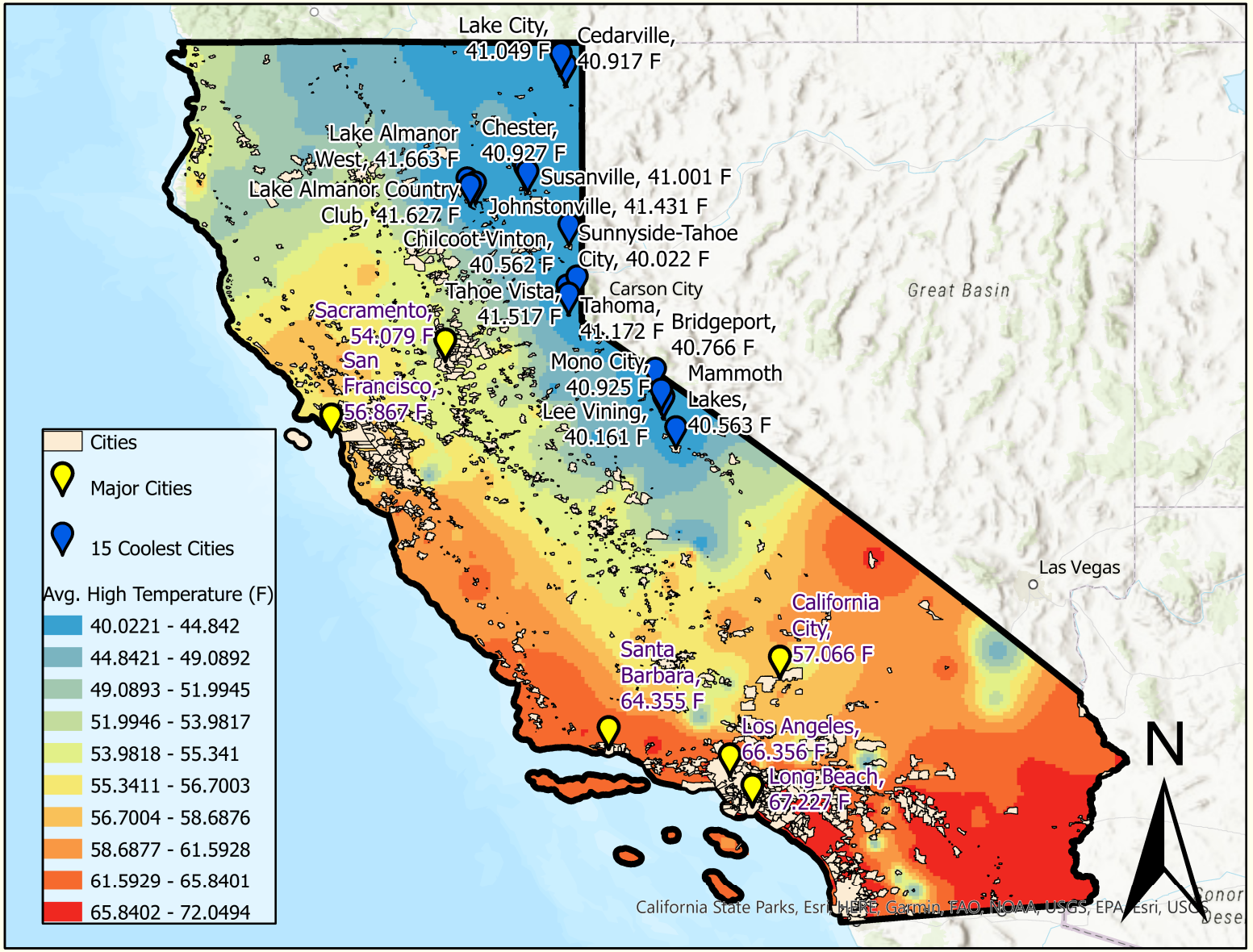
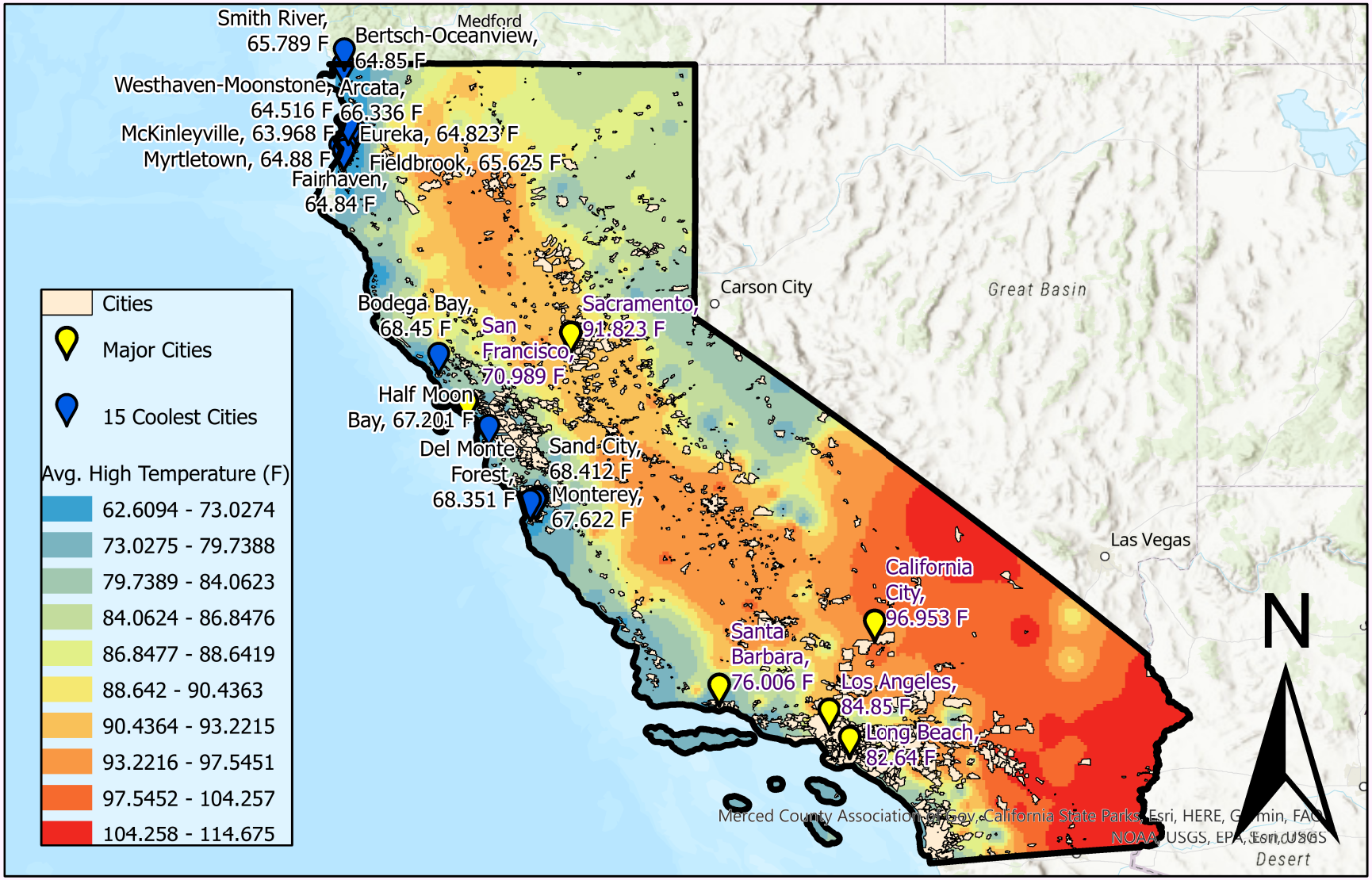
January's Average High Temperatures in California (IDW)



Scale: 1:7,300,000
Projection: GCS North American 1983
Cartographer: Jordan Lin

0 75 150 300 Miles

August's Average High Temperatures in California (IDW)



Scale: 1:7,900,000
Projection: GCS North American 1983
Cartographer: Jordan Lin

0 100 200 400 Miles

Jordan Lin

UID: 205677820

Analysis on California's Average Maximum Temperatures for January and August

Process to Gather Temperature Data

To start off the analysis process, I took data points from NOAA's website that came from the "Air Temperature: Long-term averages of monthly maximum temperature (MLY-TMAX-NORMAL)" category. Then to analyze the data from NOAA's website and apply them to California's cities, I used inverse distance weighting (IDW) to map the temperatures to California's terrain (used a power of 2 in the analysis to minimize the resulting root-mean-square error), zonal statistics to get the average maximum temperatures in every region, and table joined the resulting averages to the cities' shapefile. For both January and August, I made one map each showing the resulting temperature distribution and fifteen cities with lowest average maximum temperatures along with the average maximum temperatures of select major California Cities when using each of the two methods. That way, if a person wants to relocate to California to either a city that lets them beat the heat or to a city that is extremely popular, he or she can consult this report.

Figures 1, 2, and 3: Data Gathered Using Inverse Distance Weighting (IDW)

Figure 1: January's Data from IDW Analysis

IDW: Highest Maximum Average Temperatures (F)		**IDW: Lowest Maximum Average Temperatures (F)**	
City	**Temperature (F)**	**City**	**Temperature (F)**
Mecca	71.916767	Sunnyside-Tahoe City	40.022076
Thermal	71.368523	Lee Vining	40.160576
Indio	71.315117	Chilcoot-Vinton	40.561588
Coachella	71.27631	Mammoth Lakes	40.563231
Vista Santa Rosa	71.232056	Bridgeport	40.765564
Oasis	70.865007	Cedarville	40.917263
Placentia	70.718071	Mono City	40.92535
La Quinta	70.383181	Chester	40.926823
El Centro	70.327297	Susanville	41.001404
El Centro Naval Air Facility	70.164307	Lake City	41.048546

Figure 2: August's Data from IDW Analysis

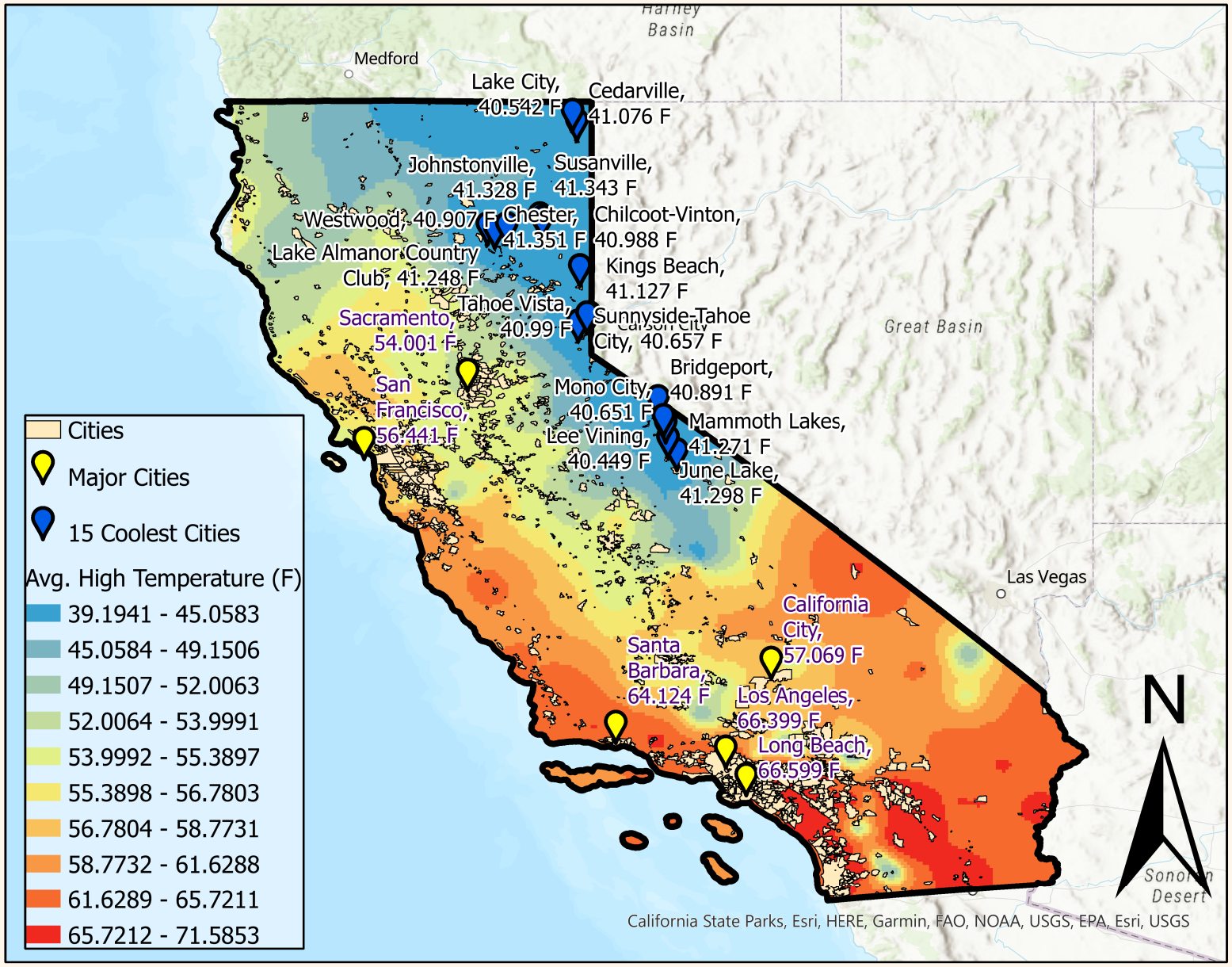
IDW: Highest Maximum Average Temperatures (F)		**IDW: Lowest Maximum Average Temperatures (F)**	
City	**Average Temperature (F)**	**City**	**Average Temperature (F)**
Furnace Creek	114.26203	McKinleyville	63.967635
Mecca	107.684422	Westhaven-Moonstone	64.516369
Baker	107.534477	Eureka	64.82259
Blythe	107.412813	Fairhaven	64.840431
Palo Verde	106.771347	Bertsch-Oceanview	64.85038
Needles	106.741638	Myrtletown	64.880173
Oasis	106.315317	Fieldbrook	65.625122
Bluewater	106.28862	Smith River	65.789238
Imperial	106.229023	Arcata	66.335739
Indio	106.199986	Pine Hills	66.844536

Figure 3; Resulting Climate Normals in Select Major Cities in California from IDW Analysis

City	IDW: Maximum Average Temperatures in January (F)	IDW: Mean Maximum Average Temperatures in August (F)
Los Angeles	66.356172	84.8502
Long Beach	67.226878	82.639825
Santa Barbara	64.355017	76.005653
San Francisco	56.866788	70.989168
Sacramento	54.078899	96.952835
California City	57.065677	96.952835

(Proceeding technical addendum consists of two maps and an additional report that consists of data tables resulting from using Empirical Bayesian kriging and analysis on differences between the two interpolation methods)

January's Average High Temperatures in California (EBK)



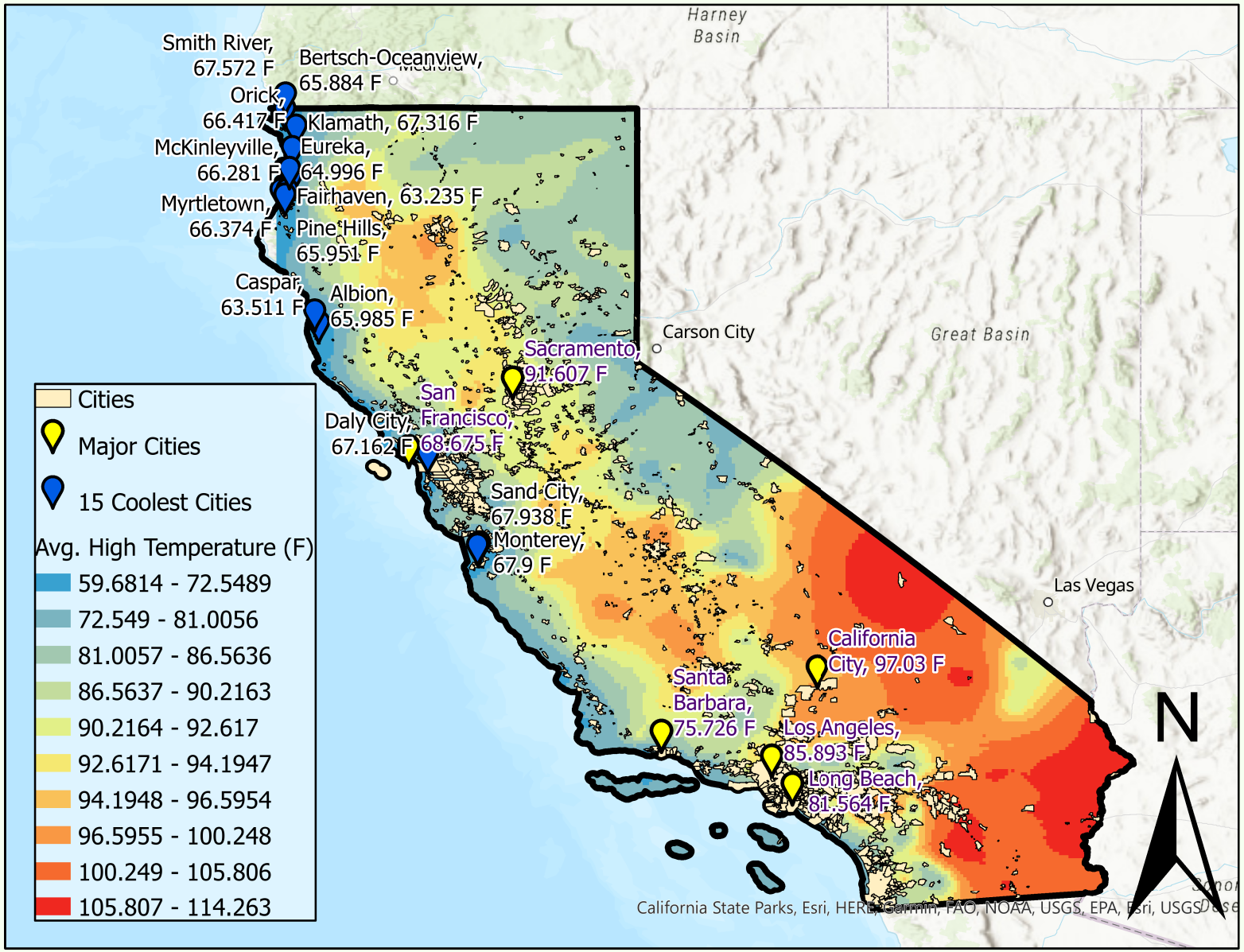
Scale: 1:7,900,000

Projection: GCS North American 1983

Cartographer: Jordan Lin

0 100 200 400 Miles

August's Average High Temperatures in California (EBK)



Scale: 1:7,900,000
Projection: GCS North American 1983
Cartographer: Jordan Lin

0 100 200 400 Miles

Technical Addendum: Using Empirical Bayesian Kriging Analysis

In this technical addendum, I applied the exact same analysis process used earlier to gather the average maximum temperatures of California's cities and create the two additional maps (shown above) of the same contents with the exception of replacing inverse distance weighting (IDW) with Empirical Bayesian kriging (EBK). Within the Geospatial Wizard tool, I chose the "Log Empirical" transformation with the "K-Bessel" semivariogram type to minimize the resulting root-mean-square error.

Figures 4, 5, and 6: Data Gathered Using EBK and Resulting Differences with IDW

Additional information for data on following pages:

- "IDW - EBK" denotes the difference between the nth highest/lowest temperature gathered from IDW and the nth highest/lowest temperature gathered from EBK

Figure 4: January's Resulting Data from EBK Analysis

EBK: Lowest Average Temperatures (F)		**EBK: Highest Average Temperatures (F)**		**Lowest Average Temperatures: IDW - EBK**	**Highest Average Temperatures: IDW - EBK**
City	**Temperature**	**City**	**Temperature**		
Lee Vinning	40.448906	Thermal	71.527866	-0.42683	0.388901
Lake City	40.448906	Vista Santa Rosa	71.375225	-0.28833	-0.006702
Mono City	40.651031	Mecca	71.312153	-0.089443	0.002964
Sunny-Tahoe City	40.656815	Coachella	71.297804	-0.093584	-0.021494
Bridgeport	40.890953	Indio	71.080448	-0.125389	0.151608
Westwood	40.906843	Oasis	70.881317	0.01042	-0.01631
Chilcoot-Vinton	40.988419	La Quinta	70.782243	-0.063069	-0.064172
Tahoe Vista	40.989666	Placentia	70.455605	-0.062843	-0.072424
Cedarville	41.075935	Villa Park	70.424812	-0.074531	-0.097515
Kings Beach	41.127151	Orange	70.36054	-0.078605	-0.196233

Figure 5: August's Resulting Data from EBK Analysis

EBK: Lowest Average Temperatures (F)		**EBK: Highest Average Temperatures (F)**		**Lowest Average Temperatures: IDW - EBK**	**Highest Average Temperatures: IDW - EBK**
City	**Temperature**	**City**	**Temperature**		
Fairhaven	63.234959	Furnace Creek	113.476366	0.732676	0.785664
Caspar	63.511099	Blythe	107.364432	1.00527	0.31999
Westhaven-Moonstone	64.892166	Mecca	107.345478	-0.069576	0.188999
Eureka	64.995628	Baker	107.26239	-0.155197	0.150423
Bertsch-Oceanview	65.883949	Oasis	107.052073	-1.033569	-0.280726
Pine Hills	65.951424	Big River	106.745121	-1.071251	-0.003483
Albion	65.98539	Bluewater	106.679428	-0.360268	-0.364111
McKinleyville	66.281153	Palo Verde	106.493484	-0.491915	-0.204864
Myrtletown	66.374245	Indio	106.322495	-0.038506	-0.093472
Orick	66.417221	Thermal	106.274845	0.427315	-0.074859

Figure 6: Resulting Climate Normals in Select Major Cities in California from EBK Analysis

City	EBK: Average Maximum Temperatures in January (F)	EBK: Average Maximum Temperatures in August (F)	January: IDW - EBK	August: IDW - EBK
Los Angeles	66.399194	85.893309	-0.043022	-1.043109
Long Beach	66.599233	81.563902	0.627645	1.075923
Santa Barbara	64.123659	75.726051	0.231358	0.279602
San Francisco	56.440514	68.674802	0.426274	2.314366
Sacramento	54.001232	91.607448	0.077667	5.345387
California City	57.069044	97.030303	-0.003367	-0.077468

Analysis of Using Inverse Distance Weighting vs. Empirical Bayesian Kriging

Although inverse distance weighting (IDW) and Empirical Bayesian kriging (EBK) generated different numbers for every city, the numbers themselves did not significantly deviate when sorted and compared side by side. In fact, the highest deviation generated between the two methods for the ten hottest/coldest cities was a major outlier that belongs to Sacramento's average maximum temperature difference of 5.345287 F during August (Figure 6) while the majority of the rest of the differences were around 1 degree Fahrenheit (Figures 4 and 5). Also, it seems that EBK generates higher average temperatures on average than IDW since when subtracting the nth lowest/highest average temperatures between the IDW and EBK methods, IDW - EBK yielded negative values more often than positive ones (Figures 4 and 5). In terms of the amount of data generated between the two methods, the amount of raster cells generated by the two methods remained the same at 1001 total cells each.

Overall, both methods are very good interpolation methods for this analysis process. I did not find one method to be better than the other, but that may change as the demand for accuracy and the complexity of the data increases.