

2023 STATEWIDE LAND USE ACCURACY ASSESSMENT

After the final classification dataset was determined, a comprehensive accuracy assessment was completed. On average, over all crops including multi-crops, about one quarter of the independent ground truth samples were set aside for this purpose. A stratified random sampling method was used for accuracy assessment sample selection. The datasets were stratified by land cover type and hydrologic region. Prior to the accuracy assessment, the validation dataset was cleaned so that each data point corresponded to a single crop at a single point in time in a single field.

Accuracy assessment can be divided into three components:

1. Reference data sampling design – how much reference data is collected, when and where
2. Reference data response design – how reference data is collected
3. Analysis – how the reference data is used to determine accuracy and how that accuracy is expressed

In this section, Land IQ's approach to all three of these components is described, and results of the accuracy assessment are provided.

SAMPLING DESIGN

In conventional accuracy assessment theory, the minimum number of samples corresponding to a specific accuracy level is calculated. This method of minimum sample size determination is not always applicable to statistics with a spatial or temporal component. In this instance, it would require knowledge of the exact location and timing of cropping statewide in advance of the ground surveys, which is not available. Therefore, Land IQ collects reference data by region or county and then partitions it into training and reference data sets for each crop based on an approximate 75%-25% split, respectively.

There are several reasons for this approach, but the main reason is that it is far more efficient to collect both training and validation data simultaneously when the reference data is collected by ground survey, particularly in the case of time sensitive crops such as annuals that need to be sampled within a narrow window of time. This approach results in both types of data being concentrated where crops are concentrated (e.g., in counties with high acreage of agricultural crops). This approach also results in more data (for both calibration and validation) being collected for predominant, high acreage crops and less data being collected for minor, low acreage crops. While this method may result in unequal distribution of samples across classes, the distribution represents the true extent and probability of each class, ensuring that the overall accuracies are truly representative of hydrologic regions and the State as a whole. Additionally, a portion of data collection efforts is focused on crops for which data are sparser, adjusting routes each year to capture more data in areas where these less prevalent crops are produced.

RESPONSE DESIGN

Reference data can be collected by different means from different sources. Currently, Land IQ collects reference data for model training and validation from cropped areas in California by conducting on-the-ground "ground truth" survey. For the purposes here, ground truth data and reference data are synonymous.

Because the ground truth surveys are real-time (as opposed to using previously acquired data such as archival imagery) and require the presence of staff, logistical considerations must be made. First, on-the-ground reference data surveys must be conducted when the crop is growing. This requirement introduces an element of timing, which is especially important for short-season crops. Second, because the area mapped in California is so large, knowledge of where some cropped fields are, especially for minor crops, is approximate and often changes from year to year. In addition, because so many crops are mapped that vary in acreage, some crops for which there is little existing reference data are prioritized for reference point data collection.

For these reasons, Land IQ uses the basic concepts of sampling design to achieve independent and random samples in addition to considering criteria to prioritize reference point data collection:

- Confidence level – Crops with estimated lower accuracy and confidence levels from the previous year's mapping effort are prioritized for ground truth data collection.
- Peak date – Time series analysis is used to find dates of peak reflectance in fields to determine the seasonality of crops and help optimize timing of ground truth data collection around peak growing seasons.

Despite these efforts to gather representative data across cropping systems, the validation dataset may still contain a statistically small sample size for certain low prevalence crop classes. To include as much validation data as possible without skewing overall accuracies and maintaining statistical validity, a minimum sample size of 10 data points was enforced for inclusion in accuracy assessments. In the rare instance where a crop with high prevalence in a region did not have enough validation data from ground surveys, supplemental data was independently added using photo interpretation and/or prior year's ground truthing data.

ANALYSIS

Uncertainty in crop classification is related to two issues: accuracy and precision.

ACCURACY

Accuracy is a relative measure of the exactness of an estimate and accounts for systematic errors. Therefore, an accurate estimate does not systematically over- or underestimate the true value. Map accuracy can be quantified by creating an error matrix (also commonly called a confusion matrix), which compares the map classification with a reference classification.

The underlying principle of the accuracy assessment is that it compares the mapped land classification to reliable reference data, collected through sample-based approaches, as described above. The objective of a validation data set, therefore, is to provide a statistically sound estimate of the accuracy of the output map based on an independent reference information source. The accuracy of a map is assessed by measuring the degree of agreement between the output map and the validation data set. An error matrix can be generated that compares the pixels or polygons in the resulting classification map to the known reference points. From this matrix, overall accuracy and accuracy of each class can be determined.

There are three measures of accuracy that can be determined from an error matrix:

1. Overall accuracy
2. Producer's accuracy (omission error)
3. User's accuracy (commission error)

Typically, accuracy of remotely sensed maps is demonstrated using an error (or confusion) matrix (Table 7). Accuracy measures that can be derived from an error matrix are described below.

OVERALL ACCURACY

Overall accuracy is calculated as the total number of correctly classified fields divided by the total number of fields. It measures the accuracy of the whole map but does not refer to any individual classes. It is the probability that a randomly selected location on the map is correctly classified. Overall accuracy is sensitive to sample size and is thus more reliable in classes with larger samples. It is the sum of the major diagonal in an error matrix that runs from the upper left corner to the bottom right corner of the matrix.

OMISSION ERROR

Omission error refers to the number of reference samples that were incorrectly classified. It is reported on the right side of the matrix.

PRODUCER'S ACCURACY

Producer's accuracy is described by the probability that a reference point is correctly classified. It indicates how well the area represented by the map can be classified. It is also reported on the right side of the matrix and can be calculated as the inverse of the omission error.

COMMISSION ERROR

Commission error refers to the number of classified samples that were incorrectly classified. It is reported at the bottom of the matrix.

USER'S ACCURACY

User's accuracy is described as the probability that a predicted point is correctly classified. It indicated the reliability that a field classified on the map truly represents that class on the ground. It is also reported at the bottom of the matrix and can be calculated as the inverse of the commission error.

PRECISION

Precision is related to the random error, which can be quantified by a confidence interval. A confidence interval gives a range that encloses the true value of an unknown fixed quantity with a specified probability. A precise estimate would thus have a small confidence interval.

RESULTS

In the WY 2023 analysis, 15,636 samples were used for accuracy assessment. These sites were not used to train the classification process and therefore represent unbiased reference information. Accuracy was assessed based on both the DWR Crop Class legend level and the more refined subclass legend level and results are generated geographically for statewide mapping, as well as hydrologic regions.

The hydrologic regions used for the accuracy assessment are displayed in Figure 1. In 2023, an accuracy assessment was performed for all hydrologic regions after identifying a need for the data in the year prior.

In the statewide and regional accuracy assessment, crops with less than 10 data points in the validation dataset were excluded. All excluded crops represent < 2% of the total cropped area in their respective regions. This indicates minimal impact of crop exclusion on the overall accuracy of the region.

In some cases, crop classes are closely related, making accuracy assessment more difficult. This primarily occurs in forage crop classes where the class designation depends on the way the crop is managed and/or harvested (e.g., miscellaneous grasses and mixed pasture). In these cases, a field may alternate between these in any given season. In 2023, DWR guidance was to classify these forage crop systems as Mixed Pasture, unless exclusively harvested for hay. Due to this shift in nomenclature, some ground truth data classifications were updated from Miscellaneous Grasses to Mixed Pasture. Additionally, non-irrigated Mixed Pasture confusion with Unclassified Fallow was removed from the accuracy assessment as this results from nomenclature differences in classifications with identical water use.

Validation data was further cleaned and pre-processed using the following methods:

1. Data points that were not representative of the entire field were excluded from the analysis. This was evaluated by comparing against high to medium resolution imagery.
2. In the case of perennial fields, multiple ground survey points could have been recorded for the same field and the same class during consecutive survey events. This would result in an over-representation of the field in the validation dataset. Such points were cleaned such that a single field contained only a single reference point.
3. In the case of annual fields, as these are grown over shorter periods, a crop may or may not have been observed during the ground survey depending on the timing or may have been observed multiple times in areas that are surveyed multiple times per year. In such cases, the reference

points were linked to the corresponding cropping segment to correctly assess accuracy. In this way, multi-cropping instances were included in the accuracy assessment.



Figure 1. Hydrologic Regions Used for WY 2023 Regional Accuracy Assessment

OVERALL ACCURACY

Accuracy statistics were calculated independently for each region (statewide and hydrologic) as well as each level of legend (DWR Class and Subclass). The overall accuracy for WY 2023 crop mapping statewide was 98% at the DWR Crop Class legend level and 97% at the Subclass legend level (Table 1). Overall accuracy by hydrologic region is displayed in Table 7. Only crop classes represented by at least 10 fields in the validation data for a hydrologic region were included in the assessment.

Table 1. WY 2023 Overall Statewide Land Use Mapping Weighted Accuracy

Crop Legend	Overall Accuracy (%)
DWR Class	98%
Subclass (Land IQ)	97%

WY 2023 Overall Land Use Mapping Weighted Accuracy by Hydrologic Region

Crop Legend	Central Coast	Colorado River	North Coast	North Lahontan	Sacramento River
DWR Class	98%	98%	97%	98%	99%
Subclass (Land IQ)	94%	96%	95%	94%	98%
	San Francisco Bay	San Joaquin River	South Coast	South Lahontan	Tulare Lake
DWR Class	97%	99%	97%	99%	99%
Subclass (Land IQ)	97%	98%	95%	98%	99%

The error matrices for crops at the DWR Crop Class legend level and the Subclass legend level for statewide and hydrologic regions (Tables 27 – 50 at the end of this report) show overall accuracy, omission and commission error, and kappa statistics by crop class (in acres).

ACCURACY BY CROP CLASS

Accuracy was calculated for each crop (percentage of reference fields correctly classified in each crop category) for both DWR Class and Subclass legends statewide (Tables 2 and 3). In addition to the statewide assessment, accuracy was also determined at the hydrologic region level (Tables 15-26). Some land cover types (e.g., miscellaneous field crops, eucalyptus, etc.) and hydrologic regions are not included in the accuracy assessment due to insufficient data. In these cases, there were either no or less than ten samples available for accuracy assessment. A weighted accuracy assessment was conducted for each crop class by hydrologic region. Count based accuracies were first calculated for each crop class as the percent of reference fields correctly classified. Weights for each crop were independently calculated as the percent of total cropped area represented by the respective crop. The count-based accuracies were then multiplied by their respective weight by crop category and region. These weighted accuracies were then summed across all crops in the region to yield the overall weighted accuracy for the respective region. Crop weights and accuracies by region are included in Tables 4-13. Results for the same calculations applied to area-based accuracies are included in Appendix A.

In total, the multi-crop resolution of mapping data in WY 2023 captures the vast majority of the cropping year-round in the state, allowing data users to characterize crop production and water use more accurately. Some crop rotations may occasionally be missed; this is because satellite data are intermittent and cropping is rotational and, in some cases, very short term. For this reason, available data will occasionally miss a rotational crop timing. However, any missed crops are short season in nature and therefore have a smaller impact on total water use analysis. It should also be noted that young perennials, while a smaller class, are challenging to detect with remote sensing approaches and can be confused with fallow until features are detectable. This is particularly true in years when higher resolution (e.g., NAIP) image resources are not available.

Table 2. WY 2023 Statewide Land Use Mapping Weighted Accuracy by DWR Crop Class Legend Level

DWR Crop Class	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Citrus and Subtropical	1,446	1,429	4.3%	98.8%	4.2%
Deciduous Fruits and Nuts	3,883	3,880	26.4%	99.9%	26.4%
Field Crops	1,219	1,190	11.0%	97.6%	10.7%
Grain and Hay	2,360	2,304	14.3%	97.6%	13.9%
Pasture	418	418	4.9%	100.0%	4.9%
Rice	2,723	2,696	10.9%	99.0%	10.8%
Truck, Nursery and Berry Crops	1,197	1,172	12.7%	97.9%	12.4%
Unclassified	1,184	1,181	7.0%	99.7%	6.9%
Vineyard	1,446	1,429	4.3%	98.8%	4.2%
Young Perennial	75	37	0.6%	49.3%	0.3%
Total Weighted Accuracy Statewide				98.6%	98.5%

Table 3. WY 2023 Statewide Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	1,336	1,304	5.8%	97.6%	5.6%
Almonds	2,136	2,131	14.6%	99.8%	14.6%
Apples	37	37	0.1%	100.0%	0.1%
Apricots	47	46	0.0%	97.9%	0.0%
Avocados	564	554	0.5%	98.2%	0.5%
Beans (Dry)	34	24	0.2%	70.6%	0.1%
Bush Berries	90	86	0.2%	95.6%	0.2%
Carrots	48	48	0.5%	100.0%	0.5%
Cherries	143	139	0.4%	97.2%	0.4%
Citrus	646	635	2.9%	98.3%	2.9%
Cole Crops	560	511	1.4%	91.3%	1.3%
Corn, Sorghum, and Sudan	847	836	6.2%	98.7%	6.2%
Cotton	108	106	1.0%	98.1%	0.9%
Dates	111	111	0.1%	100.0%	0.1%
Flowers, Nursery, and Christmas Tree Farms	191	185	0.4%	96.9%	0.3%
Grapes	1,184	1,181	7.0%	99.7%	7.0%
Kiwis	50	49	0.0%	98.0%	0.0%

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Lettuce or Leafy Greens	672	631	2.4%	93.9%	2.3%
Melons, Squash and Cucumbers	48	48	0.6%	100.0%	0.6%
Miscellaneous Deciduous	53	51	0.2%	96.2%	0.2%
Miscellaneous Grain and Hay	1,219	1,190	11.0%	97.6%	10.7%
Miscellaneous Grasses	341	274	1.7%	80.4%	1.4%
Miscellaneous Subtropical Fruits	25	22	0.0%	88.0%	0.0%
Miscellaneous Truck Crops	248	208	1.2%	83.9%	1.0%
Mixed Pasture	634	602	6.7%	95.0%	6.4%
Olives	50	48	0.5%	96.0%	0.5%
Onions and Garlic	86	86	0.6%	100.0%	0.6%
Peaches and Nectarines	104	100	0.6%	96.2%	0.6%
Pears	50	50	0.1%	100.0%	0.1%
Pecans	48	47	0.1%	97.9%	0.1%
Peppers	28	26	0.1%	92.9%	0.1%
Pistachios	511	510	5.6%	99.8%	5.6%
Plums	50	47	0.2%	94.0%	0.1%
Pomegranates	47	46	0.2%	97.9%	0.2%
Potatoes	47	46	0.3%	97.9%	0.3%
Prunes	54	54	0.4%	100.0%	0.4%
Rice	418	418	4.9%	100.0%	4.9%
Safflower	43	41	0.2%	95.3%	0.2%
Strawberries	375	369	0.6%	98.4%	0.6%
Sugar Beets	49	49	0.2%	100.0%	0.2%
Sunflowers	49	48	0.3%	98.0%	0.3%
Sweet Potatoes	55	55	0.2%	100.0%	0.2%
Tomatoes	274	268	2.5%	97.8%	2.4%
Turf	49	49	0.1%	100.0%	0.1%
Unclassified Fallow	1,197	1,172	12.7%	97.9%	12.4%
Walnuts	603	601	4.1%	99.7%	4.1%
Young Perennials	75	37	0.6%	49.3%	0.3%
Total Weighted Accuracy Statewide				97.1%	97.4%

Table 4. WY 2023 Central Coast Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Apples	18	18	0.4%	100.0%	0.4%
Avocados	57	56	1.7%	98.2%	1.6%
Bush Berries	36	33	0.9%	91.7%	0.8%
Cherries	35	35	0.2%	100.0%	0.2%
Cole Crops	488	444	16.3%	91.0%	14.9%
Flowers, Nursery, and Christmas Tree Farms	87	85	0.9%	97.7%	0.9%
Grapes	288	287	16.4%	99.7%	16.3%
Lettuce or Leafy Greens	581	544	25.8%	93.6%	24.1%
Miscellaneous Grain and Hay	89	75	7.8%	84.3%	6.6%
Miscellaneous Truck Crops	126	97	6.9%	77.0%	5.3%
Peppers	27	25	0.4%	92.6%	0.4%
Strawberries	304	299	5.9%	98.4%	5.8%
Unclassified Fallow	129	128	16.0%	99.2%	15.9%
Walnuts	38	38	0.5%	100.0%	0.5%
Total Weighted Accuracy by Region					93.6%

Table 5. WY 2023 Colorado River Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	746	733	29.4%	98.3%	28.9%
Carrots	48	48	2.4%	100.0%	2.4%
Citrus	49	49	2.6%	100.0%	2.6%
Cole Crops	47	44	3.1%	93.6%	2.9%
Corn, Sorghum, and Sudan	53	49	6.6%	92.5%	6.1%
Cotton	12	11	0.7%	91.7%	0.7%
Dates	111	111	2.0%	100.0%	2.0%
Grapes	48	48	0.6%	100.0%	0.6%
Lettuce or Leafy Greens	91	87	7.4%	95.6%	7.1%

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Melons, Squash, and Cucumbers	231	200	14.9%	86.6%	12.9%
Miscellaneous Grain and Hay	80	79	3.8%	98.8%	3.8%
Miscellaneous Grasses	38	38	3.0%	100.0%	3.0%
Onions and Garlic	49	49	2.7%	100.0%	2.7%
Peppers	228	226	20.7%	99.1%	20.5%
Sugar Beets	746	733	29.4%	98.3%	28.9%
Unclassified Fallow	48	48	2.4%	100.0%	2.4%
Total Weighted Accuracy by Region					96.2%

Table 6. WY 2023 North Coast Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass ¹	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	95	91	15.1%	95.8%	14.5%
Grapes	133	133	15.0%	100.0%	15.0%
Miscellaneous Grain and Hay	58	58	15.6%	100.0%	15.6%
Miscellaneous Grasses	12	6	2.6%	50.0%	1.3%
Mixed Pasture	192	182	40.0%	94.8%	37.9%
Potatoes	12	12	1.6%	100.0%	1.6%
Unclassified Fallow	25	23	10.1%	92.0%	9.3%
Total Weighted Accuracy by Region					95.2%

¹ A high proportion of mixed forage crops exist in this region that commonly can be confused and impact accuracy.

Table 7. WY 2023 North Lahontan Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass ¹	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	48	42	16.3%	87.5%	14.3%
Miscellaneous Grain and Hay	37	35	9.1%	94.6%	8.6%
Miscellaneous Grasses	29	22	7.7%	75.9%	5.8%
Mixed Pasture	69	67	57.7%	97.1%	56.1%
Unclassified Fallow	24	24	9.1%	100.0%	9.1%

Total Weighted Accuracy by Region**93.9%**

¹ A high proportion of mixed forage crops exist in this region that commonly can be confused and impact accuracy.

Table 8. WY 2023 Sacramento River Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	101	99	3.8%	98.0%	3.8%
Almonds	423	422	13.2%	99.8%	13.1%
Beans (Dry)	12	12	0.3%	100.0%	0.3%
Corn, Sorghum, and Sudan	51	48	2.2%	94.1%	2.1%
Grapes	100	100	2.5%	100.0%	2.5%
Miscellaneous Deciduous	20	18	0.1%	90.0%	0.1%
Miscellaneous Grain and Hay	190	189	8.5%	99.5%	8.5%
Miscellaneous Grasses	38	30	1.5%	78.9%	1.2%
Mixed Pasture	147	141	13.6%	95.9%	13.0%
Olives	50	48	1.3%	96.0%	1.3%
Peaches and Nectarines	45	41	0.4%	91.1%	0.4%
Pears	50	50	0.3%	100.0%	0.3%
Pecans	24	23	0.1%	95.8%	0.1%
Pistachios	49	48	1.0%	98.0%	1.0%
Prunes	54	54	1.7%	100.0%	1.7%
Rice	418	418	22.9%	100.0%	22.9%
Safflower	33	33	0.5%	100.0%	0.5%
Sunflowers	49	48	1.4%	98.0%	1.3%
Tomatoes	107	107	4.0%	100.0%	4.0%
Unclassified Fallow	170	164	8.9%	96.5%	8.6%
Walnuts	352	350	11.2%	99.4%	11.1%
Young Perennial	21	14	0.7%	66.7%	0.5%
Total Weighted Accuracy by Region					98.1%

Table 9. WY 2023 San Francisco Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Grapes	131	130	51.1%	99.2%	50.7%
Miscellaneous Grain and Hay	38	38	22.9%	100.0%	22.9%
Mixed Pasture	13	10	8.2%	76.9%	6.3%
Unclassified Fallow	24	23	17.7%	95.8%	17.0%
Total Weighted Accuracy by Region					97.0%

Table 10. WY 2023 San Joaquin River Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	201	195	5.1%	97.0%	4.9%
Almonds	1,036	1,036	30.0%	100.0%	30.0%
Apples	10	10	0.1%	100.0%	0.1%
Apricots	35	34	0.1%	97.1%	0.1%
Cherries	59	57	1.1%	96.6%	1.1%
Corn, Sorghum, and Sudan	395	391	11.6%	99.0%	11.5%
Cotton	48	48	1.5%	100.0%	1.5%
Grapes	145	145	8.3%	100.0%	8.3%
Melons, Squash, and Cucumbers	48	48	0.9%	100.0%	0.9%
Miscellaneous Grain and Hay	404	402	14.5%	99.5%	14.4%
Miscellaneous Grasses	31	16	0.5%	51.6%	0.3%
Mixed Pasture	109	101	3.8%	92.7%	3.5%
Pistachios	90	90	4.9%	100.0%	4.9%
Sweet Potatoes	55	55	0.7%	100.0%	0.7%
Tomatoes	102	97	3.6%	95.1%	3.4%
Unclassified Fallow	105	104	6.9%	99.0%	6.9%
Walnuts	141	141	5.3%	100.0%	5.3%
Young Perennial	24	11	0.9%	45.8%	0.4%
Total Weighted Accuracy by Region					98.3%

Table 11. WY 2023 South Coast Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Avocados	507	498	19.3%	98.2%	18.9%
Bush Berries	54	53	2.3%	98.1%	2.2%
Citrus	305	295	18.0%	96.7%	17.4%
Cole Crops	25	23	2.5%	92.0%	2.3%
Flowers, Nursery, and Christmas Tree Farms	104	100	6.5%	96.2%	6.2%
Miscellaneous Grain and Hay	43	38	11.6%	88.4%	10.2%
Miscellaneous Subtropical Fruits	16	13	0.7%	81.3%	0.6%
Miscellaneous Truck Crops	117	106	12.8%	90.6%	11.6%
Strawberries	71	70	5.4%	98.6%	5.3%
Turf	18	18	1.2%	100.0%	1.2%
Unclassified Fallow	122	117	19.7%	95.9%	18.9%
Total Weighted Accuracy by Region					95.0%

Table 12. WY 2023 South Lahontan Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass ¹	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	27	26	25.1%	96.3%	24.1%
Mixed Pasture	51	51	37.6%	100.0%	37.6%
Unclassified Fallow	35	34	37.3%	97.1%	36.3%
Total Weighted Accuracy by Region					98.0%

¹ A high proportion of mixed forage crops exist in this region that commonly can be confused and impact accuracy.

Table 13. WY 2023 Tulare Lake Hydrologic Region Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	118	118	3.1%	100.0%	3.1%
Almonds	677	673	17.6%	99.4%	17.4%
Cherries	49	47	0.3%	95.9%	0.3%

Crop Subclass	Ground Truth Count	Classified Count	Weight	Unweighted Accuracy	Weighted Accuracy
Citrus	290	289	7.2%	99.7%	7.2%
Corn, Sorghum, and Sudan	344	344	9.0%	100.0%	9.0%
Cotton	48	47	1.8%	97.9%	1.8%
Grapes	339	338	7.2%	99.7%	7.2%
Kiwis	41	41	0.1%	100.0%	0.1%
Miscellaneous Deciduous	23	23	0.1%	100.0%	0.1%
Miscellaneous Grain and Hay	280	276	12.8%	98.6%	12.6%
Mixed Pasture	52	49	0.5%	94.2%	0.5%
Onions and Garlic	48	48	0.8%	100.0%	0.8%
Peaches and Nectarines	59	59	1.3%	100.0%	1.3%
Pecans	19	19	0.1%	100.0%	0.1%
Pistachios	372	372	13.6%	100.0%	13.6%
Plums	50	47	0.5%	94.0%	0.4%
Pomegranates	47	46	0.6%	97.9%	0.6%
Potatoes	21	21	0.5%	100.0%	0.5%
Tomatoes	65	64	2.7%	98.5%	2.7%
Unclassified Fallow	335	329	17.7%	98.2%	17.4%
Walnuts	72	72	1.9%	100.0%	1.9%
Young Perennial	18	7	0.6%	38.9%	0.2%
Total Weighted Accuracy by Region					98.8%

PRECISION BY CROP

Two-tailed confidence intervals (95%) were calculated using the method in Olofsson et al. (2014) for the commission error of each crop class and are shown in Table 20. As noted above, precision is related to the random error, which can be quantified by a confidence interval. A confidence interval gives a range that encompasses the true value of an unknown fixed quantity with a specified probability. A precise estimate would thus have a small confidence interval. For example, citrus were mapped at 99% accuracy with a confidence interval of plus or minus 2%. This means that 99% of the time, we are confident that the citrus classification was between 97 and 99% correct.

As Table 14 shows, 14 crops were mapped with 100% accuracy and 0% confidence interval (100% confidence or precision). Table 20 also shows that the number of ground truth points directly influences the level of precision. As the number of ground truth points increases, precision (confidence) generally also increases, and the confidence interval becomes smaller. Some crops are mapped with high accuracy

with few ground truth points because they are very distinct and relatively easy to distinguish from other crops. Other crops have a lower accuracy but relatively high precision (miscellaneous grasses) because the number of ground truth points was relatively high. Some crops were mapped with high accuracy but lower precision because of very few ground truth points.

Table 14.WY 2023 Statewide Land Use Mapping Accuracy and Precision by Crop

Crop Class	User's Accuracy (area correctly classified/total area classified)	Total validation area (counts)	95% Two-tailed Confidence Interval
Alfalfa and Alfalfa Mixtures	97%	1,336	1%
Almonds	100%	2,136	0%
Apples	100%	37	0%
Apricots	98%	47	4%
Avocados	98%	564	1%
Beans (Dry)	96%	34	8%
Bush Berries	98%	90	3%
Carrots	94%	48	7%
Cherries	99%	143	2%
Citrus	100%	646	0%
Cole Crops	96%	560	2%
Corn, Sorghum, and Sudan	96%	847	1%
Cotton	97%	108	3%
Dates	99%	111	2%
Flowers, Nursery, and Christmas Tree Farms	100%	53	0%
Grapes	97%	191	2%
Kiwis	100%	1,184	0%
Lettuce or Leafy Greens	100%	50	0%
Melons, Squash and Cucumbers	88%	672	2%
Miscellaneous Deciduous	89%	48	8%
Miscellaneous Grain and Hay	96%	1,219	1%
Miscellaneous Grasses	88%	341	4%
Miscellaneous Subtropical Fruits	100%	25	0%
Miscellaneous Truck Crops	83%	248	5%
Mixed Pasture	97%	634	1%
Olives	100%	50	0%
Onions and Garlic	99%	86	2%
Peaches and Nectarines	93%	104	5%

Crop Class	User's Accuracy (area correctly classified/total area classified)	Total validation area (counts)	95% Two-tailed Confidence Interval
Pears	98%	50	4%
Pecans	98%	48	4%
Peppers	93%	28	10%
Pistachios	100%	511	1%
Plums	98%	50	4%
Pomegranates	100%	47	0%
Potatoes	100%	47	0%
Prunes	96%	54	5%
Rice	100%	418	0%
Safflower	98%	43	5%
Strawberries	99%	375	1%
Sugar Beets	100%	49	0%
Sunflowers	100%	49	0%
Sweet Potatoes	98%	55	4%
Tomatoes	99%	274	1%
Turf	100%	49	0%
Unclassified Fallow	95%	1,197	1%
Walnuts	99%	603	1%
Young Perennials	97%	75	5%

Table 15. Statewide Land Use Mapping Validation Data Error Matrix by DWR Class Legend Level (count)

Reference	Predicted											Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
		Citrus and Subtropical	Deciduous Fruits and Nuts	Field Crops	Grain and Hay crops	Pasture	Rice	Truck, Nursery, and Berry Crops	Unclassified	Vineyard	Young Perennial				
	Citrus and Subtropical	1,429	4	0	0	0	0	1	12	0	0	1,446	1%	99%	
	Deciduous Fruits and Nuts	0	3,880	0	0	1	0	0	1	1	0	3,883	0%	100%	
	Field Crops	0	0	1,109	3	4	0	15	0	0	0	1,131	2%	98%	
	Grain and Hay crops	0	0	0	1,190	6	0	21	2	0	0	1,219	2%	98%	
	Pasture	0	0	28	18	2,304	0	4	6	0	0	2,360	2%	98%	
	Rice	0	0	0	0	0	418	0	0	0	0	418	0%	100%	
	Truck, Nursery, and Berry Crops	0	0	5	17	0	0	2,696	5	0	0	2,723	1%	99%	
	Unclassified	5	2	0	4	9	0	2	1,172	2	1	1,197	2%	98%	
	Vineyard	0	0	0	0	0	0	0	3	1,181	0	1,184	0%	100%	
	Young Perennial	0	0	0	2	0	0	1	35	0	37	75	51%	49%	
	Predicted Total	1,434	3,886	1,142	1,234	2,324	418	2,740	1,236	1,184	38	15,636			
	Commission Error	0%	0%	3%	4%	1%	0%	2%	5%	0%	3%				
	Users Accuracy	100%	100%	97%	96%	99%	100%	98%	95%	100%	97%				
	Kappa Coefficient											0.98			

Table 17. Central Coast Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted															Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Apples	Avocados	Bushberries	Cherries	Cole Crops	Flowers, Nursery, and Christmas Tree Farms	Grapes	Lettuce or Leafy Greens	Miscellaneous Grain and Hay	Miscellaneous Truck Crops	Peppers	Strawberries	Unclassified Fallow	Walnuts					
	Apples	18	0	0	0	0	0	0	0	0	0	0	0	0	0				
	Avocados	0	56	0	0	0	0	0	0	0	0	0	0	0	0				
	Bushberries	0	0	33	0	0	0	0	0	0	0	3	0	0	0				
	Cherries	0	0	0	35	0	0	0	0	0	0	0	0	0	0				
	Cole Crops	0	0	0	0	444	0	0	37	6	0	0	0	0	0				
	Flowers, Nursery, and Christmas Tree Farms	0	0	0	0	0	85	0	0	0	0	0	2	0	0				
	Grapes	0	0	0	0	0	0	287	0	0	0	0	0	1	0				
	Lettuce or Leafy Greens	0	0	0	0	10	0	0	544	3	24	0	0	0	0				
	Miscellaneous Grain and Hay	0	0	0	0	7	0	0	2	75	4	0	0	1	0				
	Miscellaneous Truck Crops	0	0	0	0	0	0	0	24	4	97	0	0	0	0				
	Peppers	0	0	0	0	1	1	0	0	0	0	25	0	0	0				
	Strawberries	0	0	2	0	0	1	0	0	1	0	1	299	0	0				
	Unclassified Fallow	0	0	0	0	0	0	0	1	0	0	0	0	128	0				
	Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	38				
Predicted Total	18	56	35	35	462	87	287	608	89	125	26	302	132	38					
Commission Error	0%	0%	6%	0%	4%	2%	0%	11%	16%	22%	4%	1%	3%	0%					
Users Accuracy	100%	100%	94%	100%	96%	98%	100%	89%	84%	78%	96%	99%	97%	100%					
Kappa Coefficient	0.93																		

Table 18. Colorado River Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted																		
	Alfalfa and Alfalfa Mixtures	Carrots	Citrus	Cole Crops	Corn, Sorghum, and Sudan	Cotton	Dates	Grapes	Lettuce or Leafy Greens	Miscellaneous Grain and Hay	Miscellaneous Grasses	Onions and Garlic	Sugar Beets	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient	
	Alfalfa and Alfalfa Mixtures	733	0	0	0	3	0	0	0	2	0	7	0	0	1	746	2%	98%	
	Carrots	0	48	0	0	0	0	0	0	0	0	0	0	0	0	48	0%	100%	
	Citrus	0	0	49	0	0	0	0	0	0	0	0	0	0	0	49	0%	100%	
	Cole Crops	0	0	0	44	0	0	0	0	1	2	0	0	0	0	47	6%	94%	
	Corn, Sorghum, and Sudan	0	0	0	0	49	0	0	0	0	1	3	0	0	0	53	8%	92%	
	Cotton	0	0	0	0	0	11	0	0	1	0	0	0	0	0	12	8%	92%	
	Dates	0	0	0	0	0	0	111	0	0	0	0	0	0	0	111	0%	100%	
	Grapes	0	0	0	0	0	0	0	48	0	0	0	0	0	0	48	0%	100%	
	Lettuce or Leafy Greens	0	0	0	2	0	0	0	0	87	0	0	0	0	0	89	2%	98%	
	Miscellaneous Grain and Hay	0	0	0	0	0	0	0	0	0	79	1	0	0	0	80	1%	99%	
	Miscellaneous Grasses	14	0	0	0	15	0	0	0	0	0	200	0	0	0	229	13%	87%	
	Onions and Garlic	0	0	0	0	0	0	0	0	0	0	0	38	0	0	38	0%	100%	
	Sugar Beets	0	0	0	0	0	0	0	0	0	0	0	0	49	0	49	0%	100%	
	Unclassified Fallow	0	0	0	0	0	0	1	1	0	0	0	0	0	226	228	1%	99%	
	Predicted Total	747	48	49	46	67	11	112	49	91	82	211	38	49	227	1,827			
	Commission Error	2%	0%	0%	4%	27%	0%	1%	2%	4%	4%	5%	0%	0%	0%				
	Users Accuracy	98%	100%	100%	96%	73%	100%	99%	98%	96%	96%	95%	100%	100%	100%				
	Kappa Coefficient																0.96		

Table 19. North Coast Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference												
		Alfalfa and Alfalfa Mixtures	Grapes	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Potatoes	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	91	0	2	1	1	0	0	95	4%	96%	
	Grapes	0	133	0	0	0	0	0	133	0%	100%	
	Miscellaneous Grain and Hay	0	0	58	0	0	0	0	58	0%	100%	
	Miscellaneous Grasses	3	0	2	6	0	0	0	11	45%	55%	
	Mixed Pasture	1	0	1	5	182	0	3	192	5%	95%	
	Potatoes	0	0	0	0	0	12	0	12	0%	100%	
	Unclassified Fallow	0	0	0	0	2	0	23	25	8%	92%	
	Predicted Total	95	133	63	12	185	12	26	526			0.95
Comission Error	4%	0%	8%	50%	2%	0%	12%					
Users Accuracy	96%	100%	92%	50%	98%	100%	88%					
Kappa Coefficient												

Table 20. North Lahontan Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted								
		Alfalfa and Alfalfa Mixtures	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy
	Alfalfa and Alfalfa Mixtures	42	2	2	2	0	48	13%	88%
	Miscellaneous Grain and Hay	1	35	0	0	0	36	3%	97%
	Miscellaneous Grasses	7	0	22	0	0	29	24%	76%
	Mixed Pasture	0	0	2	67	0	69	3%	97%
	Unclassified Fallow	0	0	0	0	24	24	0%	100%
	Predicted Total	50	37	26	69	24	206		
	Commission Error	16%	5%	15%	3%	0%			
	Users Accuracy	84%	95%	85%	97%	100%			
Kappa Coefficient									0.90

Table 21. Sacramento River Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

		Predicted																							Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
		Alfalfa and Alfalfa Mixtures	Almonds	Beans (Dry)	Corn, Sorghum, and Sudan	Grapes	Miscellaneous Deciduous	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Olives	Peaches and Nectarines	Pears	Pecans	Pistachios	Prunes	Rice	Safflower	Sunflowers	Tomatoes	Unclassified Fallow	Walnuts	Young Perennials					
Reference	Alfalfa and Alfalfa Mixtures	99	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101	2%	98%	0.98	
	Almonds	0	422	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	423	0%	100%		
	Beans (Dry)	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	0%	100%		
	Corn, Sorghum, and Sudan	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	49	2%	98%		
	Grapes	0	0	0	0	100	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	100	0%	100%		
	Miscellaneous Deciduous	0	0	0	0	0	18	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	20	10%	90%		
	Miscellaneous Grain and Hay	0	0	0	0	0	0	189	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	190	1%	99%		
	Miscellaneous Grasses	5	0	0	0	0	0	0	30	3	0	0	0	0	0	0	0	0	0	0	0	0	0	38	21%	79%		
	Mixed Pasture	0	0	0	0	0	0	3	3	141	0	0	0	0	0	0	0	0	0	0	0	0	0	147	4%	96%		
	Olives	0	0	0	0	0	0	0	0	0	48	0	0	0	0	1	0	0	0	0	0	1	0	50	4%	96%		
	Peaches and Nectarines	0	2	0	0	0	0	0	0	0	0	41	0	0	0	1	0	0	0	0	0	1	0	45	9%	91%		
	Pears	0	0	0	0	0	0	0	0	0	0	0	50	0	0	0	0	0	0	0	0	0	0	50	0%	100%		
	Pecans	0	0	0	0	0	0	0	0	0	0	0	0	23	0	0	0	0	0	0	0	1	0	24	4%	96%		
	Pistachios	0	1	0	0	0	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0	0	49	2%	98%		
	Prunes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	54	0	0	0	0	0	0	0	54	0%	100%		
	Rice	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	418	0	0	0	0	0	0	418	0%	100%		
	Safflower	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33	0	0	0	0	0	33	0%	100%		
	Sunflowers	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	48	0	0	0	0	49	2%	98%		
	Tomatoes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	107	0	0	0	107	0%	100%		
	Unclassified Fallow	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	164	0	0	169	3%	97%		
	Walnuts	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	350	0	352	1%	99%		
	Young Perennials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	14	21	33%	67%		
	Predicted Total		104	425	12	48	100	18	192	35	151	48	42	51	24	48	56	418	34	48	108	171	354	14	2,501			0.98
	Commission Error		5%	1%	0%	0%	0%	0%	2%	14%	7%	0%	2%	2%	4%	0%	4%	0%	3%	0%	1%	4%	1%	0%				
	Users Accuracy		95%	99%	100%	100%	100%	100%	98%	86%	93%	100%	98%	98%	96%	100%	96%	100%	97%	100%	99%	96%	99%	100%				
	Kappa Coefficient																											0.98

Table 22. San Francisco Bay Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted								
		Grapes	Miscellaneous Grain and Hay	Mixed Pasture	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Grapes	130	0	0	1	131	1%	99%	
	Miscellaneous Grain and Hay	0	38	0	0	38	0%	100%	
	Mixed Pasture	0	2	10	1	13	23%	77%	
	Unclassified Fallow	1	0	0	23	24	4%	96%	
	Predicted Total	131	40	10	25	206			0.96
	Commission Error	1%	5%	0%	8%				
	Users Accuracy	99%	95%	100%	92%				
Kappa Coefficient									

Table 23. San Joaquin River Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted																				Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	Almonds	Apples	Apricots	Cherries	Corn, Sorghum, and Sudan	Cotton	Grapes	Melons, Squash, and Cucumbers	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Pistachios	Sweet Potatoes	Tomatoes	Unclassified Fallow	Walnuts	Young Perennials						
	Alfalfa and Alfalfa Mixtures	195	0	0	0	0	1	0	0	0	1	3	0	0	0	0	1	0	0	201	3%	97%	0.98	
	Almonds	0	1,036	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,036	0%	100%		
	Apples	0	0	10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0%	100%		
	Apricots	0	0	0	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34	0%	100%		
	Cherries	0	1	0	0	57	0	0	0	0	0	0	0	0	0	0	0	0	0	58	2%	98%		
	Corn, Sorghum, and Sudan	0	0	0	0	0	391	0	0	2	0	1	0	0	1	0	0	0	0	395	1%	99%		
	Cotton	0	0	0	0	0	0	48	0	0	0	0	0	0	0	0	0	0	0	48	0%	100%		
	Grapes	0	0	0	0	0	0	0	145	0	0	0	0	0	0	0	0	0	0	145	0%	100%		
	Melons, Squash, and Cucumbers	0	0	0	0	0	0	0	0	48	0	0	0	0	0	0	0	0	0	48	0%	100%		
	Miscellaneous Grain and Hay	0	0	0	0	0	0	0	0	0	402	1	0	0	0	0	0	0	0	403	0%	100%		
	Miscellaneous Grasses	5	0	0	0	0	7	0	0	1	0	16	2	0	0	0	0	0	0	31	48%	52%		
	Mixed Pasture	2	0	0	0	0	0	0	0	0	5	1	101	0	0	0	0	0	0	109	7%	93%		
	Pistachios	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	90	0%	100%		
	Sweet Potatoes	0	0	0	0	0	0	0	0	0	0	0	0	0	55	0	0	0	0	55	0%	100%		
	Tomatoes	0	0	0	0	0	0	2	0	2	0	0	0	0	0	97	0	0	0	101	4%	96%		
	Unclassified Fallow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	104	0	1	105	1%	99%		
	Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	141	0	141	0%	100%		
	Young Perennials	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	11	0	11	24	54%	46%		
	Predicted Total	202	1,037	10	34	57	399	50	145	53	410	22	103	90	56	97	116	141	12	3,034				
	Commission Error	3%	0%	0%	0%	0%	2%	4%	0%	9%	2%	27%	2%	0%	2%	0%	10%	0%	8%					
	Users Accuracy	97%	100%	100%	100%	100%	98%	96%	100%	91%	98%	73%	98%	100%	98%	100%	90%	100%	92%					
	Kappa Coefficient																				0.98			

Table 24. South Coast Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted																
													Reference	Omission	Producers	Kappa	
													Total	Error	Accuracy	Coefficient	
		Avocados	Bushberries	Citrus	Cole Crops	Flowers, Nursery, and Christmas Tree Farms	Miscellaneous Grain and Hay	MiscellaneousSubtropicals	Miscellaneous Truck Crops	Strawberries	Turf	Unclassified Fallow					
	Avocados	498	0	1	0	0	0	0	0	0	0	8	507	2%	98%		
	Bushberries	0	53	0	0	1	0	0	0	0	0	0	54	2%	98%		
	Citrus	8	0	295	0	0	0	0	0	0	0	2	305	3%	97%		
	Cole Crops	0	0	0	23	0	0	0	0	0	0	0	23	0%	100%		
	Flowers, Nursery, and Christmas Tree Farms	0	0	0	1	100	0	0	0	0	0	3	104	4%	96%		
	Miscellaneous Grain and Hay	0	0	0	0	0	38	0	3	0	0	0	41	7%	93%		
	MiscellaneousSubtropicals	0	0	0	0	1	0	13	0	0	0	2	16	19%	81%		
	Miscellllaneous Truck Crops	0	0	0	0	0	1	0	106	0	0	0	107	1%	99%		
	Strawberries	0	0	0	0	1	0	0	0	70	0	0	71	1%	99%		
	Turf	0	0	0	0	0	0	0	0	0	18	0	18	0%	100%		
	Unclassified Fallow	4	0	0	0	0	1	0	0	0	0	117	122	4%	96%		
Predicted Total		510	53	296	24	103	40	13	109	70	18	132	1,368				
Commission Error		2%	0%	0%	4%	3%	5%	0%	3%	0%	0%	11%					
Users Accuracy		98%	100%	100%	96%	97%	95%	100%	97%	100%	100%	89%					
Kappa Coefficient														0.97			

Table 25. South Lahontan Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (count)

Reference	Predicted							
		Alfalfa and Alfalfa Mixtures	Mixed Pasture	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	26	0	0	26	0%	100%	
	Mixed Pasture	0	51	0	51	0%	100%	
	Unclassified Fallow	0	1	34	35	3%	97%	
	Predicted Total	26	52	34	112			
	Commission Error	0%	2%	0%				
	Users Accuracy	100%	98%	100%				
	Kappa Coefficient					0.99		

ACCURACY ASSESSMENT BY AREA (ACRES)

WEIGHTED ACCURACY BY CROP CLASS

Table 27. WY 2023 Statewide Land Use Mapping Weighted Accuracy by DWR Crop Class Legend Level

DWR Crop Class	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Citrus and Subtropical	14,567	14,537	4%	100%	4%
Deciduous Fruits and Nuts	145,784	145,759	26%	100%	26%
Field Crops	55,291	54,572	8%	99%	8%
Grain and Hay	53,220	52,480	11%	99%	11%
Pasture	119,989	118,299	14%	99%	14%
Rice	22,343	22,343	5%	100%	5%
Truck, Nursery and Berry Crops	69,290	68,680	11%	99%	11%
Unclassified	42,059	41,439	13%	99%	12%
Vineyard	28,046	28,013	7%	100%	7%
Young Perennials	2,312	1,395	1%	60%	0%
Total Weighted Accuracy Statewide				99%	99%

Table 28. WY 2023 Statewide Land Use Mapping Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	72,070	70,775	6%	98%	6%
Almonds	83,990	83,874	15%	100%	15%
Apples	407	407	0%	100%	0%
Apricots	542	535	0%	99%	0%
Avocados	2,449	2,426	1%	99%	0%
Beans (Dry)	1,307	1,096	0%	84%	0%
Bush Berries	899	855	0%	95%	0%
Carrots	2,117	2,117	0%	100%	0%
Cherries	2,599	2,573	0%	99%	0%
Citrus	8,616	8,602	3%	100%	3%
Cole Crops	11,966	10,928	1%	91%	1%
Corn, Sorghum and Sudan	38,822	38,608	6%	99%	6%
Cotton	6,099	5,926	1%	97%	1%
Dates	1,505	1,505	0%	100%	0%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Flowers, Nursery and Christmas Tree Farms	933	841	0%	90%	0%
Grapes	28,046	28,013	7%	100%	7%
Kiwis	811	807	0%	100%	0%
Lettuce/Leafy Greens	14,621	13,567	2%	93%	2%
Melons, Squash and Cucumbers	2,180	2,180	1%	100%	1%
Miscellaneous Deciduous	413	405	0%	98%	0%
Miscellaneous Grain and Hay	53,220	52,480	11%	99%	11%
Miscellaneous Grasses	18,078	15,549	2%	86%	1%
Miscellaneous Subtropical Fruits	115	112	0%	97%	0%
Miscellaneous Truck Crops	4,496	3,764	1%	84%	1%
Mixed Pasture	28,649	28,116	7%	98%	7%
Olives	1,071	1,070	1%	100%	1%
Onions and Garlic	5,255	5,255	1%	100%	1%
Peaches/Nectarines	1,497	1,472	1%	98%	1%
Pears	984	984	0%	100%	0%
Pecans	1,112	1,110	0%	100%	0%
Peppers	735	705	0%	96%	0%
Pistachios	32,096	31,952	6%	100%	6%
Plums	544	505	0%	93%	0%
Pomegranates	1,521	1,521	0%	100%	0%
Potatoes	2,481	2,413	0%	97%	0%
Prunes	1,383	1,383	0%	100%	0%
Rice	22,343	22,343	5%	100%	5%
Safflower	1,946	1,770	0%	91%	0%
Strawberries	5,739	5,633	1%	98%	1%
Sugar Beets	3,734	3,734	0%	100%	0%
Sunflowers	3,380	3,340	0%	99%	0%
Sweet Potatoes	1,019	1,019	0%	100%	0%
Tomatoes	16,847	16,551	2%	98%	2%
Turf	1,192	1,192	0%	100%	0%
Unclassified Fallow	42,059	41,439	13%	99%	13%
Walnuts	18,695	18,691	4%	100%	4%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Young Perennials	2,312	1,395	1%	60%	0%
Total Weighted Accuracy Statewide				98%	98%

Table 29 .WY 2023 Central Coast Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Apples	214	214	0.4%	100.0%	0.4%
Avocados	303	303	1.7%	99.9%	1.7%
Bush Berries	395	360	0.9%	91.0%	0.8%
Cherries	374	374	0.2%	100.0%	0.2%
Cole Crops	9,314	8,469	16.3%	90.9%	14.9%
Flowers, Nursery and Christmas Tree Farms	538	474	0.9%	88.2%	0.8%
Grapes	6,706	6,695	16.4%	99.8%	16.4%
Lettuce/Leafy Greens	11,541	10,708	25.8%	92.8%	23.9%
Miscellaneous Grain and Hay	2,047	1,736	7.8%	84.8%	6.6%
Miscellaneous Truck Crops	2,392	1,918	6.9%	80.2%	5.5%
Peppers	615	585	0.4%	95.1%	0.4%
Strawberries	4,509	4,433	5.9%	98.3%	5.8%
Unclassified Fallow	2,522	2,513	16.0%	99.6%	15.9%
Walnuts	609	609	0.5%	100.0%	0.5%
Total Weighted Accuracy					93.7%

Table 30. WY 2023 Colorado River Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	42,077	41,298	29.4%	98.1%	28.9%
Carrots	2,117	2,117	2.4%	100.0%	2.4%
Citrus	1,176	1,176	2.6%	100.0%	2.6%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Cole Crops	2,241	2,058	3.1%	91.8%	2.8%
Corn, Sorghum and Sudan	3,150	3,044	6.6%	96.6%	6.4%
Cotton	382	364	0.7%	95.3%	0.7%
Dates	1,505	1,505	2.0%	100.0%	2.0%
Grapes	739	739	0.6%	100.0%	0.6%
Lettuce/Leafy Greens	3,080	2,859	7.4%	92.8%	6.9%
Melons, Squash and Cucumbers	3,854	3,838	3.8%	99.6%	3.8%
Miscellaneous Grain and Hay	14,128	12,761	14.9%	90.3%	13.5%
Miscellaneous Grasses	2,097	2,097	3.0%	100.0%	3.0%
Onions and Garlic	3,734	3,734	2.7%	100.0%	2.7%
Sugar Beets	7,845	7,804	20.7%	99.5%	20.6%
Unclassified Fallow	42,077	41,298	29.4%	98.1%	28.9%
Total Weighted Accuracy					96.9%

Table 31. WY 2023 North Coast Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	6,450	6,234	15.1%	96.6%	14.6%
Grapes	845	845	15.0%	100.0%	15.0%
Miscellaneous Grain and Hay	2,410	2,410	15.6%	100.0%	15.6%
Miscellaneous Grasses	299	108	2.6%	36.1%	0.9%
Mixed Pasture	3,431	3,320	40.0%	96.8%	38.7%
Potatoes	764	764	1.6%	100.0%	1.6%
Unclassified Fallow	602	586	10.1%	97.4%	9.8%
Total Weighted Accuracy					96.3%

Table 32. WY 2023 North Lahontan Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	2,307	2,234	16.3%	96.8%	15.8%
Miscellaneous Grain and Hay	1,240	1,213	9.1%	97.8%	8.9%
Miscellaneous Grasses	1,088	720	7.7%	66.1%	5.1%
Mixed Pasture	16,229	16,209	57.7%	99.9%	57.7%
Unclassified Fallow	960	960	9.1%	100.0%	9.1%
Total Weighted Accuracy					96.6%

Table 33. WY 2023 Sacramento River Hydrologic Region Land Use Acreage Weighted Mapping Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	5,113	5,076	3.8%	99.3%	3.8%
Almonds	18,987	18,966	13.2%	99.9%	13.2%
Beans (Dry)	592	592	0.3%	99.9%	0.3%
Corn, Sorghum and Sudan	2,066	2,013	2.2%	97.4%	2.1%
Grapes	2,630	2,630	2.5%	100.0%	2.5%
Miscellaneous Deciduous	111	103	0.1%	92.8%	0.1%
Miscellaneous Grain and Hay	8,369	8,361	8.5%	99.9%	8.5%
Miscellaneous Grasses	1,771	1,438	1.5%	81.2%	1.2%
Mixed Pasture	3,320	3,162	13.6%	95.2%	12.9%
Olives	1,071	1,070	1.3%	100.0%	1.3%
Peaches/Nectarines	670	646	0.4%	96.4%	0.4%
Pears	984	984	0.3%	100.0%	0.3%
Pecans	545	543	0.1%	99.6%	0.1%
Pistachios	2,628	2,483	1.0%	94.5%	0.9%
Prunes	1,383	1,383	1.7%	100.0%	1.7%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Rice	22,343	22,343	22.9%	100.0%	22.9%
Safflower	1,408	1,408	0.5%	100.0%	0.5%
Sunflowers	3,380	3,340	1.4%	98.8%	1.3%
Tomatoes	6,739	6,739	4.0%	100.0%	4.0%
Unclassified Fallow	5,049	5,000	8.9%	99.0%	8.8%
Walnuts	11,768	11,763	11.2%	100.0%	11.2%
Young Perennials	949	728	0.7%	76.7%	0.5%
Total Weighted Accuracy					98.6%

Table 34. WY 2023 San Francisco Bay Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Grapes	1,093	1,085	51.1%	99.3%	50.7%
Miscellaneous Grain and Hay	1,265	1,265	22.9%	100.0%	22.9%
Mixed Pasture	247	223	8.2%	90.1%	7.4%
Unclassified Fallow	222	222	17.7%	100.1%	17.8%
Total Weighted Accuracy					98.8%

Table 35. WY 2023 San Joaquin River Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	7,244	7,117	5.1%	98.2%	5.0%
Almonds	34,354	34,354	30.0%	100.0%	30.0%
Apples	154	154	0.1%	100.0%	0.1%
Apricots	454	447	0.1%	98.5%	0.1%
Cherries	1,039	1,028	1.1%	99.0%	1.1%
Corn, Sorghum and Sudan	13,718	13,663	11.6%	99.6%	11.6%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Cotton	2,171	2,171	1.5%	100.0%	1.5%
Grapes	5,693	5,693	8.3%	100.0%	8.3%
Melons, Squash and Cucumbers	2,180	2,180	0.9%	100.0%	0.9%
Miscellaneous Grain and Hay	14,869	14,816	14.5%	99.6%	14.4%
Miscellaneous Grasses	791	522	0.5%	66.0%	0.4%
Mixed Pasture	2,266	2,056	3.8%	90.7%	3.4%
Pistachios	6,033	6,033	4.9%	100.0%	4.9%
Sweet Potatoes	1,019	1,019	0.7%	100.0%	0.7%
Tomatoes	5,289	5,087	3.6%	96.2%	3.4%
Unclassified Fallow	2,984	2,982	6.9%	99.9%	6.9%
Walnuts	4,436	4,436	5.3%	100.0%	5.3%
Young Perennials	721	437	0.9%	60.6%	0.6%
Total Weighted Accuracy					98.7%

Table 36. WY 2023 South Coast Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Avocados	2,146	2,123	19.3%	98.9%	19.0%
Bush Berries	504	496	2.3%	98.4%	2.2%
Citrus	2,559	2,545	18.0%	99.4%	17.9%
Cole Crops	411	401	2.5%	97.5%	2.4%
Flowers, Nursery and Christmas Tree Farms	395	366	6.5%	92.8%	6.0%
Miscellaneous Grain and Hay	969	933	11.6%	96.3%	11.2%
Miscellaneous Subtropical Fruits	46	43	0.7%	93.5%	0.7%
Miscellaneous Truck Crops	1,945	1,688	12.8%	86.8%	11.1%
Strawberries	1,230	1,200	5.4%	97.6%	5.3%
Turf	312	312	1.2%	99.9%	1.2%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Unclassified Fallow	1,195	1,175	19.7%	98.3%	19.3%
Total Weighted Accuracy					96.5%

Table 37. WY 2022 Sout3 Lahontan Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixes	2,563	2,500	25.1%	97.5%	24.5%
Mixed Pasture	2,747	2,747	37.6%	100.0%	37.6%
Unclassified Fallow	2,665	2,361	37.3%	88.6%	33.1%
Total Weighted Accuracy					95.1%

Table 38. WY 2023 Tulare Lake Hydrologic Region Land Use Mapping Acreage Weighted Accuracy by Subclass Legend Level

Crop	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Alfalfa and Alfalfa Mixtures	6,317	6,317	3.1%	100.0%	3.1%
Almonds	30,649	30,554	17.6%	99.7%	17.5%
Cherries	1,186	1,171	0.3%	98.7%	0.3%
Citrus	4,880	4,880	7.2%	100.0%	7.2%
Corn, Sorghum and Sudan	19,776	19,776	9.0%	100.0%	9.0%
Cotton	3,546	3,391	1.8%	95.6%	1.7%
Grapes	10,341	10,326	7.2%	99.9%	7.2%
Kiwis	741	741	0.1%	100.0%	0.1%
Miscellaneous Deciduous	165	165	0.1%	100.2%	0.1%
Miscellaneous Grain and Hay	18,197	17,909	12.8%	98.4%	12.6%
Mixed Pasture	398	387	0.5%	97.3%	0.5%
Onions and Garlic	3,158	3,158	0.8%	100.0%	0.8%
Peaches/Nectarines	826	826	1.3%	100.0%	1.3%

Crop Subclass	Ground Truth Area	Classified Area	Weight	Unweighted Accuracy	Weighted Accuracy
Pecans	530	530	0.1%	100.0%	0.1%
Pistachios	23,435	23,435	13.6%	100.0%	13.6%
Plums	544	505	0.5%	92.8%	0.4%
Pomegranates	1,521	1,521	0.6%	100.0%	0.6%
Potatoes	1,041	1,041	0.5%	100.0%	0.5%
Tomatoes	4,819	4,725	2.7%	98.0%	2.7%
Unclassified Fallow	18,015	17,836	17.7%	99.0%	17.5%
Walnuts	1,882	1,882	1.9%	100.0%	1.9%
Young Perennials	589	219	0.6%	37.1%	0.2%
Total Weighted Accuracy					99.0%

PRECISION BY CROP

Table 39. Statewide Land Use Mapping Validation Data Error Matrix by DWR Class Legend Level (acres)

Reference	Predicted														
		Citrus and Subtropical	Deciduous Fruits and Nuts	Field Crops	Grain and Hay Crops	Pasture	Rice	Truck, Nursery and Berry Crops	Unclassified Fallow	Vineyard	Young Perennial	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Citrus and Subtropical	14,537	5	0	0	0	0	1	24	0	0	14,567	0%	100%	
	Deciduous Fruits and Nuts	0	145,759	0	0	7	0	0	0	18	0	145,784	0%	100%	
	Field Crops	0	0	54,572	185	99	0	435	0	0	0	55,291	1%	99%	
	Grain and Hay Crops	0	0	0	52,480	92	0	525	123	0	0	53,220	1%	99%	
	Pasture	0	0	1,111	324	118,299	0	182	73	0	0	119,989	1%	99%	
	Rice	0	0	0	0	0	22,343	0	0	0	0	22,343	0%	100%	
	Truck, Nursery and Berry Crops	0	0	186	356	0	0	68,680	67	0	0	69,290	1%	99%	
	Unclassified Fallow	10	12	0	154	393	0	14	41,439	36	2	42,059	1%	99%	
	Vineyard	0	0	0	0	0	0	0	33	28,013	0	28,046	0%	100%	
	Young Perennial	0	0	0	42	0	0	4	871	0	1,395	2,312	40%	60%	
Predicted Total	14,546	145,776	55,869	53,541	118,889	22,343	69,841	42,630	28,067	1,398	552,900			0.98	
Commission Error	0%	0%	2%	2%	0%	0%	2%	3%	0%	0%					
Users Accuracy	100%	100%	98%	98%	100%	100%	98%	97%	100%	100%					
Kappa Coefficient															

Table 40. Statewide Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

[illegible]

Table 41. Central Coast Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted																		
	Apples	Avocados	Bushberries	Cherries	Cole Crops	Flowers, Nursery, and Christmas Tree Farms	Grapes	Lettuce or Leafy Greens	Miscellaneous Grain and Hay	Miscellaneous Truck Crops	Peppers	Strawberries	Unclassified Fallow	Walnuts	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient	
	Apples	214	0	0	0	0	0	0	0	0	0	0	0	0	214	0%	100%		
	Avocados	0	303	0	0	0	0	0	0	0	0	0	0	0	303	0%	100%		
	Bushberries	0	0	360	0	0	0	0	0	0	0	0	35	0	395	9%	91%		
	Cherries	0	0	0	374	0	0	0	0	0	0	0	0	0	374	0%	100%		
	Cole Crops	0	0	0	0	8,469	0	0	735	83	0	0	0	0	9,286	9%	91%		
	Flowers, Nursery, and Christmas Tree Farms	0	0	0	0	0	474	0	0	0	0	0	0	63	538	12%	88%		
	Grapes	0	0	0	0	0	0	6,695	0	0	0	0	0	11	6,706	0%	100%		
	Lettuce or Leafy Greens	0	0	0	0	148	0	0	10,708	44	641	0	0	0	11,541	7%	93%		
	Miscellaneous Grain and Hay	0	0	0	0	139	0	0	56	1,736	97	0	0	18	2,047	15%	85%		
	Miscellaneous Truck Crops	0	0	0	0	0	0	0	407	53	1,918	0	0	0	2,378	19%	81%		
	Peppers	0	0	0	0	27	3	0	0	0	0	585	0	0	615	5%	95%		
	Strawberries	0	0	31	0	0	11	0	0	2	0	32	4,433	0	4,509	2%	98%		
	Unclassified Fallow	0	0	0	0	0	0	0	9	0	0	0	0	2,513	2,522	0%	100%		
	Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	609	0%	100%		
	Predicted Total	214	303	390	374	8,783	489	6,695	11,915	1,918	2,656	617	4,468	2,604	609	42,036			0.93
	Commission Error	0%	0%	8%	0%	4%	3%	0%	10%	9%	28%	5%	1%	3%	0%				
	Users Accuracy	100%	100%	92%	100%	96%	97%	100%	90%	91%	72%	95%	99%	97%	100%				
	Kappa Coefficient																		

Table 42. Colorado River Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted															Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	Carrots	Citrus	Cole Crops	Corn, Sorghum, and Sudan	Cotton	Dates	Grapes	Lettuce or Leafy Greens	Miscellaneous Grain and Hay	Miscellaneous Grasses	Onions and Garlic	Sugar Beets	Unclassified Fallow					
	Alfalfa and Alfalfa Mixtures	41,298	0	0	0	153	0	0	0	166	0	439	0	0	20	42,077	2%	98%	
	Carrots	0	2,117	0	0	0	0	0	0	0	0	0	0	0	0	2,117	0%	100%	
	Citrus	0	0	1,176	0	0	0	0	0	0	0	0	0	0	0	1,176	0%	100%	
	Cole Crops	0	0	0	2,058	0	0	0	0	37	146	0	0	0	0	2,241	8%	92%	
	Corn, Sorghum, and Sudan	0	0	0	0	3,044	0	0	0	0	9	97	0	0	0	3,150	3%	97%	
	Cotton	0	0	0	0	0	364	0	0	18	0	0	0	0	0	382	5%	95%	
	Dates	0	0	0	0	0	0	1,505	0	0	0	0	0	0	0	1,505	0%	100%	
	Grapes	0	0	0	0	0	0	0	739	0	0	0	0	0	0	739	0%	100%	
	Lettuce or Leafy Greens	0	0	0	99	0	0	0	0	2,859	0	0	0	0	0	2,958	3%	97%	
	Miscellaneous Grain and Hay	0	0	0	0	0	0	0	0	0	3,838	17	0	0	0	3,854	0%	100%	
	Miscellaneous Grasses	565	0	0	0	790	0	0	0	0	0	12,761	0	0	0	14,116	10%	90%	
	Onions and Garlic	0	0	0	0	0	0	0	0	0	0	0	2,097	0	0	2,097	0%	100%	
	Sugar Beets	0	0	0	0	0	0	0	0	0	0	0	0	3,734	0	3,734	0%	100%	
	Unclassified Fallow	0	0	0	0	0	0	5	36	0	0	0	0	0	7,804	7,845	1%	99%	
	Predicted Total	41,864	2,117	1,176	2,157	3,986	364	1,510	775	3,079	3,992	13,315	2,097	3,734	7,825	87,991			
	Commission Error	1%	0%	0%	5%	24%	0%	0%	5%	7%	4%	4%	0%	0%	0%				
	Users Accuracy	99%	100%	100%	95%	76%	100%	100%	95%	93%	96%	96%	100%	100%	100%				
	Kappa Coefficient																0.96		

Table 43. North Coast Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted											
		Alfalfa and Alfalfa Mixtures	Grapes	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Potatoes	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	6,234	0	58	140	18	0	0	6,450	3%	97%	
	Grapes	0	845	0	0	0	0	0	845	0%	100%	
	Miscellaneous Grain and Hay	0	0	2,410	0	0	0	0	2,410	0%	100%	
	Miscellaneous Grasses	83	0	87	108	0	0	0	278	61%	39%	
	Mixed Pasture	3	0	4	83	3,320	0	21	3,431	3%	97%	
	Potatoes	0	0	0	0	0	764	0	764	0%	100%	
	Unclassified Fallow	0	0	0	0	15	0	586	602	3%	97%	
Predicted Total	6,320	845	2,558	331	3,354	764	608	14,779			0.95	
Comission Error	1%	0%	6%	67%	1%	0%	4%					
Users Accuracy	99%	100%	94%	33%	99%	100%	96%					
Kappa Coefficient												

Table 44. North Lahontan Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted								
		Alfalfa and Alfalfa Mixtures	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy
	Alfalfa and Alfalfa Mixtures	2,234	20	47	5	0	2,307	3%	97%
	Miscellaneous Grain and Hay	27	1,213	0	0	0	1,240	2%	98%
	Miscellaneous Grasses	369	0	720	0	0	1,088	34%	66%
	Mixed Pasture	0	0	20	16,209	0	16,229	0%	100%
	Unclassified Fallow	0	0	0	0	960	960	0%	100%
	Predicted Total	2,629	1,233	787	16,214	960	21,823		
	Commission Error	15%	2%	9%	0%	0%			
	Users Accuracy	85%	98%	91%	100%	100%			
	Kappa Coefficient							0.90	

Table 46. San Francisco Bay Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted								
		Grapes	Miscellaneous Grain and Hay	Mixed Pasture	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Grapes	1,085	0	0	8	1,093	1%	99%	
	Miscellaneous Grain and Hay	0	1,265	0	0	1,265	0%	100%	
	Mixed Pasture	0	9	223	16	247	10%	90%	
	Unclassified Fallow	0	0	0	222	222	0%	100%	
	Predicted Total	1,085	1,274	223	245	2,827			0.96
	Commission Error	0%	1%	0%	9%				
	Users Accuracy	100%	99%	100%	91%				
	Kappa Coefficient								

Table 47. San Joaquin River Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted																				Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	Almonds	Apples	Apricots	Cherries	Corn, Sorghum, and Sudan	Cotton	Grapes	Melons, Squash, and Cucumbers	Miscellaneous Grain and Hay	Miscellaneous Grasses	Mixed Pasture	Pistachios	Sweet Potatoes	Tomatoes	Unclassified Fallow	Walnuts	Young Perennials						
	Alfalfa and Alfalfa Mixtures	7,117	0	0	0	0	9	0	0	0	15	88	0	0	0	0	16	0	0	7,244	2%	98%	0.98	
	Almonds	0	34,354	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	34,354	0%	100%		
	Apples	0	0	154	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	154	0%	100%		
	Apricots	0	0	0	447	0	0	0	0	0	0	0	0	0	0	0	0	0	0	447	0%	100%		
	Cherries	0	5	0	0	1,028	0	0	0	0	0	0	0	0	0	0	0	0	0	1,033	0%	100%		
	Corn, Sorghum, and Sudan	0	0	0	0	0	13,663	0	0	36	0	1	0	0	18	0	0	0	0	13,718	0%	100%		
	Cotton	0	0	0	0	0	0	2,171	0	0	0	0	0	0	0	0	0	0	0	2,171	0%	100%		
	Grapes	0	0	0	0	0	0	0	5,693	0	0	0	0	0	0	0	0	0	0	5,693	0%	100%		
	Melons, Squash, and Cucumbers	0	0	0	0	0	0	0	0	2,180	0	0	0	0	0	0	0	0	0	2,180	0%	100%		
	Miscellaneous Grain and Hay	0	0	0	0	0	0	0	0	0	14,816	14	0	0	0	0	0	0	0	14,830	0%	100%		
	Miscellaneous Grasses	113	0	0	0	0	131	0	0	15	0	522	11	0	0	0	0	0	0	791	34%	66%		
	Mixed Pasture	119	0	0	0	0	0	0	0	0	87	4	2,056	0	0	0	0	0	0	2,266	9%	91%		
	Pistachios	0	0	0	0	0	0	0	0	0	0	0	0	6,033	0	0	0	0	0	6,033	0%	100%		
	Sweet Potatoes	0	0	0	0	0	0	0	0	0	0	0	0	0	1,019	0	0	0	0	1,019	0%	100%		
	Tomatoes	0	0	0	0	0	0	75	0	81	0	0	0	0	0	5,087	0	0	0	5,243	3%	97%		
	Unclassified Fallow	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,982	0	2	2,984	0%	100%		
	Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,436	0	4,436	0%	100%		
	Young Perennials	0	0	0	0	0	0	0	0	0	42	0	0	0	0	0	242	0	437	721	39%	61%		
	Predicted Total	7,349	34,358	154	447	1,028	13,803	2,246	5,693	2,311	14,959	630	2,066	6,033	1,037	5,087	3,240	4,436	439	105,318				
	Commission Error	3%	0%	0%	0%	0%	1%	3%	0%	6%	1%	17%	0%	0%	2%	0%	8%	0%	0%					
	Users Accuracy	97%	100%	100%	100%	100%	99%	97%	100%	94%	99%	83%	100%	100%	98%	100%	92%	100%	100%					
	Kappa Coefficient																				0.98			

Table 48. South Coast Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Predicted																
Reference																
													Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Avocados	Bushberries	Citrus	Cole Crops	Flowers, Nursery, and Christmas Tree Farms	Miscellaneous Grain and Hay	MiscellaneousSsubtropicals	Miscellaneous Truck Crops	Strawberries	Turf	Unclassified Fallow					
	Avocados	2,123	0	1	0	0	0	0	0	0	21	2,146	1%	99%		
	Bushberries	0	496	0	0	8	0	0	0	0	0	504	2%	98%		
	Citrus	13	0	2,545	0	0	0	0	0	0	1	2,559	1%	99%		
	Cole Crops	0	0	0	401	0	0	0	0	0	0	401	0%	100%		
	Flowers, Nursery, and Christmas Tree Farms	0	0	0	25	366	0	0	0	0	4	395	7%	93%		
	Miscellaneous Grain and Hay	0	0	0	0	0	933	0	10	0	0	944	1%	99%		
	MiscellaneousSsubtropicals	0	0	0	0	1	0	43	0	0	2	46	7%	93%		
	Miscellaneous Truck Crops	0	0	0	0	0	29	0	1,688	0	0	1,717	2%	98%		
	Strawberries	0	0	0	0	30	0	0	0	1,200	0	1,230	2%	98%		
	Turf	0	0	0	0	0	0	0	0	0	312	312	0%	100%		
	Unclassified Fallow	5	0	0	0	0	15	0	0	0	1,175	1,195	2%	98%		
Predicted Total		2,141	496	2,546	426	405	977	43	1,699	1,200	312	1,202	11,448			
Commission Error		1%	0%	0%	6%	10%	5%	0%	1%	0%	0%	2%				
Users Accuracy		99%	100%	100%	94%	90%	95%	100%	99%	100%	100%	98%				
Kappa Coefficient													0.97			

Table 49. South Lahontan Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted							
		Alfalfa and Alfalfa Mixtures	Mixed Pasture	Unclassified Fallow	Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	2,500	0	0	2,500	0%	100%	
	Mixed Pasture	0	2,747	0	2,747	0%	100%	
	Unclassified Fallow	0	304	2,361	2,665	11%	89%	
	Predicted Total	2,500	3,051	2,361	7,912			
	Commission Error	0%	10%	0%				
	Users Accuracy	100%	90%	100%				
	Kappa Coefficient							

Table 50. Tulare Lake Hydrologic Region Land Use Mapping Validation Data Error Matrix by Subclass Legend Level (acres)

Reference	Predicted																							Reference Total	Omission Error	Producers Accuracy	Kappa Coefficient
	Alfalfa and Alfalfa Mixtures	Almonds	Cherries	Citrus	Corn, Sorghum, and Sudan	Cotton	Grapes	Kiwi	Miscellaneous Deciduous	Miscellaneous Grain and Hay	Mixed Pasture	Onions and Garlic	Peaches/nectarines	Pecans	Pistachios	Plums	Pomegranates	Potatoes	Tomatoes	Unclassified Fallow	Walnuts	Young Perennials					
Alfalfa and Alfalfa Mixtures	6,317	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6,317	0%	100%		
Almonds	0	30,554	0	0	0	0	18	0	0	0	0	0	9	0	15	0	0	0	0	0	54	0	30,649	0%	100%		
Cherries	0	0	1,171	0	0	0	0	0	0	0	0	0	15	0	0	0	0	0	0	0	0	0	1,186	1%	99%		
Citrus	0	0	1	4,880	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4,880	0%	100%		
Corn, Sorghum, and Sudan	0	0	0	0	19,776	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	19,776	0%	100%		
Cotton	0	0	0	0	0	3,391	0	0	0	0	0	0	0	0	0	0	0	0	155	0	0	0	3,546	4%	96%		
Grapes	0	0	0	0	0	0	10,326	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	10,341	0%	100%		
Kiwi	0	0	0	0	0	0	0	741	0	0	0	0	0	0	0	0	0	0	0	0	0	0	741	0%	100%		
Miscellaneous Deciduous	0	0	0	0	0	0	0	0	165	0	0	0	0	0	0	0	0	0	0	0	0	0	165	0%	100%		
Miscellaneous Grain and Hay	0	0	0	0	0	0	0	0	0	17,909	0	0	0	0	0	0	0	0	0	105	0	0	18,014	1%	99%		
Mixed Pasture	0	0	0	0	8	0	0	0	0	0	387	0	0	0	0	0	0	0	0	0	0	0	395	2%	98%		
Onions and Garlic	0	0	0	0	0	0	0	0	0	0	0	3,158	0	0	0	0	0	0	0	0	0	0	3,158	0%	100%		
Peaches/nectarines	0	0	0	0	0	0	0	0	0	0	0	0	826	0	0	0	0	0	0	0	0	0	826	0%	100%		
Pecans	0	0	0	0	0	0	0	0	0	0	0	0	0	530	0	0	0	0	0	0	0	0	530	0%	100%		
Pistachios	0	0	0	0	0	0	0	0	0	0	0	0	0	0	23,435	0	0	0	0	0	0	0	23,435	0%	100%		
Plums	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	505	0	0	0	0	0	0	529	5%	95%		
Pomegranates	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,521	0	0	0	0	0	1,521	0%	100%		
Potatoes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,041	0	0	0	0	1,041	0%	100%		
Tomatoes	0	0	0	0	0	94	0	0	0	0	0	0	0	0	0	0	0	0	4,725	0	0	0	4,819	2%	98%		
Unclassified Fallow	0	0	0	0	0	0	0	0	0	139	29	0	0	0	7	0	0	0	0	17,836	0	0	18,011	1%	99%		
Walnuts	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,882	0	1,882	0%	100%		
Young Perennials	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	366	0	219	585	63%	37%		
Predicted Total	6,317	30,554	1,171	4,880	19,784	3,485	10,344	741	165	18,047	417	3,158	875	530	23,457	505	1,521	1,041	4,880	18,322	1,936	219	152,348				
CommissionError	0%	0%	0%	0%	0%	3%	0%	0%	0%	1%	7%	0%	6%	0%	0%	0%	0%	0%	3%	3%	3%	0%					
Users Accuracy	100%	100%	100%	100%	100%	97%	100%	100%	100%	99%	93%	100%	94%	100%	100%	100%	100%	100%	97%	97%	97%	100%					
Kappa Coefficient																							0.99				