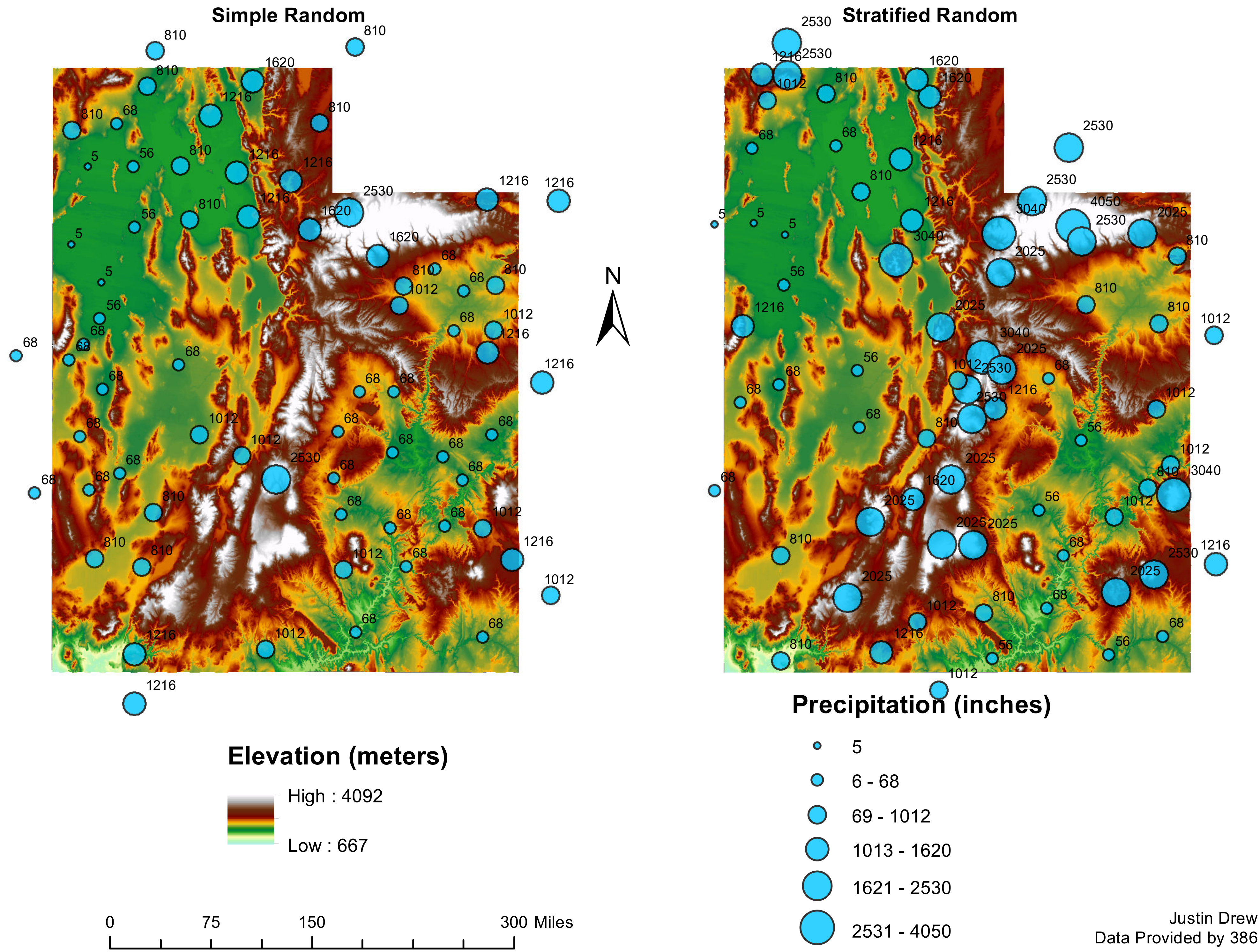
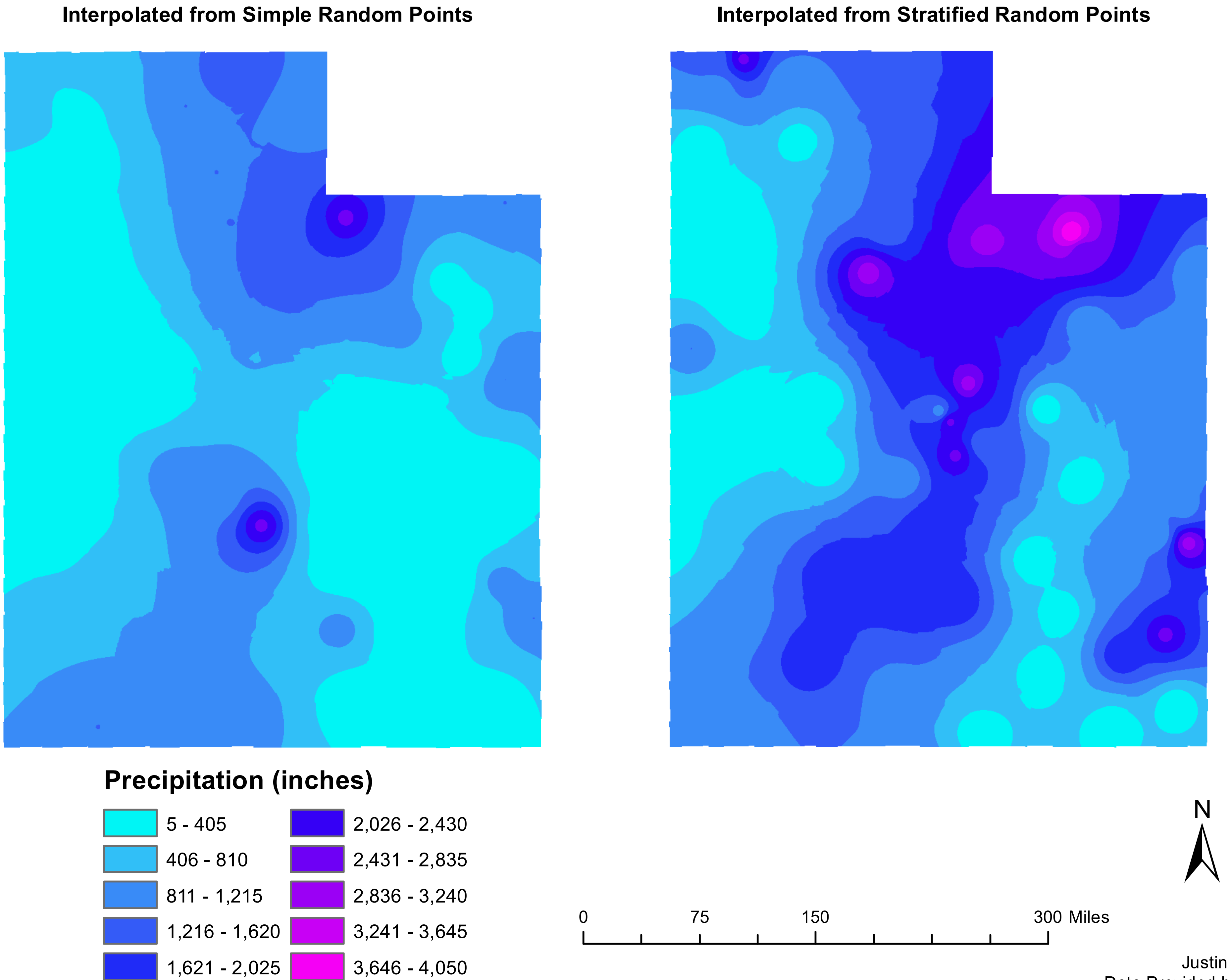
Utah Precipitation Samples



Part 1 – Stratified vs Simple Random

Based on visual observation, the stratified random sampling seems better because there’s more even sampling between the different elevations. Judging from the difference between precipitation measurements in lowlands and those in higher elevations, this seems to have been a variable that needed to be accounted for. By contrast, the simple random sampling appears to have introduced a bias toward precipitation values in lower elevations.

Utah Precipitation IDW Interpolations



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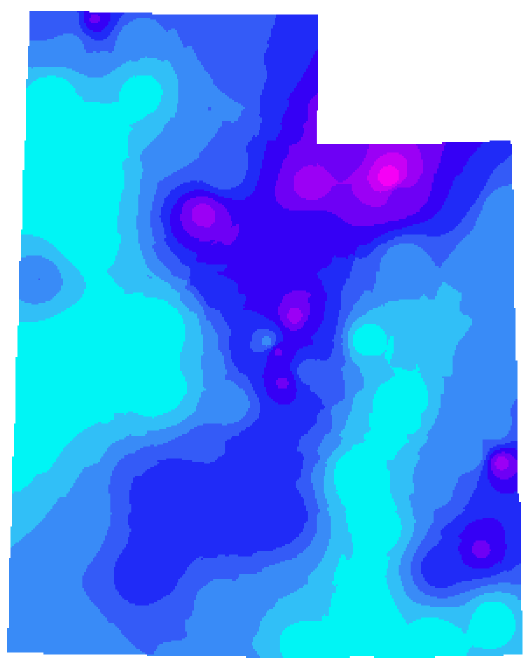
Comparing IDW of Stratified versus Simple Random Sample Points

The IDW surface resulting from the stratified random points seems more realistic because the intervals of the predicted precipitation values better correlate with the intervals of Utah's elevation.

Changing the Radius to 6

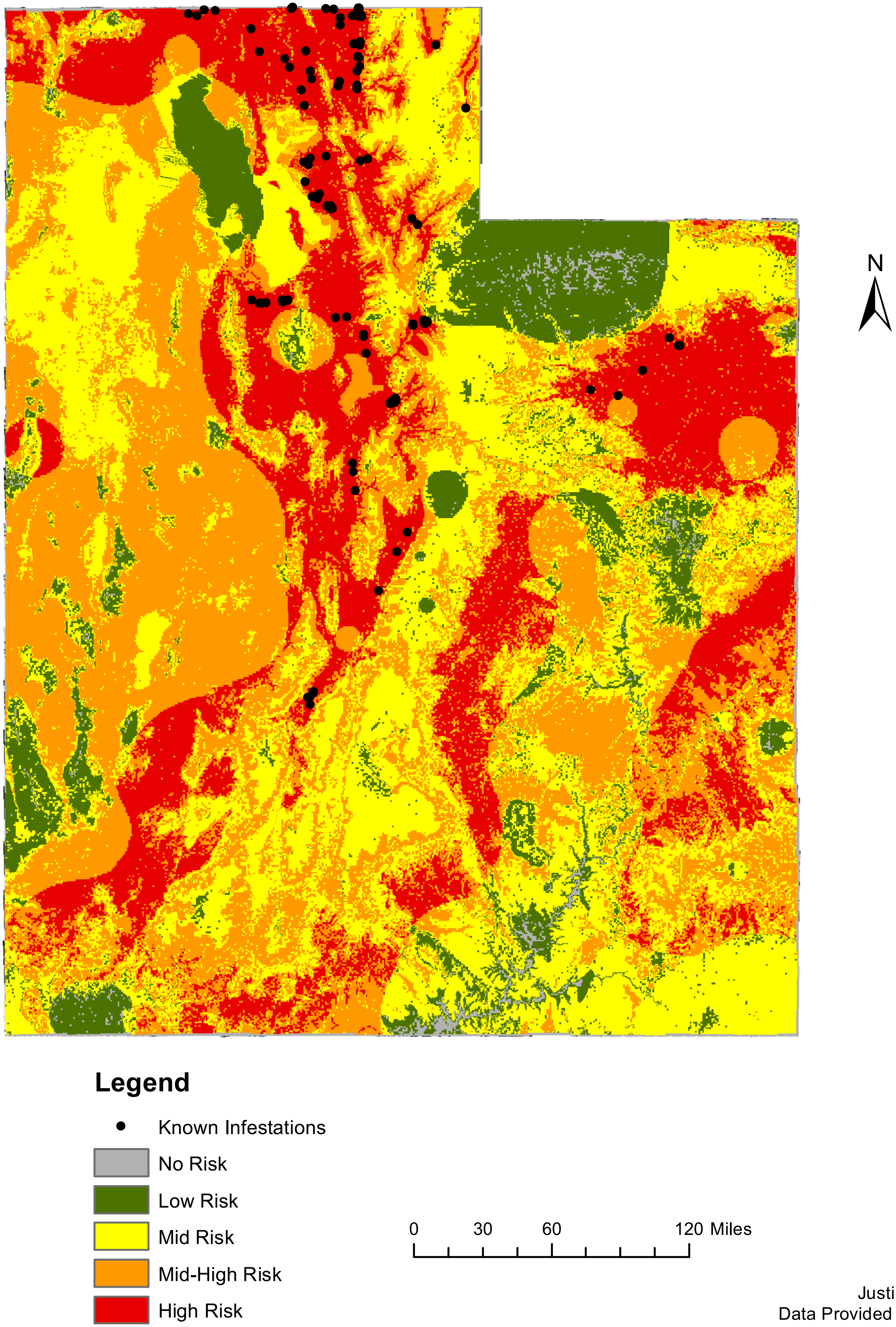
By comparing each cell with less neighbor points, the resulting surface would be less smooth. The following screenshot of the IDW interpolation of the stratified random points with a radius of 6 illustrates this:



Reasons Raster Analysis Cannot Be Done between “ut_temp” and “ut_elevat”

(1) The cell size of two rasters are different, and (2) their extents do not match. Both of these issues can be resolved using the Project Raster tool to change the cell size and set them to the same coordinate system and origin.

Utah Vulnerability to Potato Beetle Infestation



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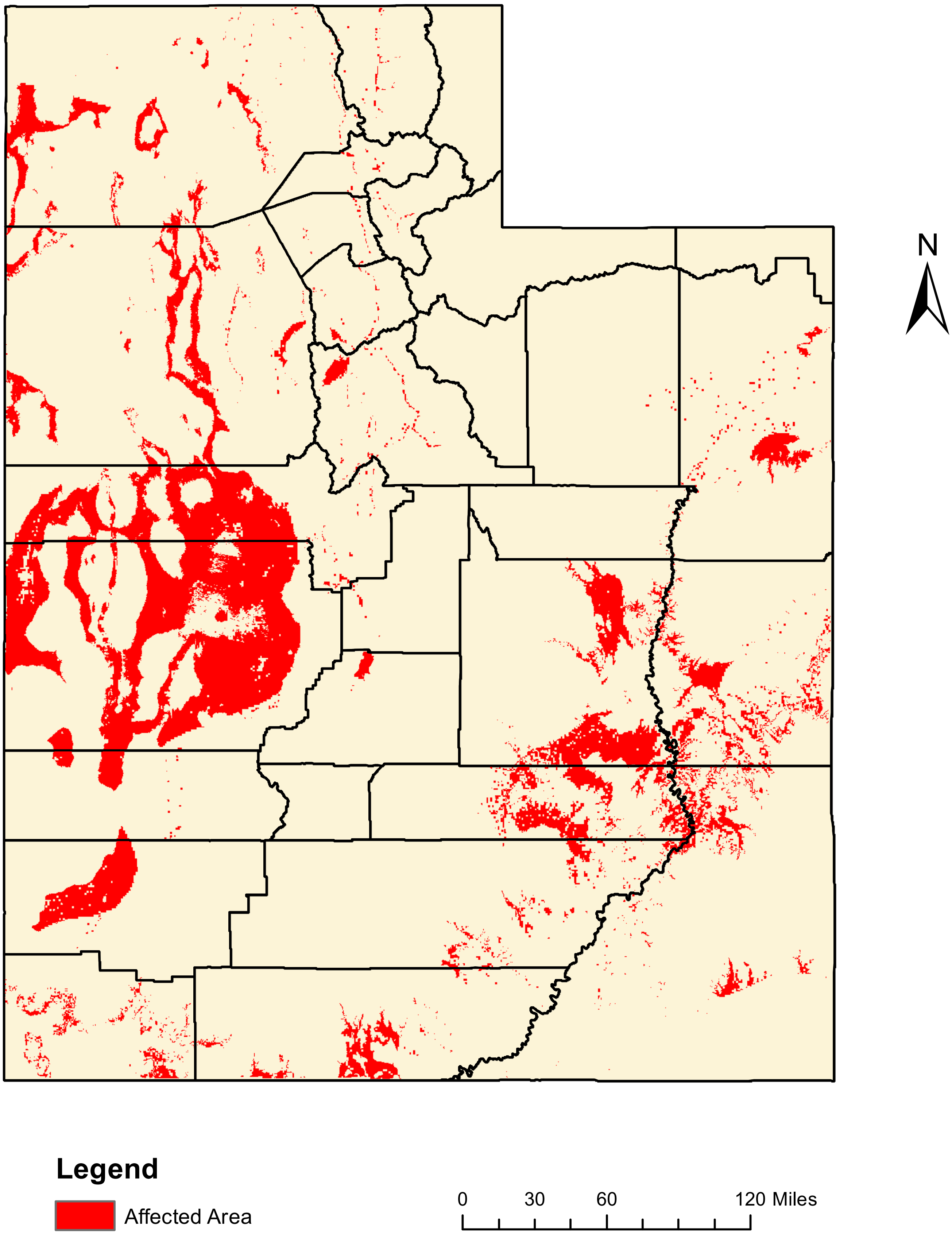
Utah Areas Affected by This Summer's Colorado Potato Beetle Infestations



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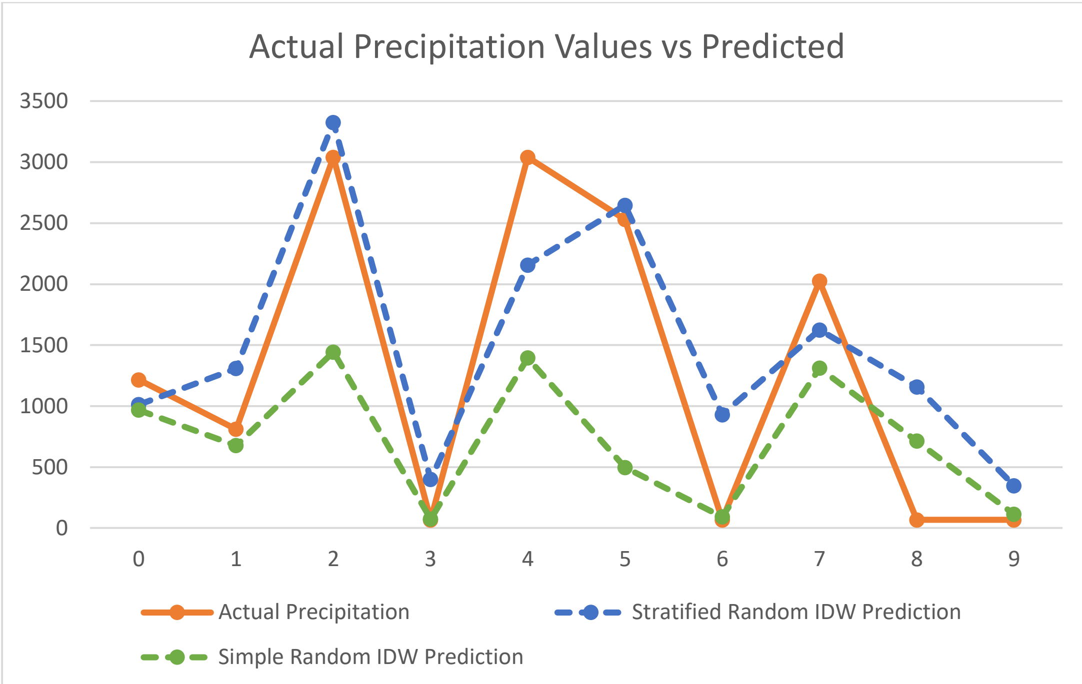
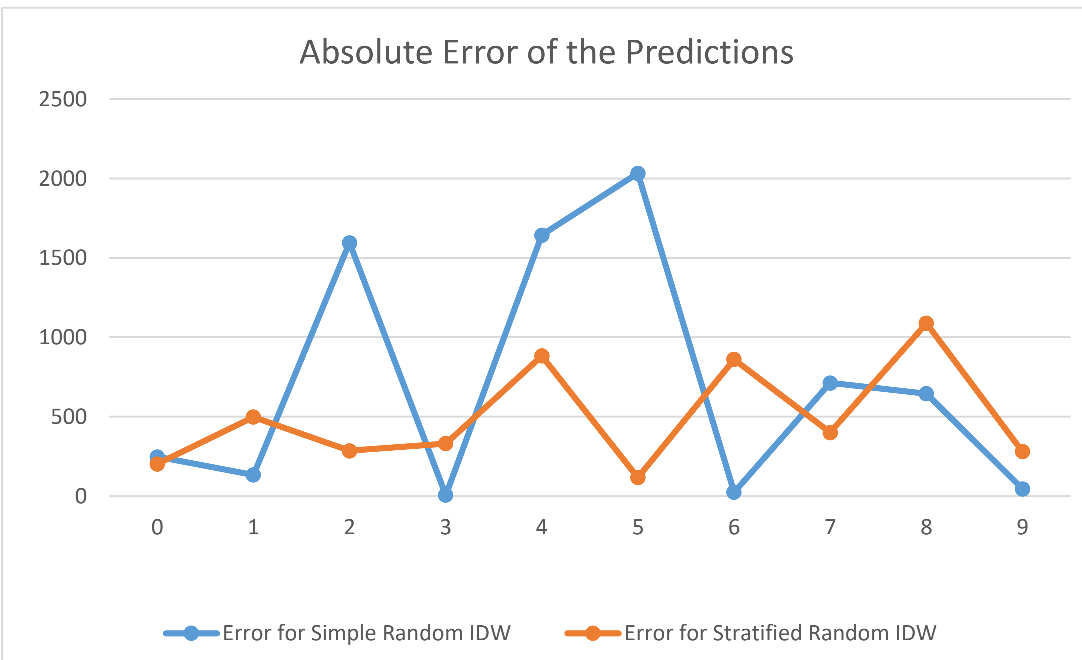
Part 2A – Procedure

Using the Con() function in ArcMap's Raster Calculator, I created a raster that had a value of 1 in the areas of risk class 3 that also occurred in the specified elevation range and 0 otherwise. I symbolized the raster by unique values, and removed the class for the value of zero. This left only the areas with a value of one (those fulfilling the specified conditions) visible. So that it would be clear where these areas were in Utah, I created two layers from the provided utahbnd polygon: a solid color block, and an outline of the counties. I moved the outline above the raster and the solid color below, and then created a legend to show what the raster signified.

Part 2B – Which IDW Surface (Part 1) had the Least Error

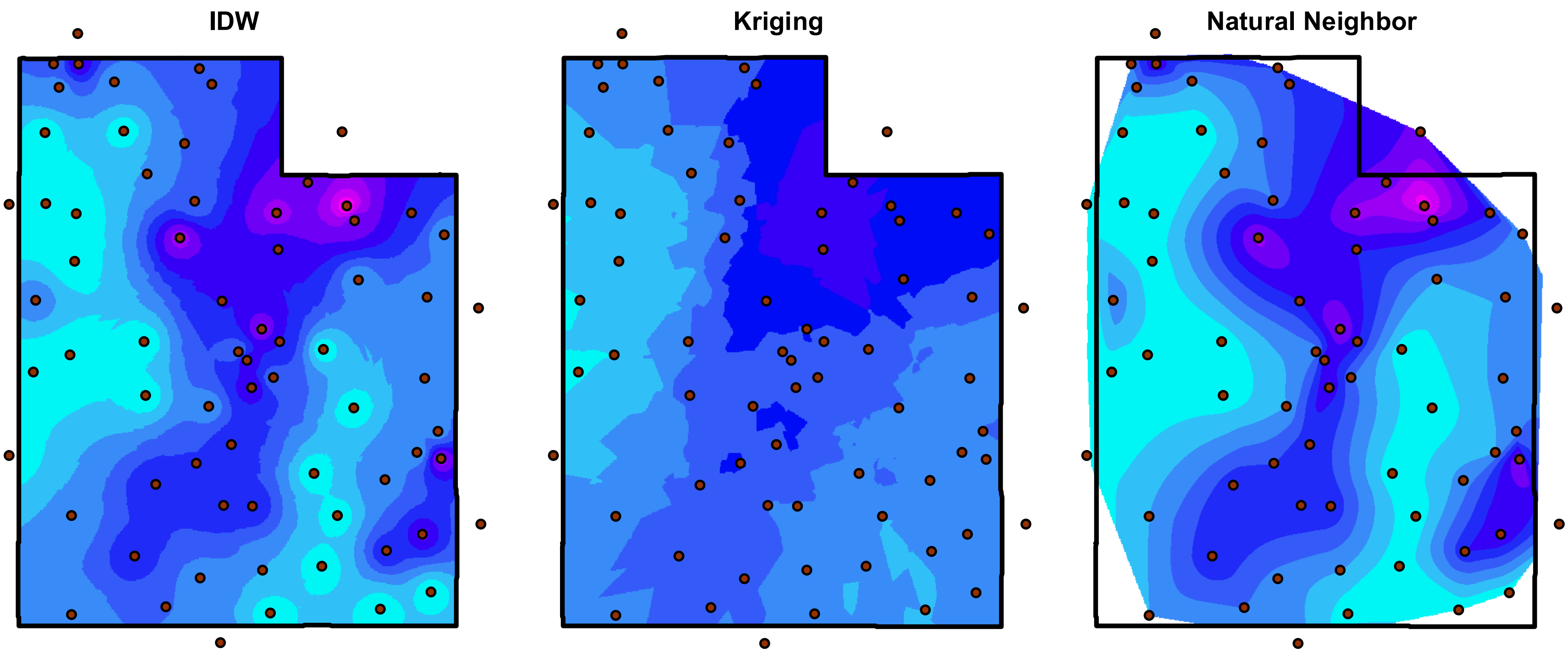
The following graphs represent the precipitation values at each of the ten verification points:





It’s apparent from the first graph that the values predicted from the stratified random points are closer to the actual values than those predicted from the simple random points, but to be certain of this, I also plotted the absolute error and calculated the Mean Absolute Error (MAE) for each prediction. The stratified random IDW had a MAE of 495.2 and the simple random IDW had a MAE of 709.0. My reason for using MAE rather than RMSE to measure error is that, as the second graph shows, the simple random IDW values had large differences, which RMSE exaggerates. From these error calculations, I conclude that the IDW interpolation from the stratified random points was the best of the two.

Comparison of Interpolation Methods from Stratified Random Points



The IDW interpolation calculated the value of each cell by using a weighted average of the values of the 12 nearest sample points, where the weights are the inverse of the distance from the cell to the point (i.e. closer points have more influence).

The Kriging method produces a different result because although it uses a similar weighting scheme, it also accounts for spatial autocorrelation as a means of explaining (and smoothing) variation on the surface. This is why the surface appears more uniform, and lacks the high values in the other two interpolations.

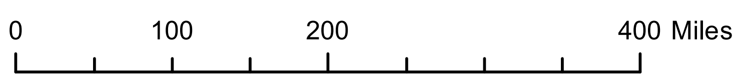
The Natural Neighbor interpolation first constructs a Voronoi diagram using all of the given points, and then creates a new Voronoi polygon at each cell. The amount of overlap with the polygons in the initial diagram determines the weight of each point in calculating the final cell value. This explains why the Natural Neighbor interpolation is only within the area within the polygon formed using the outermost points as vertices and also why the result is closer to that of IDW, but has less of the smaller variations IDW allows for between points that have significant differences.

Precipitation (inches)

- 5 - 405
- 406 - 810
- 811 - 1,215
- 1,216 - 1,620
- 1,621 - 2,025
- 2,026 - 2,430
- 2,431 - 2,835
- 2,836 - 3,240
- 3,241 - 3,645
- 3,646 - 4,050

Symbols

- Sample Point
- Outline of Utah



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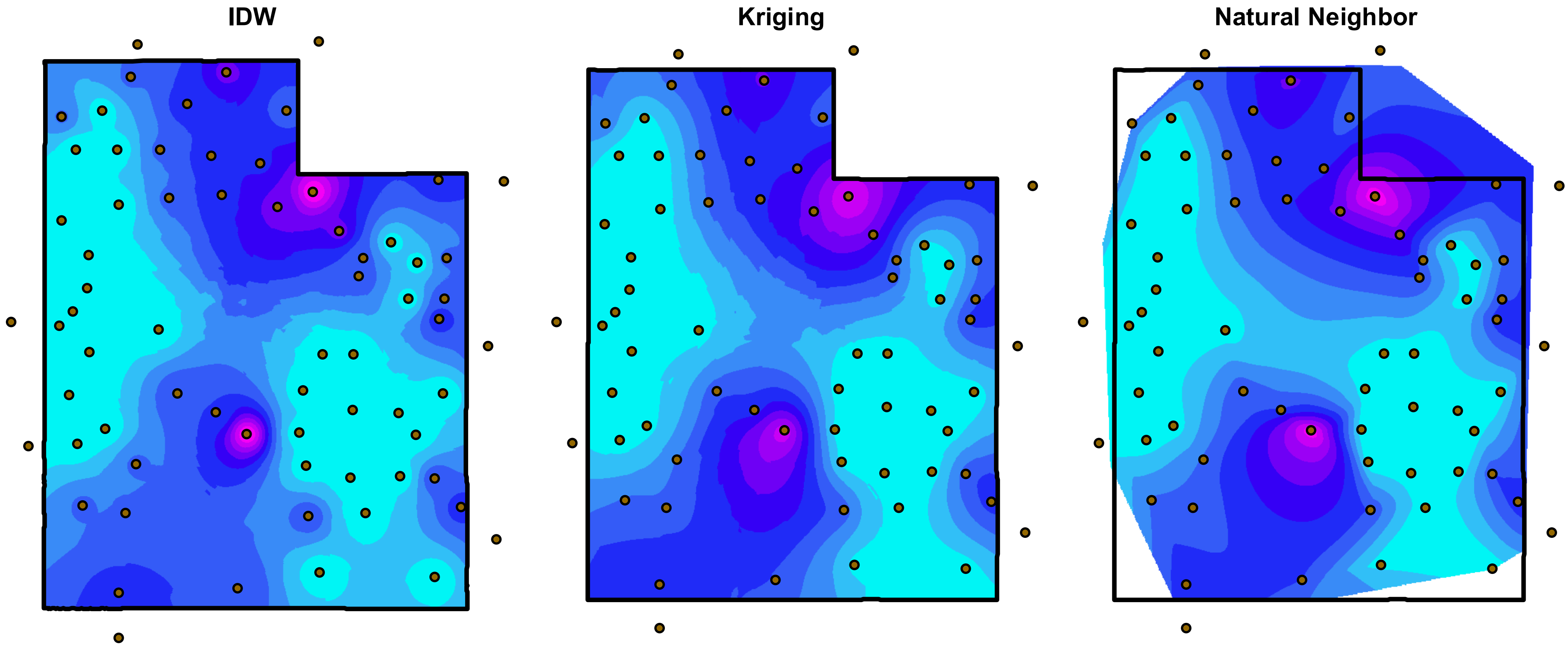
Comparison of Interpolation Methods from Simple Random Points



The IDW interpolation calculated the value of each cell by using a weighted average of the values of the 12 nearest sample points, where the weights are the inverse of the distance from the cell to the point (i.e. closer points have more influence).

The Kriging method produces a different result because although it uses a similar weighting scheme, it also accounts for spatial autocorrelation as a means of explaining (and smoothing) variation on the surface. This is why the surface appears somewhat more uniform than the other two interpolations.

The Natural Neighbor interpolation first constructs a Voronoi diagram using all of the given points, and then creates a new Voronoi polygon at each cell. The amount of overlap with the polygons in the initial diagram determines the weight of each point in calculating the final cell value. This explains why the Natural Neighbor interpolation is only within the area within the polygon formed using the outermost points as vertices and has less of the smaller variations the IDW surface has, which allows for more variation between points that have significant differences.

Precipitation (inches)

0 - 253	1,266 - 1,518
254 - 506	1,519 - 1,771
507 - 759	1,772 - 2,024
760 - 1,012	2,025 - 2,277
1,013 - 1,265	2,278 - 2,530

Symbols

Sample Point

Outline of Utah

N

0 100 200 400 Miles

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