

Sources, characteristics and opportunities for pesticide use and usage information applied to listed species risk assessment

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Introduction

One challenge in national-level pesticide endangered species risk assessments is the viable identification and incorporation of pesticide usage information in the risk assessment process.

Pesticide “usage” differs from pesticide “use”,

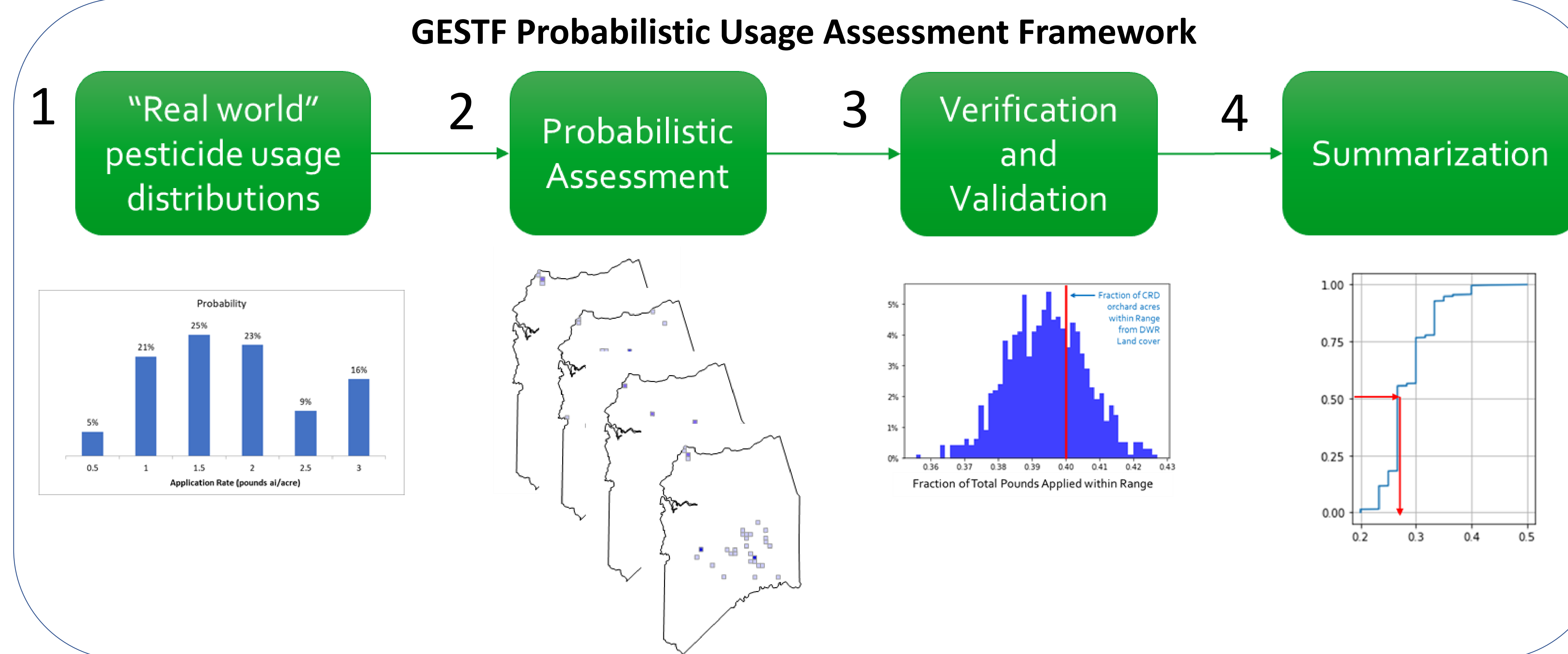
- “Use” is defined by registered labels and describes limits on how the pesticide may be applied (i.e., maximum rates and number of applications)
- “Usage” describes documented applications with specific information on each individual application event (usually surveys or self-reporting)

How we can utilize pesticide usage data to help inform our understanding of potential exposure?

Our goals :

- Account for variability in pesticide usage practices for which we have information
- Address uncertainty about which fields are treated (and to what degree)
- Must be applicable nationally, and suitable with existing species range definitions
- Transparent and robust (i.e., configurable)
- Ultimately provide context for potential exposure within the species range

Available usage data can improve exposure predictions and ultimately lead to improved risk assessments

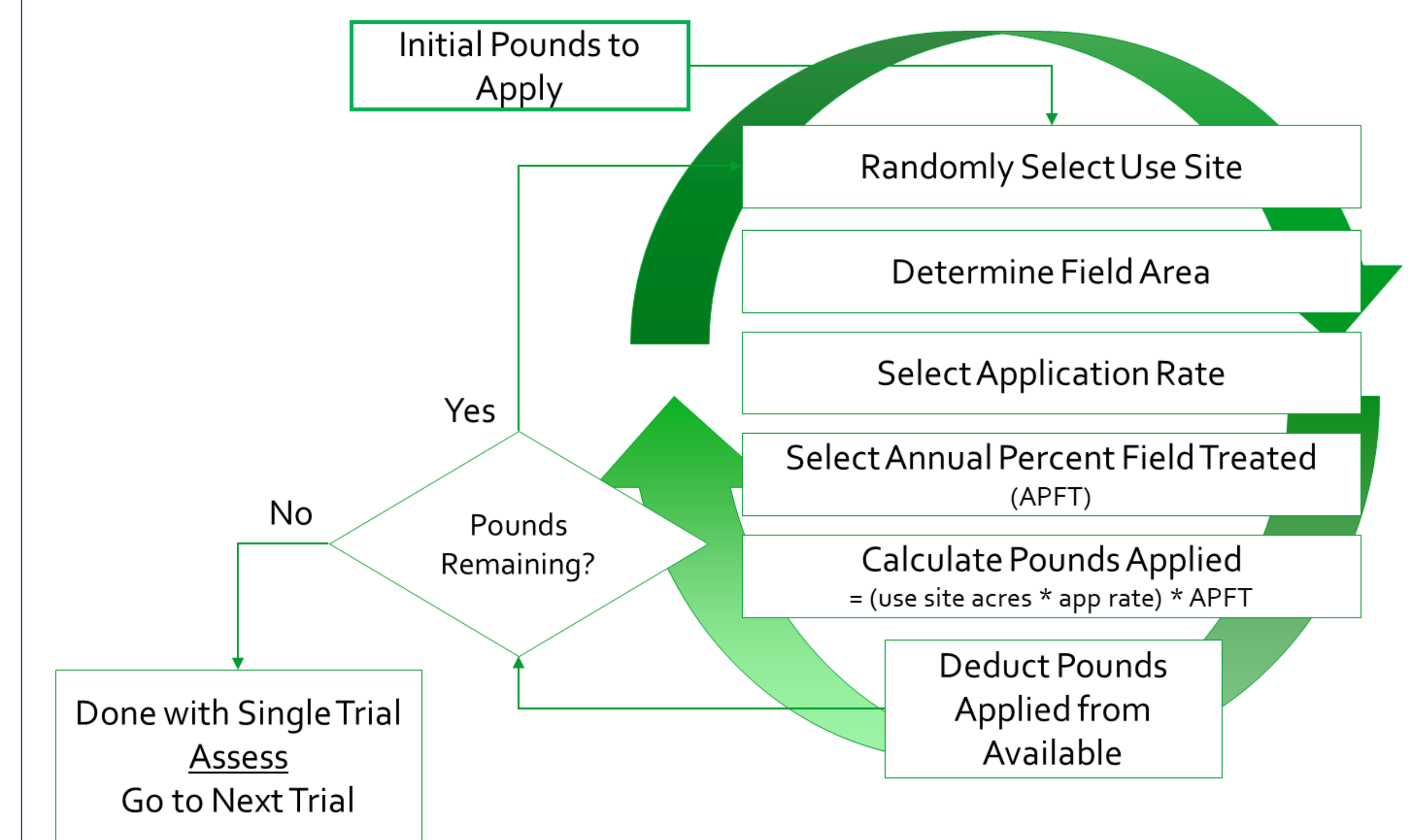


Each use site is assigned an index relating it to maximum usage (per acre):

$$\text{Usage Index} = \text{Lbs_Applied}_{\text{probabilistic}} / \text{Lbs_Applied}_{\text{max}}$$

Where: $\text{Lbs_Applied}_{\text{probabilistic}} = \text{App_Rate}_{\text{probabilistic}} * \text{Annual_}\% \text{Field_Treated}_{\text{probabilistic}}$
 $\text{Lbs_Applied}_{\text{max}} = \text{Label_Rate}_{\text{max}} * (100\% \text{Field_Treated} * \text{Annual_Applications}_{\text{max}})$

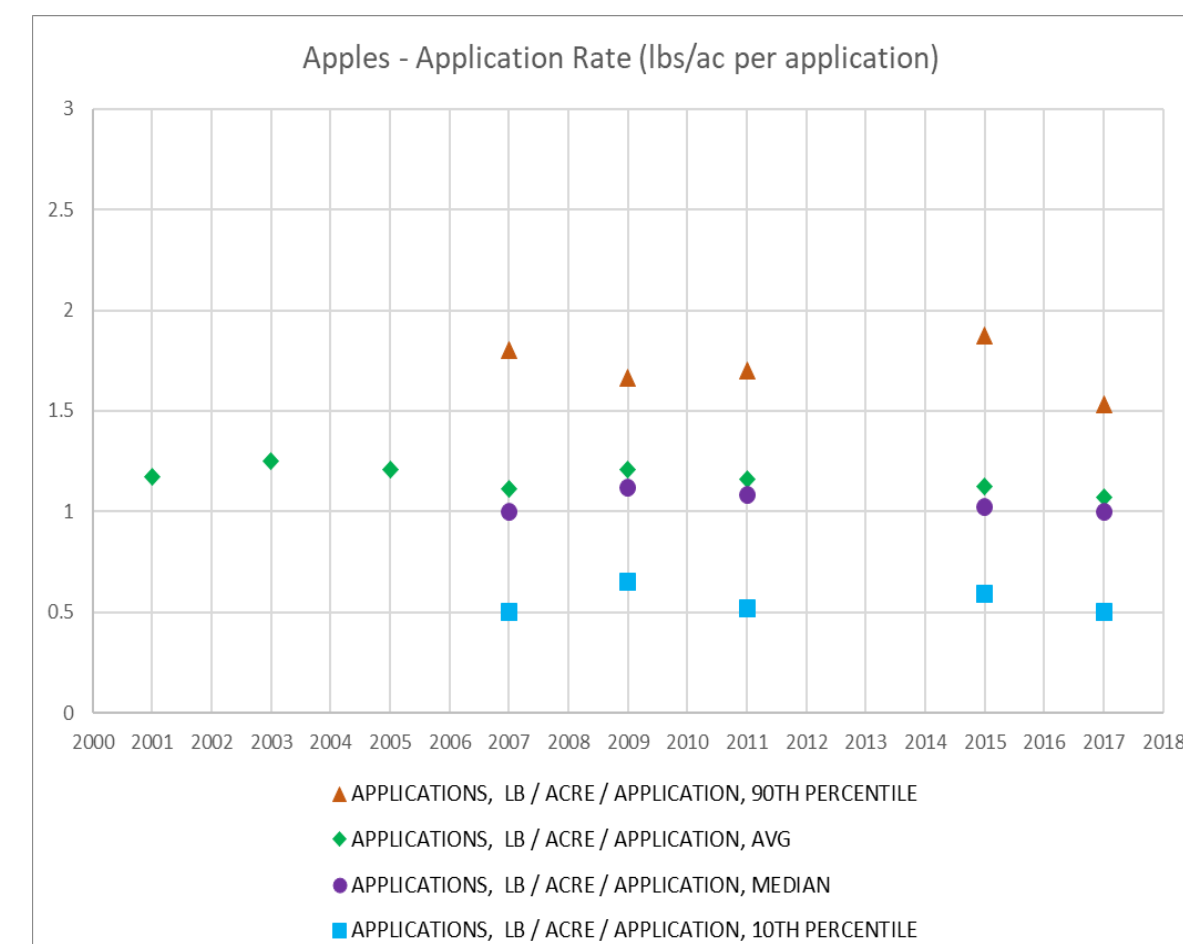
2. Probabilistic Simulation



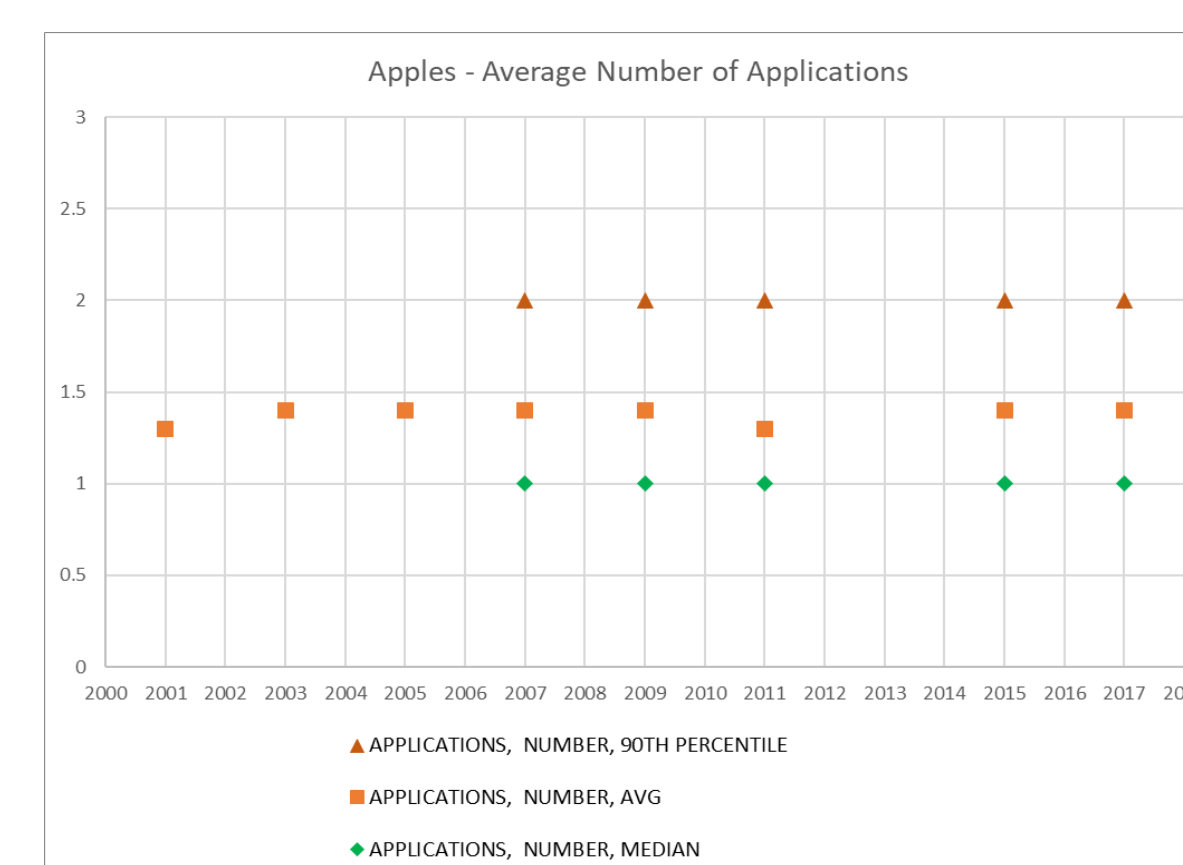
A simulation consists of multiple trials (e.g., 1000) in which inputs are selected randomly based on probability, and each trial represents one possible instance. By running many trials, the range of possible outcomes is defined, as well as the most probable outcomes.

1. Pesticide Usage Data

USDA NASS Agricultural Chemical Use Survey

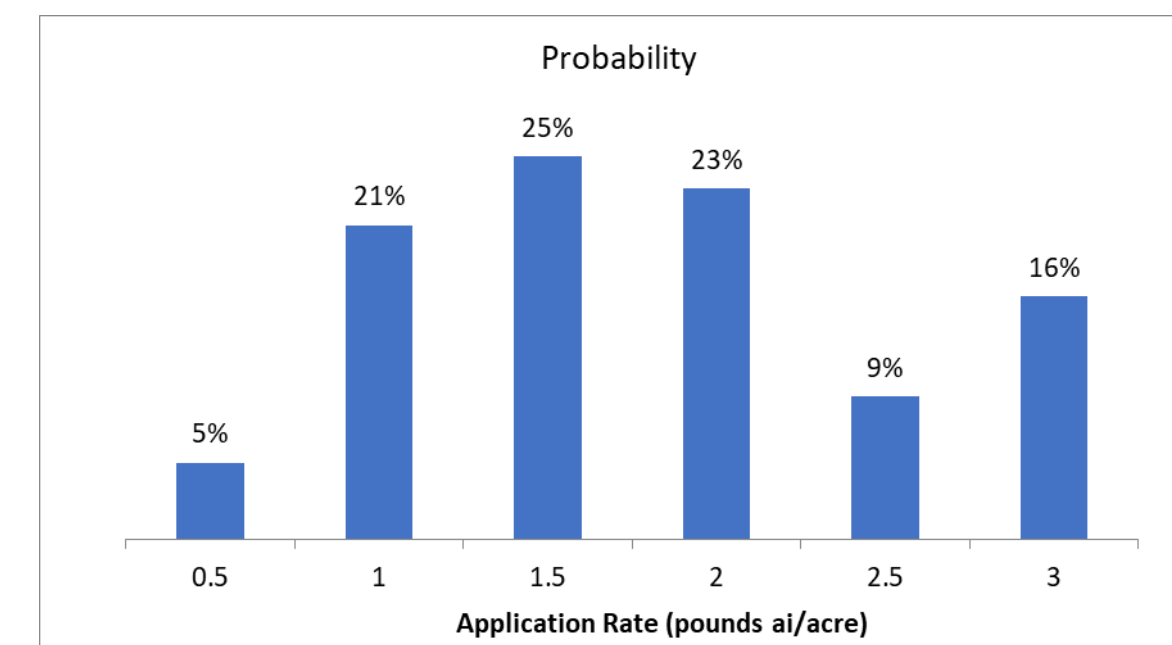


Selected percentiles of reported application rate (per application) distribution for carbaryl applied to apples from 2007-2017 for all program states combined. The maximum application rate listed on the label is 3 lbs/acre.

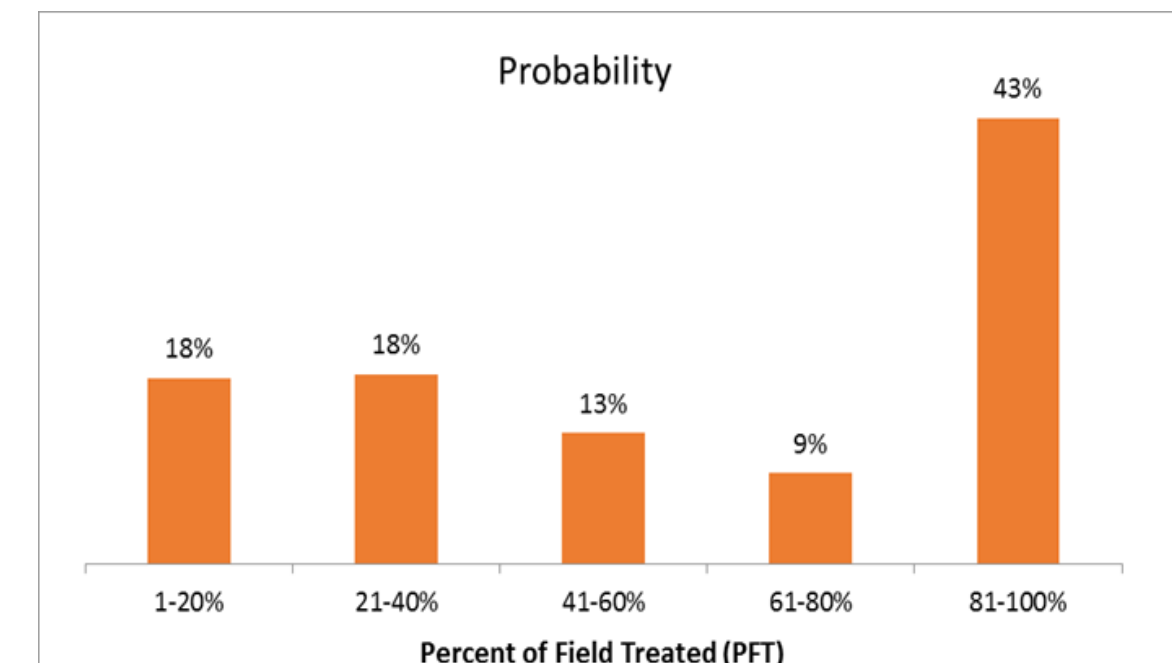


Selected percentiles of the distribution of number of applications for carbaryl applied to apples from 2007-2017 for all program states combined. The maximum number of applications listed on the label is 5.

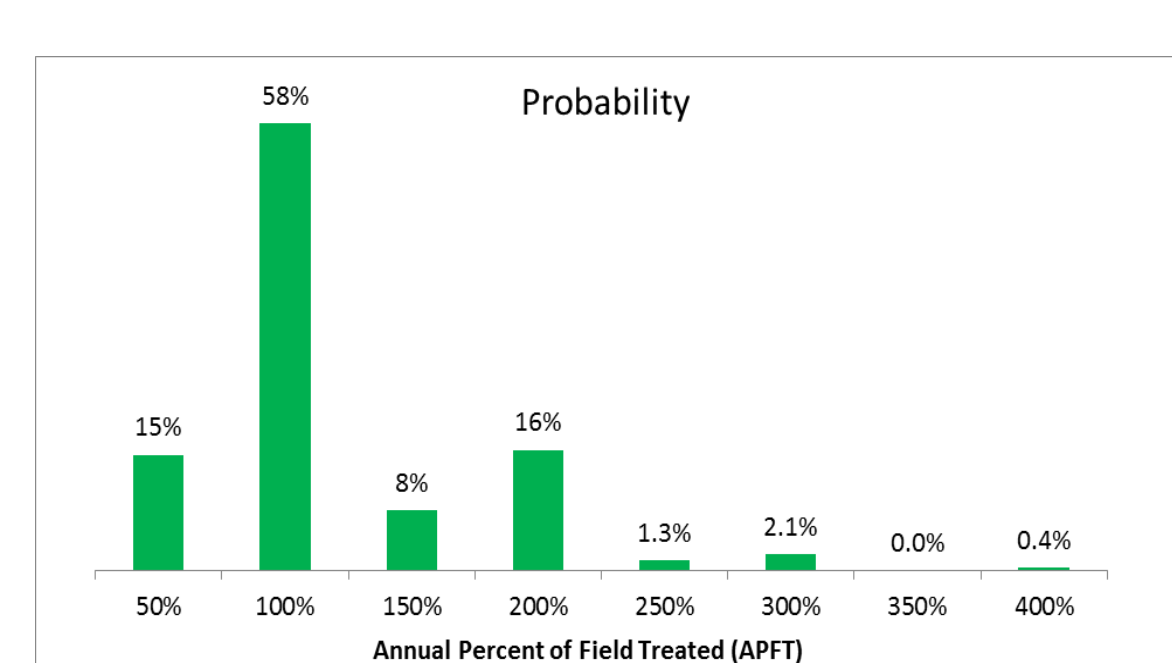
CA Dept. of Pesticide Regulation, Pesticide Use Report (PUR)



Probability distribution of application rates for carbaryl usage on apples in CA from 2010-2016.



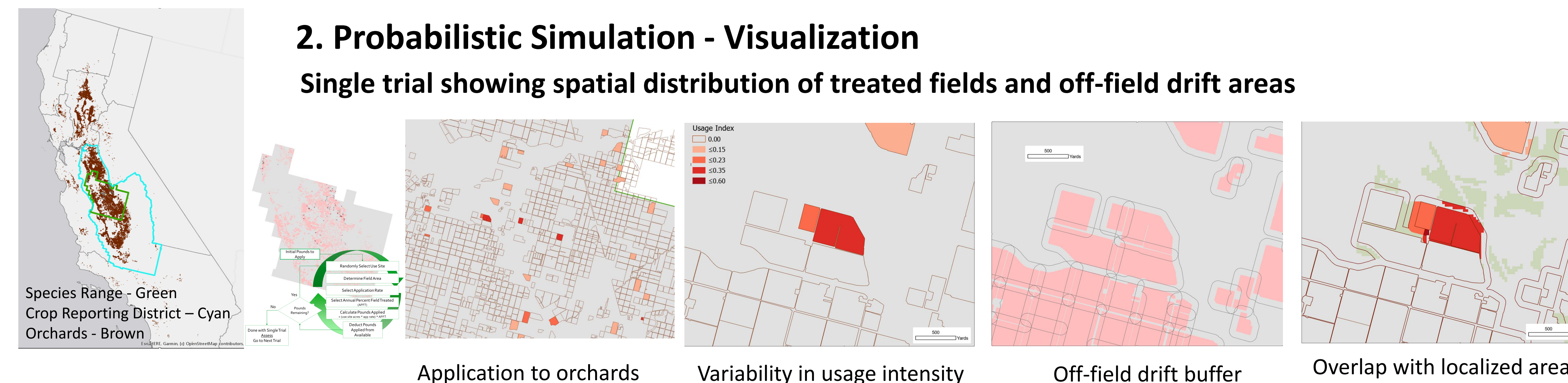
Probability distribution of percent of field treated (PFT) for carbaryl usage on apples in CA from 2010-2016



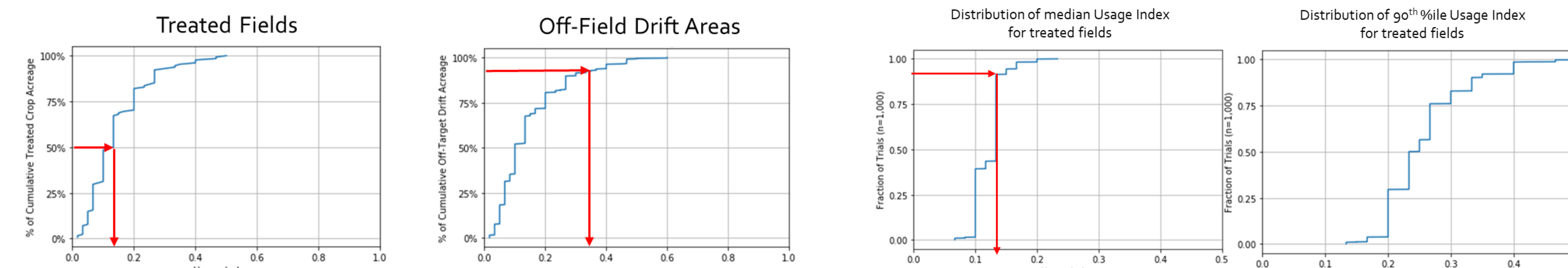
Probability distribution of annual percent of field treated (APFT) for carbaryl usage on apples in CA from 2010-2016

2. Probabilistic Simulation - Visualization

Single trial showing spatial distribution of treated fields and off-field drift areas

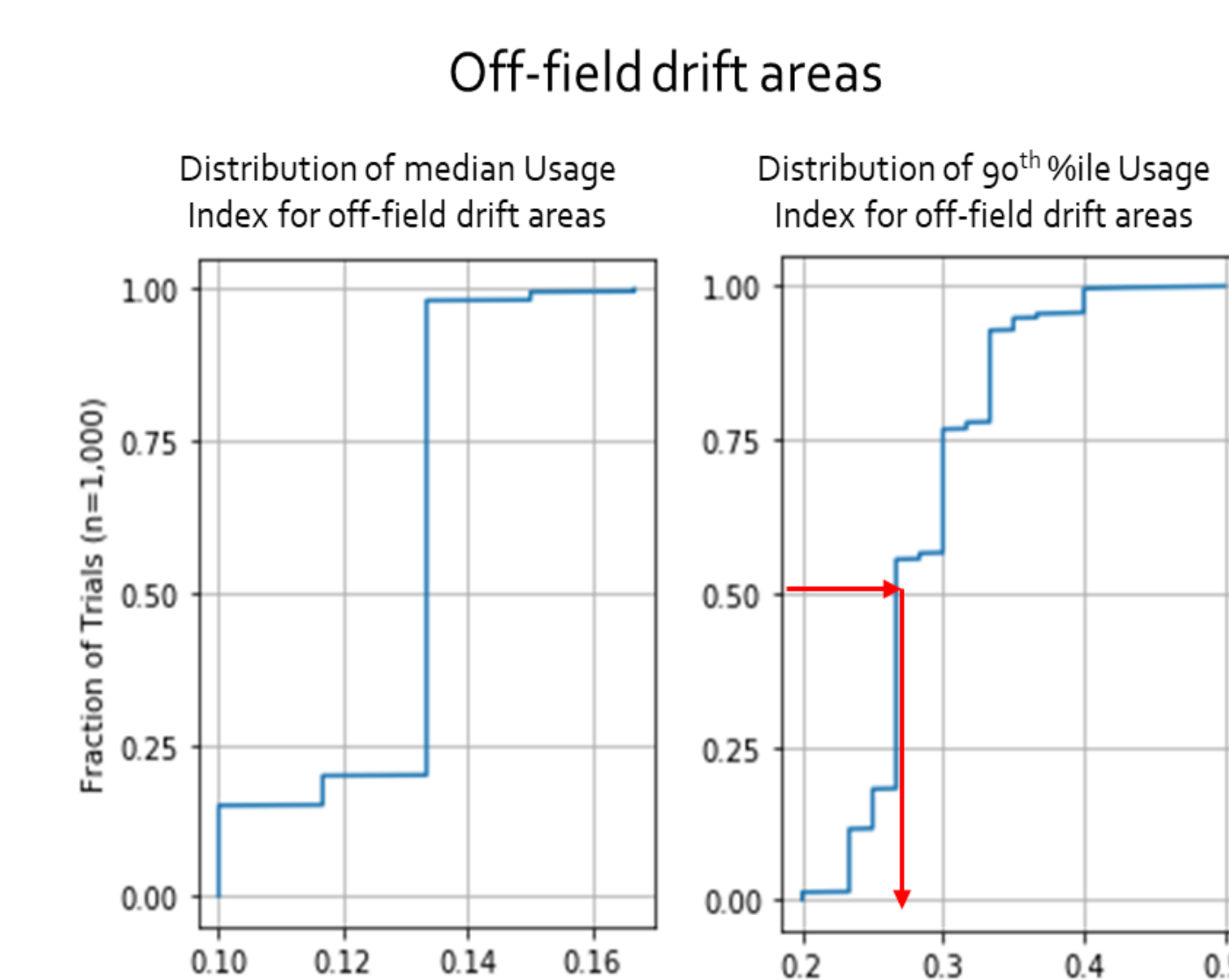


4. Summarization



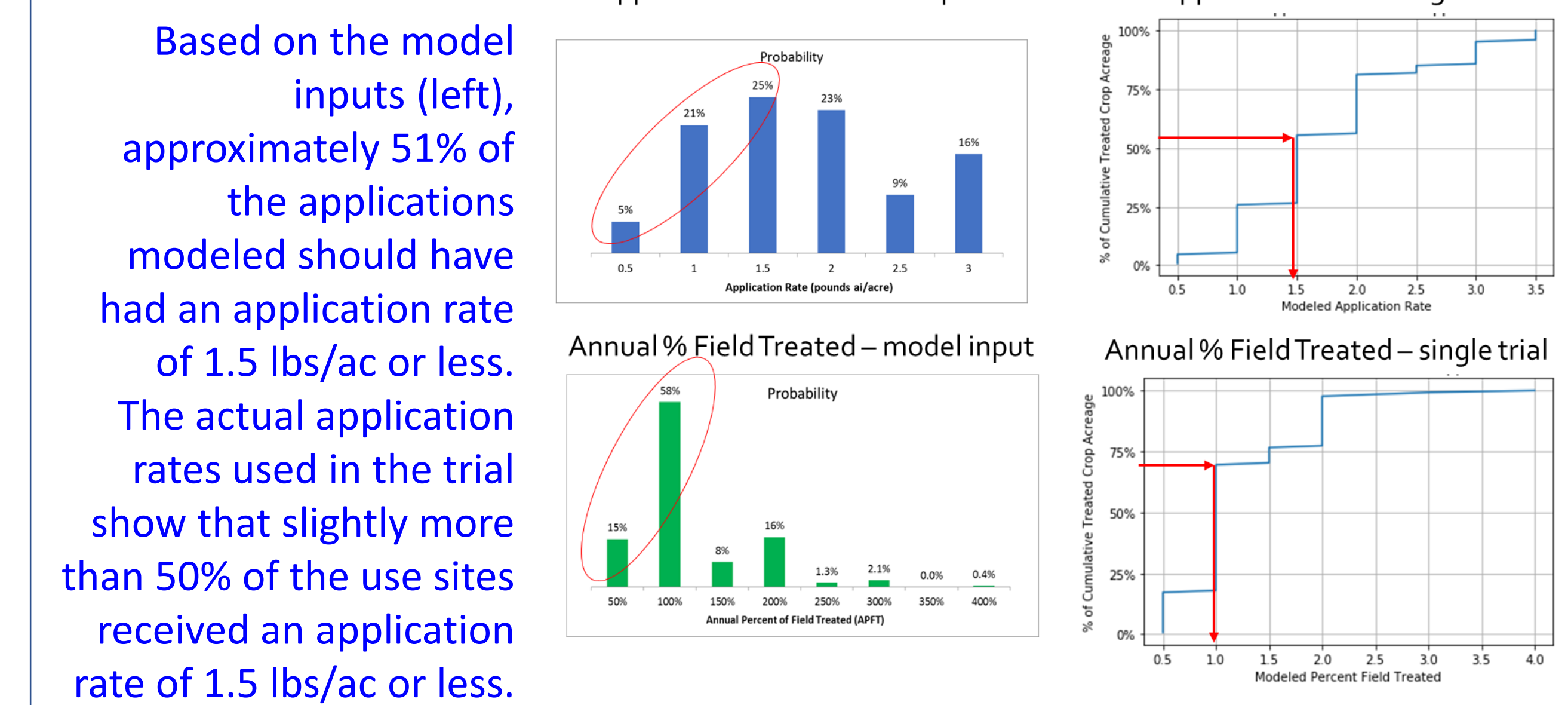
Of the area receiving applications in the species range for a single trial, 50% has less than 17% of the maximum usage from screening level exposure modeling, and 90% of the area less than 36% of max.

900 of the 1000 trials in the simulation indicated that, of the area receiving applications in the species range, 50% has 13% or less of the maximum usage from screening level exposure modeling.

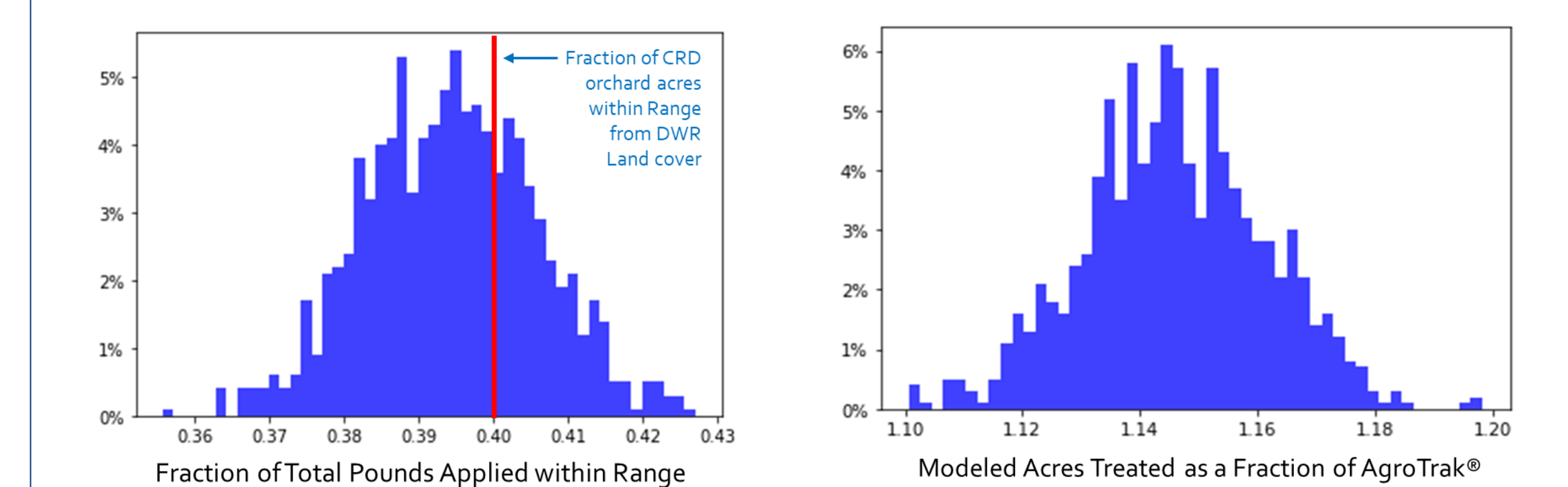


The median of 1000 trials in the simulation indicated that 90% of the off-field area receiving drift from applications in the species range received less than 28% of the maximum usage from screening level exposure modeling.

3. Verification and Validation



Based on the model inputs (left), approximately 51% of the applications modeled should have had an application rate of 1.5 lbs/ac or less. The actual application rates used in the trial show that slightly more than 50% of the use sites received an application rate of 1.5 lbs/ac or less.



Each trial in the simulation had between 35-43% of the CRD pounds applied within the species range, which contains 40% of the use site area in the CRD.

Each trial in the simulation resulted in total acres treated between 110%-120% of the acreage estimated from an independent source.

Conclusions

- Real world pesticide usage data can help inform potential exposure for listed species risk assessment
- Approach presented here is applicable with a variety of sources for pesticide use sites; national USDA Cropland Data Layer and state-level
- The Usage Index concept normalizes simulation results to a reference (e.g., screening level use)
- Approach leverages known variability in pesticide usage data and agronomic practices
- Addresses uncertainty about which fields are treated (and to what degree) related to species range location
- Provides context for exposure based on pounds applied and spatial distribution of use sites within species range

