# Mapping California rice weed species using ArcGIS maps

Taiyu Guan[1], Consuelo Baez Vega[1], Whitney Brim-DeForest[1]

*[1]University of California Cooperative Extension*

## Introduction

The last weed species survey in California rice was conducted in the 1980's, leaving a big hole in the data in terms of distribution and frequency of species across the 9 major rice-growing counties. Thus an updated weed species survey is necessary to establish a baseline of the weed species present across the California rice region.

In the fall of 2019, a comprehensive survey took place by soil sampling from fields in each major rice-growing county. Fields were randomly selected: 10 from Glenn, Butte, Sutter, and Colusa Counties, 5 from Yolo and Yuba Counties, and 2 from Sacramento and Placer Counties (Figure 1).

In order to ensure that the data is easily accessible to growers, registrants, and other industry members, weed species maps were created using ArcGIS summarizing the data at a county level and at a site level. They are hosted on a website for easy and centralized access.

## Methodology

In this research, the samples were collected after the rice harvest, from October to November in 2019. Each field was sampled four times, randomly throughout the field, approximately a gallon of soil for each sample, for a total of approximately 4 gallons of soil from the top 6 inches of soil in each field. The samples were wet-chilled in freezers (to break dormancy) until the beginning of January 2020. Samples were then placed in pots and grown out in the Department of Plant Biology greenhouses in Davis, CA for approximately 3-4 months. Each sample (four per location) were split equally into two 12-in by 12-in flats: one pot was flooded and one pot was kept at saturation (0 mPa). The total number of pots per location was 8 (4 flooded, 4 flushed). The two types of irrigation per sample were to ensure that weeds species that emerge under only one irrigation type versus the other were allowed to emerge.

Each soil sample was marked simply for the presence or absence of known weed species. Any unidentifiable or unknown species were grown to flowering and were identified by Advisor Brim-DeForest. Samples were averaged per field, and averages for all samples in each county are summarized in Table 1.

The weed species survey was completed in 2020. In order to ensure that the data is available to growers, registrants, and other industry members, it needs to be easily accessible. Preliminary maps were created using ArcGIS, which summarized the data at a county level. After feedback from the Rice Research Board, the maps was redone using individual data points for each field, and showed presence/absence data on a per-field basis.

## Results

Weeds were rated on a presence-absence basis for each sample. Redstem and smallflower umbrellasedge were the only two weed species found across all sites and counties. Ducksalad was found in all counties, as was waterhyssop, but not 100% of sites in each of those counties. Arrowhead was not found at any sites in any county, nor was junglerice. Bulrush was widespread, but was not found at 100% of sites in each county. Late watergrass, early watergrass, and barnyardgrass were found in all but three rice-growing counties. In order to ensure that the data is easily accessible to growers, registrants, and other industry members, weed species maps were created using ArcGIS summarizing the data at a county level (Figure 2) and at a site level (Figure 3). They are hosted on a website for easy and centralized access.

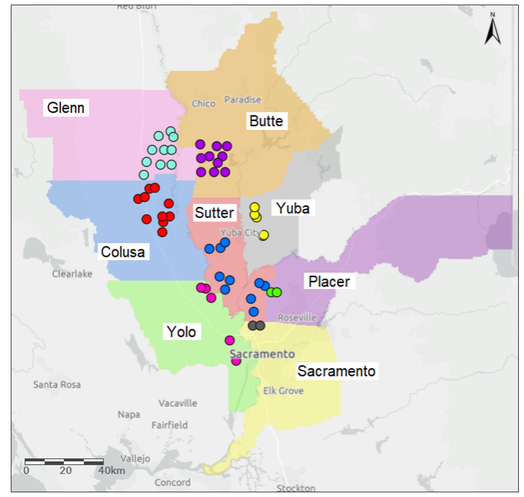


**Figure 1.** Sampling locations of the 2019 weed survey, which took place in October-November 2019. The number of sites per county was as follows: 10 in Butte, Sutter, Colusa, and Glenn counties, 5 in Yuba and Yolo counties, and 2 in Sacramento and Placer counties.

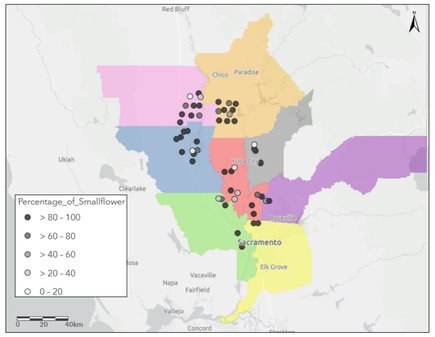


**Figure 2.** Percentage of Smallflower present, which is based on a gradient scale, according to samples obtained in 2019 at each county site.

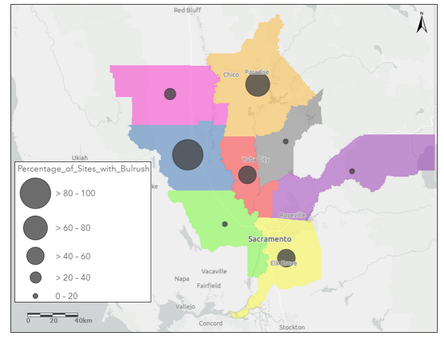


**Figure 3.** Percentages of sites with bulrush present at a per county level from the 2019.

| | Percentage of Locations (1 or more samples at site with species present) | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Arrowhead | Barnyard grass | Bulrush | Ducksalad | Early WG | Junglerice | Late WG | Monochoria | Redstem | Smallflower | Sprangletop | Waterhyssop | Cattail | Rice |
| **Glenn** | 0 | 10 | 30 | 90 | 0 | 0 | 20 | 0 | 100 | 100 | 10 | 80 | 10 | 80 |
| **Butte** | 0 | 20 | 80 | 100 | 0 | 0 | 10 | 10 | 100 | 100 | 40 | 100 | 0 | 80 |
| **Sutter** | 0 | 40 | 60 | 100 | 10 | 0 | 0 | 0 | 100 | 100 | 30 | 100 | 10 | 100 |
| **Colusa** | 0 | 40 | 90 | 100 | 10 | 0 | 10 | 0 | 100 | 100 | 10 | 100 | 30 | 100 |
| **Yolo** | 0 | 0 | 0 | 80 | 0 | 0 | 0 | 0 | 100 | 100 | 40 | 100 | 40 | 60 |
| **Yuba** | 0 | 20 | 20 | 100 | 0 | 0 | 20 | 0 | 100 | 100 | 20 | 100 | 40 | 100 |
| **Placer** | 0 | 0 | 100 | 100 | 0 | 0 | 0 | 0 | 100 | 100 | 0 | 100 | 0 | 50 |
| **Sacramento** | 0 | 0 | 50 | 100 | 0 | 0 | 0 | 0 | 100 | 100 | 50 | 100 | 0 | 0 |

**Table 1.** Presence-absence of each major weed species in rice over the major 8 rice-growing counties. For each county, the percentage of samples is the average of the samples per field, averaged over the number of sites per county.

## Future Direction

1. Due to the changing weed conditions in California rice systems, new weed species might be discovered in the future. Therefore, new weed survey will be conducted to update the rice weed species mappings in California.
2. The updated maps will be presented to growers during grower meetings or field days through presentations or handouts to help them better understand the changing weed conditions in California, including those specific to their county.
3. We will continue to develop more interactive mappings that provide better understanding to growers, such as maps that focus on one county but include more weed species details and integrated pest management information.

For more information visit our website by scanning this QR code.

**Contact Information**

Taiyu Guan: tyguan@ucdavis.edu Consuelo Baez Vega: cbbaezvega@ucanr.edu Whitney Brim-Deforest: wbrimdeforest@ucanr.edu