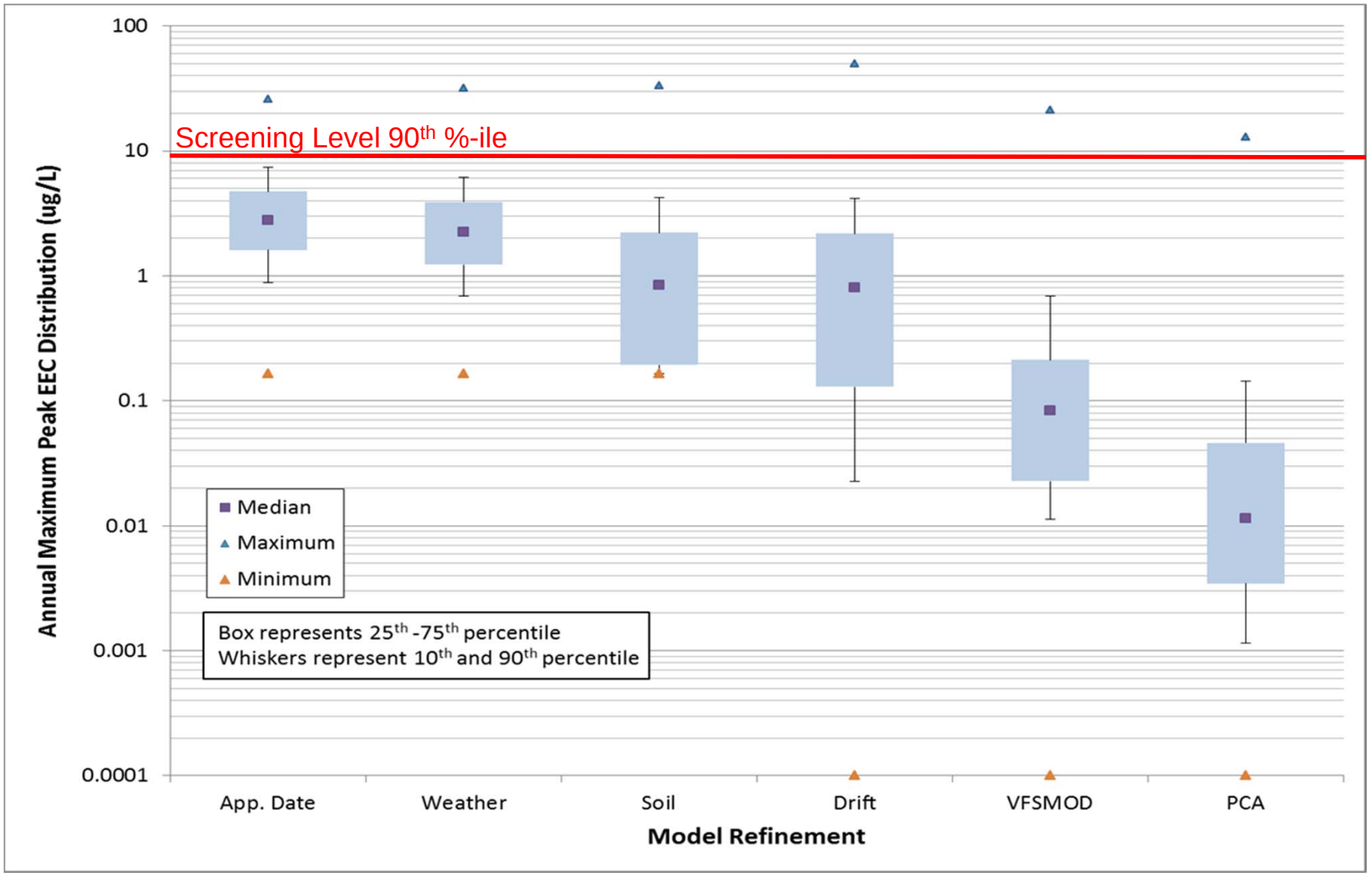
- 1 to 3 orders of magnitude lower than standard screening level assessment

Important factors impacting the relative magnitude of the EECs among the different scenarios were spray drift, percent cropped area (PCA), and filter strip efficiency



Uncertainties

The independent effects of each refinement on the EEC distribution shows their relative significance to the final EECs



Conclusions

A probabilistic exposure assessment was conducted to characterize the exposure concentrations of imidacloprid reflecting the spatial and temporal variability of environmental conditions

- Significantly refined screening level assessment

The approach was developed within the regulatory modeling framework by making use of best available high resolution spatial data and models

Current label mitigations (runoff and drift buffer) should be quantitatively considered in regulatory exposure assessment process using best available modeling tools

Thank you.

Contact / mwinchell@stone-env.com