

ACTUAL EVAPOTRANSPIRATION ANALYSIS

September 2021

Prepared for
Eastern Tule Groundwater Sustainability Agency



Prepared by
 **LAND IQ**

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INTRODUCTION

The Eastern Tule Groundwater Sustainability Agency (ETGSA) has partnered with Land IQ to develop spatial datasets of monthly actual evapotranspiration (ETa) within its boundaries. In this analysis, remotely sensed data from satellites are calibrated against in-situ measurements from ground-based climate stations to create a spatially continuous map of ETa within ETGSA for the month.

ANALYSIS

Consumptive use analysis is done in in two main parts:

1. Ground truthing measurements and calibration
2. Remotely sensed analysis and summarization

GROUND TRUTHING

Table 1 shows stations that were active and used in the ET model, and Table 2 shows the daily precipitation totals for the month measured by Land IQ stations and California Department of Water Resources CIMIS stations. A current map of the stations showing all locations along with the crop distribution across the district (Figure 1) demonstrates the variety of calibration data available for model building. The precipitation for the entire area is shown in Figure 2.

TABLE 1. SENSORS USED IN DAILY AND MONTHLY ETa ANALYSIS BY CROP CATEGORY

Crop Type	Number of Active Stations	Number of Used Stations in model
Alfalfa	11	9
Almonds	23	16
Annuals	6	6
Citrus	14	12
Fallow/Native	6	6
Grapes	10	7
Olives	2	1
Pistachios	11	9
Pomegranates	1	1
Walnuts	1	1

TABLE 2. PRECIPITATION MEASURED BY FIELD STATIONS.

Station_ID	Source	September Precipitation (in)
LandIQ_ET_Full_Murcotts	LIQ	0.0
LandIQ_ET_Full_Fallow	LIQ	0.0
CIMIS #205: Coalinga	CIMIS	0.1
CIMIS #5: Shafter	CIMIS	0.0
CIMIS #15: Stratford	CIMIS	0.0
CIMIS #54: Blackwells Corner (westside)	CIMIS	0.0
CIMIS #2: FivePoints	CIMIS	0.0
CIMIS #146: Belridge	CIMIS	0.0
CIMIS #39: Parlier	CIMIS	0.1
CIMIS #105: Westlands	CIMIS	0.0
CIMIS # 80: Fresno State	CIMIS	0.0
CIMIS #182: Delano	CIMIS	0.0
CIMIS #169: Porterville	CIMIS	0.0
FTNC1	CNRFC	0.0
KTLC1	CNRFC	0.0
PNOC1	CNRFC	0.0
SCSC1	CNRFC	0.0
USW00023155	GHCN	0.0
USW00093193	GHCN	0.0
USW00053119	GHCN	0.0
USC00044890	GHCN	0.0
USW00023110	GHCN	0.0
USC00049367	GHCN	0.0

CIMIS - California Irrigation Management Information System; CNRFC - California Nevada River Forecast Center; GHCN - Global Historical Climate Network.

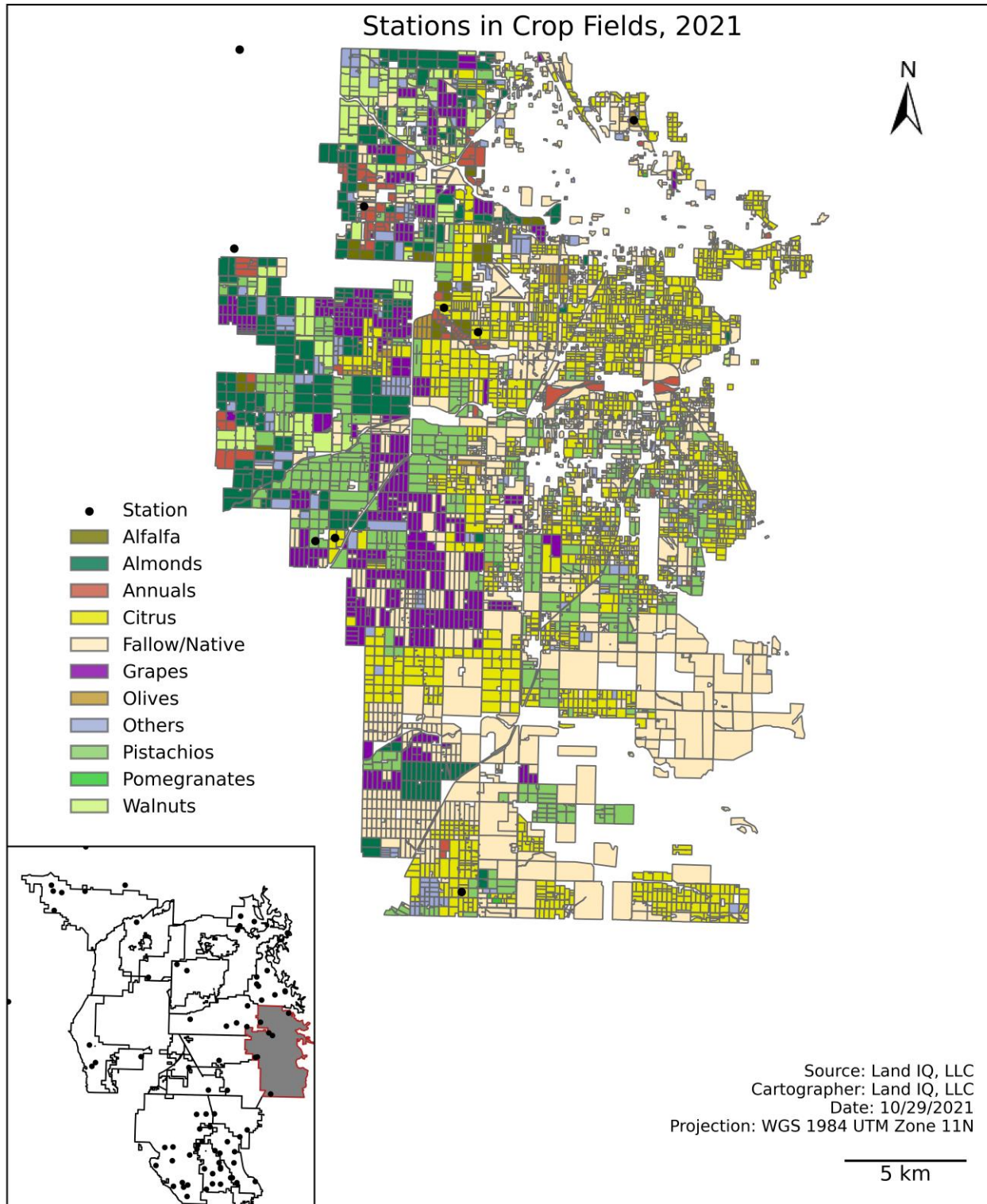


FIGURE 1. MAP OF CROP DISTRIBUTION AND STATION LOCATIONS

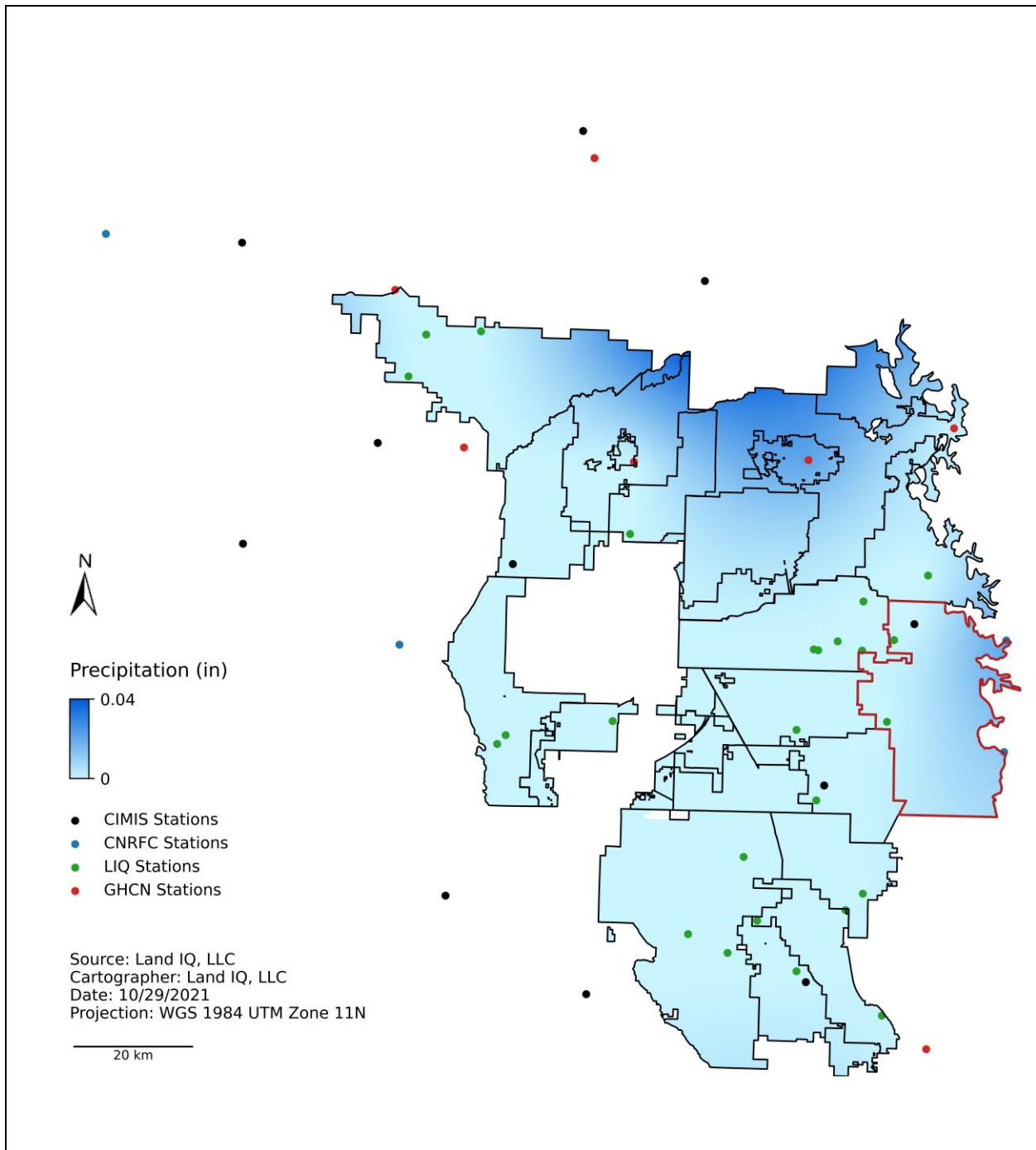


FIGURE 2. PRECIPITATION DURING THE MONTH WITHIN THE ENTIRE ANALYSIS AREA

REMOTE SENSING RESULTS

For this specific analysis, the image analysis dates and sources are shown in Table 3. Other imagery could not be used in the analysis because of cloud cover on the overpass dates. The ET_a image is shown in Figure 4 (at the end of this report). Monthly district-wide ET_a for the entire 161,257 acres, including depth and volume, is shown in Table 4, and the monthly ET_a by field is shown in Table 5. Monthly district-wide precipitation generated from kriging interpolation is shown in Table 6.

TABLE 3. IMAGE DATES AND SOURCES

Date	Image Source
September 03, 2021	Sentinel 2
September 08, 2021	Sentinel 2
September 18, 2021	Sentinel 2

TABLE 4. MONTHLY DISTRICT ET_a

Unit	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
(mm)	16.9	17.8	36.9	53.6	72.0	87.5	89.2	72.6	51.9
(inch)	0.7	0.7	1.5	2.1	2.8	3.4	3.5	2.9	2.0
(AF)	8,936	9,399	19,535	28,375	38,112	46,307	47,188	38,408	27,476

TABLE 5. MONTHLY FIELD ET_a

		ET _a (in)								
	Field Size (ac)	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
Maximum	634	1.7	2.2	3.9	5.4	7.9	8.8	8.1	7.7	5.5
Minimum	0.02	0.2	0.0	0.4	0.2	0.2	0.2	0.0	0.0	0.0
Average	17.1	0.8	0.9	1.6	2.5	3.3	3.9	4.1	3.4	2.6

TABLE 6. MONTHLY DISTRICT PRECIPITATION

Precipitation Unit	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
(mm)	37.8	6.0	27.7	4.6	0.1	0.1	0.2	0.0	0.1
(inch)	1.5	0.2	1.1	0.2	0.0	0.0	0.0	0.0	0.0
(AF)	19,996	3,170	14,661	2,449	44	48	106	0	71

ACCURACY OF REMOTE SENSING RESULTS

Measured versus predicted monthly ET_a is presented in Figure 3. Measured values represent data from field stations, whereas predicted values represented those generated by the Land IQ ET model. Stations are displayed as different symbols by crop types. For instance, all square symbols represent fallow/native stations. The stations are also symbolized by color for station type. Black symbols represent “Full” stations, green ones are “WIQ” stations, and red ones are “Tule Tech” stations. For example, green circles represent measurements and predictions of WIQ citrus stations.

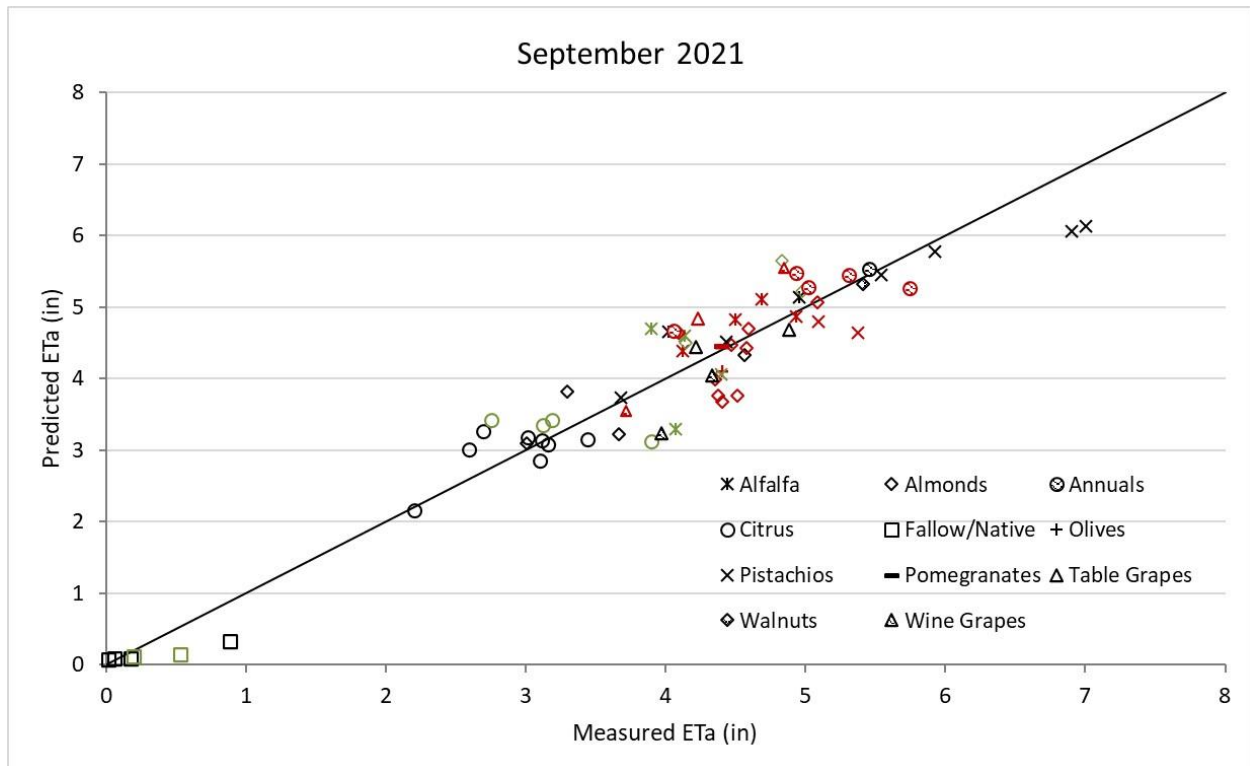


FIGURE 3. MEASURED VERSUS PREDICTED ET_a FOR THE MONTH. SYMBOL COLORS REPRESENT THE STATION TYPES (BLACK = FULL, GREEN = WATER IQ (WIQ), RED = TULE TECH)

Table 7 shows the accuracy results for this month. The R² value is the relative measure of fit of the observed data to the predicted result, where a value of 1 indicates a perfect fit. RMSE can be interpreted as the standard deviation, where a value of 0 in would indicate perfect fit to the observed data.

TABLE 7. MEASURED VS. PREDICTED MONTHLY ET_a

R ²	RMSE (IN)
0.9	0.4

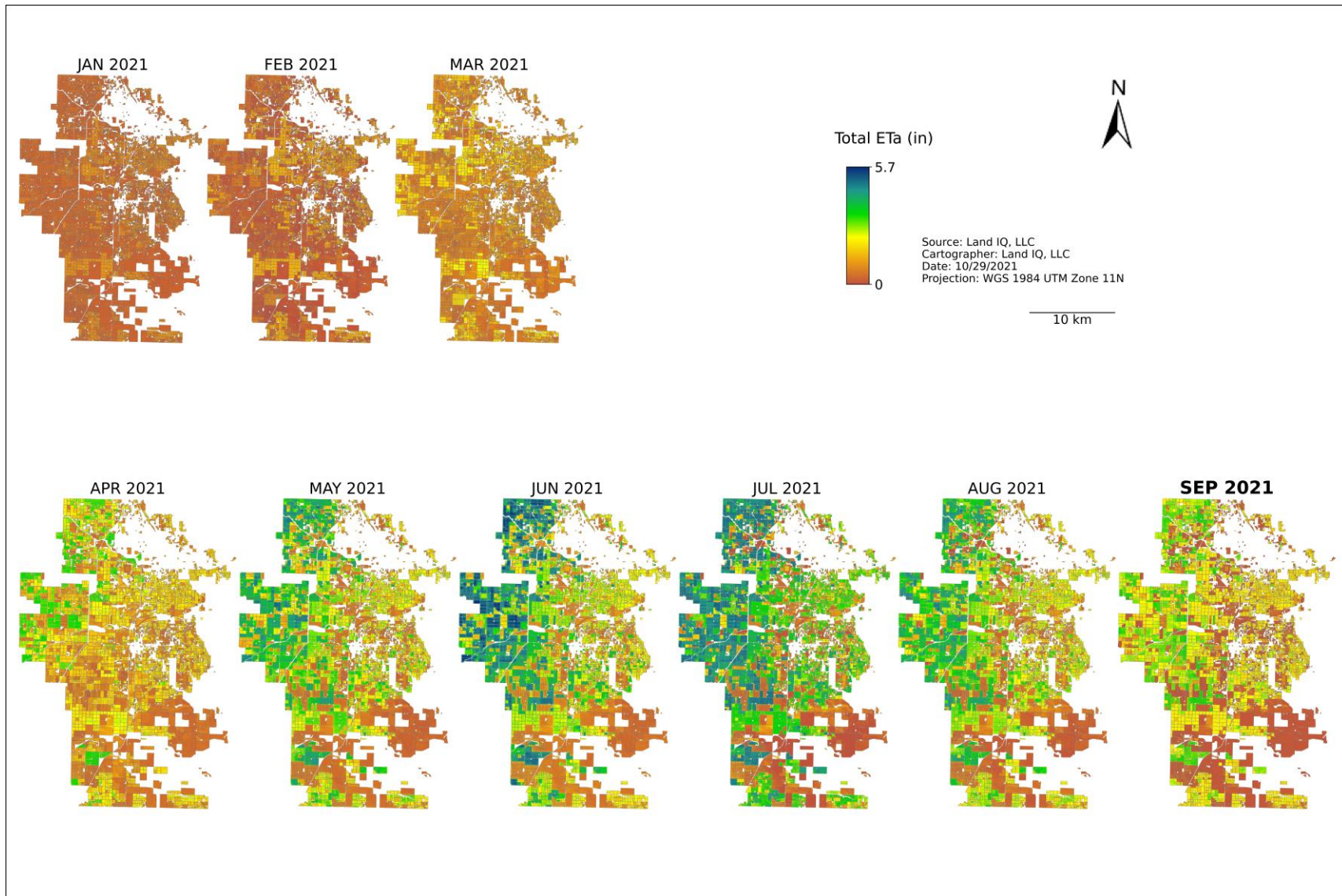


FIGURE 4. PIXEL LEVEL TOTAL ET_A (in)